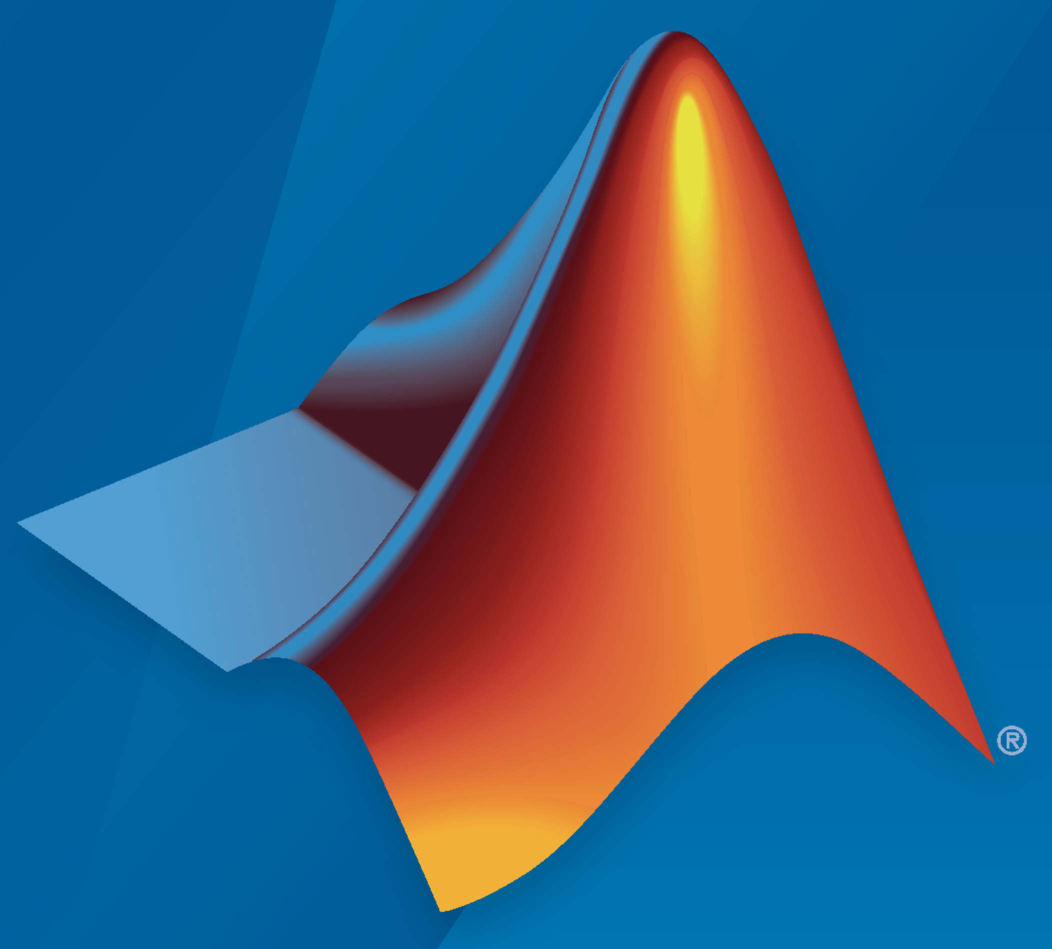
Database Toolbox™

User's Guide



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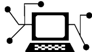

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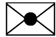

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Database Toolbox™ User's Guide

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Revision History

May 1998	Online Only	New for Version 1 for MATLAB® 5.2
July 1998	First Printing	For Version 1
Online only	June 1999	Revised for Version 2 (Release 11)
December 1999	Second printing	For Version 2 (Release 11)
Online only	September 2000	Revised for Version 2.1 (Release 12)
June 2001	Third printing	Revised for Version 2.2 (Release 12.1)
July 2002	Online only	Revised for Version 2.2.1 (Release 13)
November 2002	Fourth printing	Version 2.2.1
June 2004	Fifth printing	Revised for Version 3.0 (Release 14)
October 2004	Online only	Revised for Version 3.1 (Release 14SP1)
March 2005	Online only	Revised for Version 3.0.2 (Release 14SP2)
September 2005	Online only	Revised for Version 3.1 (Release 14SP3)
March 2006	Online only	Revised for Version 3.1.1 (Release 2006a)
September 2006	Online only	Revised for Version 3.2 (Release 2006b)
October 2006	Sixth printing	Revised for Version 3.2 (Release 2006b)
March 2007	Online only	Revised for Version 3.3 (Release 2007a)
September 2007	Seventh printing	Revised for Version 3.4 (Release 2007b)
March 2008	Online only	Revised for Version 3.4.1 (Release 2008a)
October 2008	Online only	Revised for Version 3.5 (Release 2008b)
March 2009	Online only	Revised for Version 3.5.1 (Release 2009a)
September 2009	Online only	Revised for Version 3.6 (Release 2009b)
March 2010	Online only	Revised for Version 3.7 (Release 2010a)
September 2010	Online only	Revised for Version 3.8 (Release 2010b)
April 2011	Online only	Revised for Version 3.9 (Release 2011a)
September 2011	Online only	Revised for Version 3.10 (Release 2011b)
March 2012	Online only	Revised for Version 3.11 (Release 2012a)
September 2012	Online only	Revised for Version 4.0 (Release 2012b)
March 2013	Online only	Revised for Version 4.1 (Release 2013a)
September 2013	Online only	Revised for Version 5.0 (Release 2013b)
March 2014	Online only	Revised for Version 5.1 (Release 2014a)
October 2014	Online only	Revised for Version 5.2 (Release 2014b)
March 2015	Online only	Revised for Version 5.2.1 (Release 2015a)
September 2015	Online only	Revised for Version 6.0 (Release 2015b)
March 2016	Online only	Revised for Version 6.1 (Release 2016a)
September 2016	Online only	Revised for Version 7.0 (Release 2016b)
March 2017	Online only	Revised for Version 7.1 (Release 2017a)
September 2017	Online only	Revised for Version 8.0 (Release 2017b)
March 2018	Online only	Revised for Version 8.1 (Release 2018a)
September 2018	Online only	Revised for Version 9.0 (Release 2018b)
March 2019	Online only	Revised for Version 9.1 (Release 2019a)
September 2019	Online only	Revised for Version 9.2 (Release 2019b)
March 2020	Online only	Revised for Version 9.2.1 (Release 2020a)
September 2020	Online only	Revised for Version 10.0 (Release 2020b)
March 2021	Online only	Revised for Version 10.1 (Release 2021a)
September 2021	Online only	Revised for Version 10.2 (Release 2021b)
March 2022	Online only	Revised for Version 10.3 (Release 2022a)
September 2022	Online only	Revised for Version 10.4 (Release 2022b)
March 2023	Online only	Revised for Version 11.0 (Release 2023a)
September 2023	Online only	Revised for Version 23.2 (R2023b)
March 2024	Online only	Revised for Version 24.1 (R2024a)

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12 Functions

Before You Begin

Database Toolbox Product Description

Interact with relational and NoSQL databases

Database Toolbox provides functions and an app for interacting with relational and NoSQL databases. The toolbox supports any ODBC-compliant or JDBC-compliant relational database and provides NoSQL support for Apache® Cassandra®, MongoDB®, and Neo4j®.

Native interfaces for MySQL®, PostgreSQL, and SQLite provide functionality that streamlines interaction with your database. The interfaces ship with third-party drivers that connect to your database in deployed and cloud environments without additional setup or installation.

Database Toolbox provides direct read and write workflows for novice users and fine-grained control for advanced users who are familiar with SQL. With the Database Explorer app, you can explore relational data interactively and generate MATLAB® code to automate or operationalize database workflows. For large data workflows, you can run query filters directly on your SQL queries. The toolbox has an Object Relational Mapper (ORM), which provides a layer between MATLAB and SQL queries, so your MATLAB objects can interact with your database tables.

Data Type Support

You can import these data types into the MATLAB workspace and export them back to your database.

Database	Supported Data Type
All databases	• BOOLEAN • CHAR • DATE • DECIMAL • DOUBLE • FLOAT • INTEGER • NUMERIC • REAL • SMALLINT • TIME • TIMESTAMP **Note** When importing TIMESTAMP data into MATLAB, you can get an incorrect value at the daylight saving time change. To avoid an incorrect value, convert TIMESTAMP data to strings in your SQL query. Then, convert the strings back to the MATLAB data type you want. Or, connect to your database using a different driver.
Microsoft® SQL Server®	• NTEXT • TEXT • VARCHAR(MAX) • CHAR(8000) • NCHAR(4000) • NVARCHAR(MAX) • TINYINT
MySQL	• MEDIUMTEXT • LONGTEXT • TINYINT
Oracle®	• LONG • VARCHAR2(4000) • NCHAR(2000) • NVARCHAR2(4000)

To import data of another data type, manipulate the data before importing it into the MATLAB workspace. For details, see your database documentation.

See Also

`fetch` | `sqlwrite` | `update`

More About

- “Import Data from Database Table Using sqlread Function” on page 5-58
- “Insert Data into Database Table” on page 5-61

Data Retrieval Restrictions

Spaces in Table Names or Column Names

Microsoft Access® supports the use of spaces in table and column names, but most other databases do not. Queries that retrieve data from tables and fields whose names contain spaces require delimiters around table names and field names. In Access®, enclose the table names or field names in quotation marks, for example, `"order id"`. Other databases use different delimiters, such as brackets, [ ].

Quotation Marks in Table Names or Column Names

Do not include quotation marks in table names or column names. The Database Toolbox software does not support data retrieval from table and column names that contain quotation marks.

Reserved Words in Column Names

You cannot use the Database Toolbox software to import or export data in columns whose names contain database reserved words, such as `DATE` or `TABLE`.

See Also

More About

- “Data Import Using Database Explorer App or Command Line” on page 2-133

2

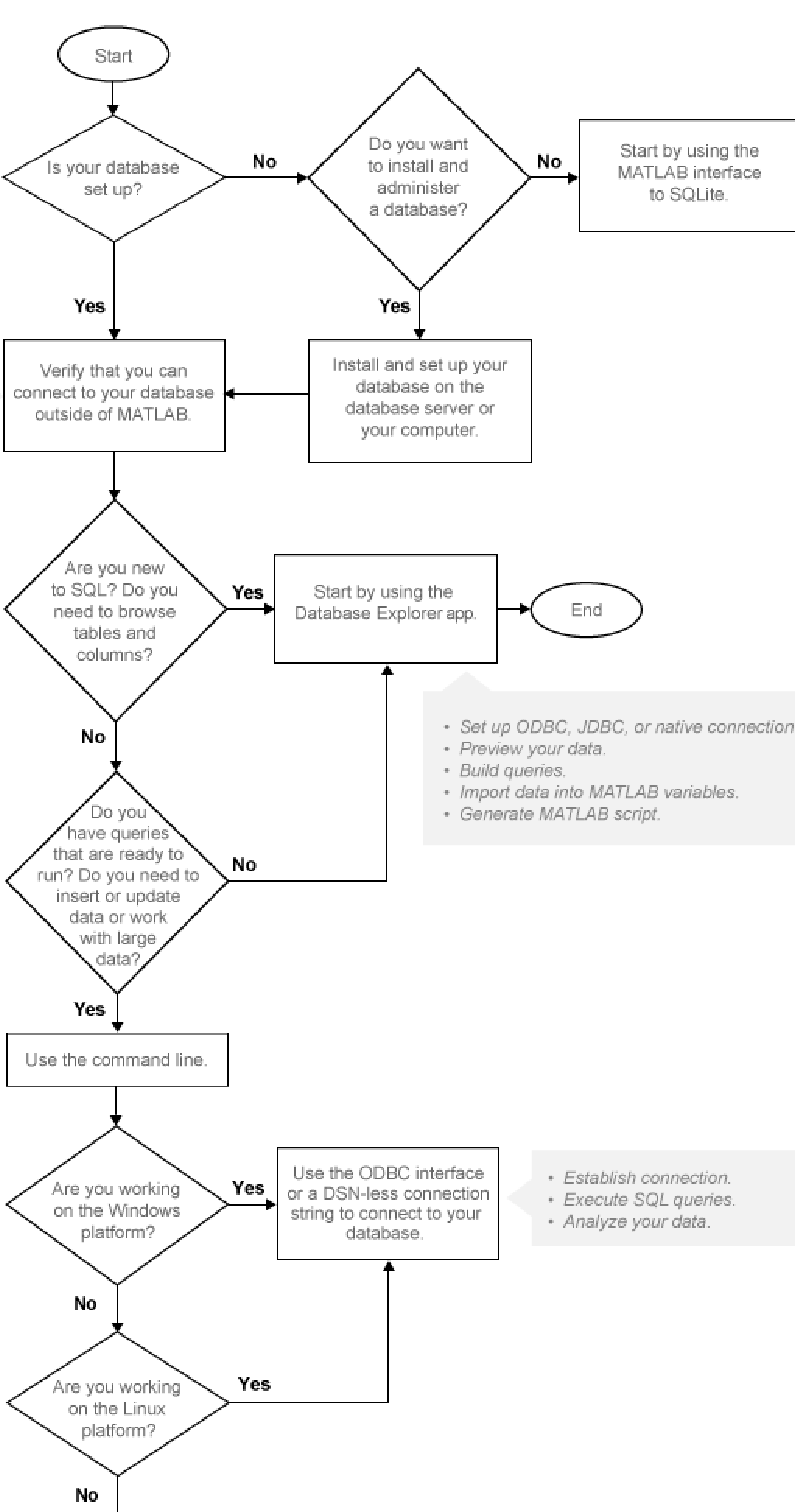
Getting Started with Database Toolbox

Access Relational Database Data in MATLAB

This tutorial shows how to use Database Toolbox with relational databases. To gain the maximum benefit from this toolbox and understand its capabilities, use the following steps and decision flow chart.

1. If you do not have an installed database and want to store relational data quickly, use the MATLAB interface to SQLite. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.
2. Install your database. For details, refer to your database administrator or your database documentation.
3. Choose between using the Database Explorer app or the command line. For details, see “Connection Options” on page 2-8.
4. If you have a MySQL database, then you can use the MySQL native interface. For details, see “MySQL Native Interface”.
5. If you have a PostgreSQL database, then you can use the PostgreSQL native interface. For details, see “PostgreSQL Native Interface”.
6. Choose between using an ODBC driver or a JDBC driver. For details, see “Choose Between ODBC and JDBC Drivers” on page 2-12.
7. If you are using a JDBC driver, you need to install the driver. An ODBC driver is typically preinstalled on your computer. For details about ODBC and JDBC drivers, see Driver Installation. If you have questions about which driver you need, refer to your database administrator or your database documentation.
8. If you have a Linux® platform, then you can use the `odbc` function to create an ODBC database connection using a defined data source or a connection string. The connection string is a DSN-less connection. (DSN is a data source name.)
9. Create a data source for an ODBC-compliant or JDBC-compliant driver. For details, see “Configure Driver and Data Source” on page 2-14.
10. Test the connection to your database using the Database Explorer app or the command line.
11. Connect to your database using the Database Explorer app or the command line. For details, see “Connect to Database” on page 2-129.
12. Select data from your database and import the data into a MATLAB variable by using the Database Explorer app or the command line. For details, see “Data Import Using Database Explorer App or Command Line” on page 2-133.
13. Insert data into your database by exporting data from a MATLAB variable. For details, see the `sqlwrite` function.
14. When you use the Database Explorer app to import data, generate a MATLAB script to automate your tasks. For details, see “Generate MATLAB Script” on page 4-20.

This flow chart illustrates the steps to take and the decisions to make when you use Database Toolbox with relational databases.


Start
Is your database set up?
No
Do you want to install and administer a database?
No
Start by using the MATLAB interface to SQLite.
Yes
Yes
Verify that your database is ODBC- or JDBC-compliant.
Find and use your server name, database name, schema or catalog name, user name, and password.
Verify that you can connect to your database outside of MATLAB.
Install and set up your database on the database server or your computer.
Are you new to SQL? Do you need to browse tables and columns?
Yes
Start by using the Database Explorer app.
End
• Set up ODBC, JDBC, or native connection.
• Preview your data.
• Build queries.
• Import data into MATLAB variables.
• Generate MATLAB script.
No
Do you have queries that are ready to run? Do you need to insert or update data or work with large data?
No
Yes
Use the command line.
Are you working on the Windows platform?
Yes
Use the ODBC interface or a DSN-less connection string to connect to your database.
• Establish connection.
• Execute SQL queries.
• Analyze your data.
No
Are you working on the Linux platform?
Yes
No
Use the JDBC driver to connect to your
If you need Operating System authentication,
• Establish connection by adding the driver to MATLAB path.

See Also

More About

- “Setup Requirements for Database Connection” on page 2-11
- “Choose Between ODBC and JDBC Drivers” on page 2-12
- “Configure Driver and Data Source” on page 2-14
- “Connect to Database” on page 2-129
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5

Interact with Data in SQLite Database Using MATLAB Interface to SQLite

To analyze your data using SQL in MATLAB without access to any database or driver, use the MATLAB interface to SQLite. After installing Database Toolbox, you can use the MATLAB interface to SQLite to move data between MATLAB and an SQLite database file. For details, see "MATLAB Interface to SQLite". The SQLite connection is different from a database connection created using a JDBC driver. For background information about SQLite databases, see the SQLite Home Page.

MATLAB Interface to SQLite Advantages

With the MATLAB interface to SQLite, you can start working with data immediately after installing the Database Toolbox by creating an SQLite database file. No installation or administration of software or drivers is required. You can share data using SQLite database files. Also, you can deploy a standalone database application without additional installation or configuration on target machines. The MATLAB interface to SQLite supports Windows®, Linux, and Mac.

Command Line Workflow for MATLAB Interface to SQLite

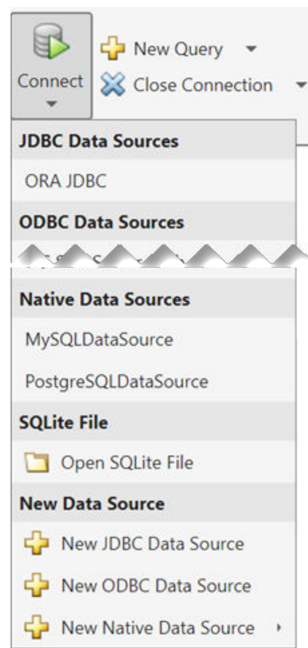
To connect to a database quickly and import data, use the MATLAB interface to SQLite. These steps provide a high-level workflow for using the MATLAB interface to SQLite.

1. Create an SQLite database file by using `sqlite`. The SQLite database file has a `.db` extension. The `sqlite` object signifies an SQLite database connection.
2. Create tables in the SQLite database file by using `execute`.
3. Export your data into the SQLite database file by using `sqlwrite`.
4. Import data into MATLAB by using `sqlread` or `fetch`.
5. Perform data analysis in MATLAB.
6. Export results into the SQLite database file by using `sqlwrite`.
7. Close the SQLite connection by using `close`.
8. Share the SQLite database file with others.
9. Create a standalone SQLite database application and deploy it.

Database Explorer App Workflow for MATLAB Interface to SQLite

If you have an existing SQLite database file, you can use the Database Explorer app to create an SQLite connection. These steps show how to create the connection.

1. Open the Database Explorer app.
2. In the **Connections** section, click **Connect**.
3. Select **Open SQLite File**.



4 Navigate to the folder where your SQLite database file exists and select the file. Click **OK**.
5 Database Explorer creates an SQLite connection. The **Database Browser** pane displays the available tables in the database.

After you create the SQLite connection, you can use Database Explorer to explore the data in the SQLite database and import the data into MATLAB. For details, see these topics:

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14

SQLite JDBC Connection Differences

The following table describes the differences between using the MATLAB interface to SQLite and using the JDBC driver to connect to an SQLite database.

Item	SQLite Connection Using the MATLAB Interface to SQLite	SQLite Database Connection Using a JDBC Driver
Driver installation	Not required	Required
Database installation	Not required	Required
Database administration	Not required	Required
Database connection function	`sqlite`	`database`
Import data	Yes	Yes
Export data	Yes	Yes
Database operations	Yes	Yes
Database Explorer	Yes	Yes

Item	SQLite Connection Using the MATLAB Interface to SQLite	SQLite Database Connection Using a JDBC Driver
Database metadata	No	Yes
Complex functionality	No	Yes

MATLAB Interface to SQLite Limitations

The limitations of using the MATLAB interface to SQLite are:

- `NULL` values are not supported as the first value in any column.
- Database import options are not supported.

See Also

Related Examples

- "Access Relational Database Data in MATLAB" on page 2-2
- "Import Data Using MATLAB Interface to SQLite" on page 5-32
- "Insert Data into SQLite Database Table" on page 5-36
- "Create Table and Add Column in SQLite Database" on page 5-38
- "Deploy MATLAB Interface to SQLite Database Application with MATLAB Compiler" on page 5-43

External Websites

- SQLite Home Page

Connection Options

You can connect to a database in various ways using Database Toolbox. If you have access to a database, create a data source. Then, you can connect to the database either by using the Database Explorer app or the command line. If you do not have an installed database and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see "Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5.

Creating or Connecting to Data Source

If you already have a database driver installed, you can create a data source.

- For an ODBC driver, open the Microsoft ODBC Data Source Administrator dialog box by using the `configureODBCDataSource` function or the Database Explorer app. You can also configure an ODBC data source by using the `databaseConnectionOptions` function at the command line.
- For a JDBC driver, open the JDBC Data Source Configuration dialog box by using the Database Explorer app, or configure a JDBC data source by using the `databaseConnectionOptions` function at the command line.

For examples, see "Configure Driver and Data Source" on page 2-14. Otherwise, see Driver Installation for information about installing your driver. For configuring MySQL or PostgreSQL native interfaces, see "MySQL Native Interface" or "PostgreSQL Native Interface".

If your data source is already defined, then you are ready to connect to your database. If you do not define a data source, you can connect to your database using a DSN-less connection string with the `odbc` function. (DSN is a data source name.) For details, see "Connect to Database" on page 2-129.

After establishing a connection, you can explore the database and view data using the Database Explorer app or the command line. For details, see "Data Import Using Database Explorer App or Command Line" on page 2-133.

Defining Operating System Authentication

Operating system authentication enables you to connect to a database using your operating system user account. The operating system performs user validation, and the database does not require a different user name and password. Operating system authentication facilitates the maintenance of database access credentials. For example, Windows provides operating system authentication that can be configured to work with a Microsoft SQL Server database. For details about Microsoft SQL Server Windows authentication, see Set up the operating system authentication. on page 2-31

Connection Options

Use this table to choose your best connection option.

Connection Option	Usage
Database Explorer app	• Visually inspect the structure, or schema, of a database. • Assess the general size of a database by viewing the database structure. • Select the data in a table and import it into a MATLAB variable. • Generate a MATLAB script. • Generate an SQL query.
Command line	• Import data from a database into MATLAB. • Export data from MATLAB into a database. • Work with large amounts of data. • Run SQL queries stored in text files. • Run stored procedures and functions.

Several options enable you to connect to your database at the command line. Use this table to choose your best command line connection option.

Command Line Connection Option	Usage
ODBC connection	Connect to your database with maximum performance.
DSN-less connection	Connect to your database by using a connection string. For details, see the `odbc` function.
Native interface connection	Connect to MySQL and PostgreSQL databases. For PostgreSQL databases, you can connect without the installation of a driver. For details, see “MySQL Native Interface” and “PostgreSQL Native Interface”.
JDBC connection	Achieve maximum platform independence.
SQLite connection	Import data without installing a database or driver. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

You can create multiple connections at a time to the same database or different databases. For creating multiple connections using the Database Explorer app, see “Create SQL Queries Using Database Explorer App” on page 4-2. Or, you can use the `database` function to create multiple connections at the command line.

See Also

`odbc` | `database` | `mysql` | `postgresql`

More About

- “Choose Between ODBC and JDBC Drivers” on page 2-12
- “Connect to Database” on page 2-129
- “Data Import Using Database Explorer App or Command Line” on page 2-133
- “MySQL Native Interface”

- “PostgreSQL Native Interface”
- “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5

Setup Requirements for Database Connection

Refer to these setup requirements to establish the first connection to a database.

- If you do not have an installed database and want to store relational data quickly, use the MATLAB interface to SQLite. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.
- Ensure that you know the name of your database server or machine, the name of your database, the port number, and your user name and password. For ODBC drivers, once you create a data source, remember the data source name. For JDBC drivers, ensure that you know the file path where the JDBC driver is installed. For some JDBC drivers, you also need the URL string and the driver Java® class object. For some databases, more credentials are required. Contact your database administrator for all required database credentials to establish a connection to the database.
- Ensure that you have access to your database and driver documentation.
- Determine if your database uses operating system authentication. If you can connect to your database from outside of MATLAB without providing a user name and password, then your database uses operating system authentication. Exceptions to this rule are databases set up without any operating system or database authentication requirements, such as Microsoft Access and SQLite database files. Connecting to a database using operating system authentication from MATLAB can require additional steps.
- Ensure that you have write access to the path MATLAB displays after you execute `prefdir` at the command line.
- For ODBC data sources, ensure that you have administrator rights to the database for creating and modifying data sources.

See Also

`database`

More About

- “Access Relational Database Data in MATLAB” on page 2-2
- “Connect to Database” on page 2-129

Choose Between ODBC and JDBC Drivers

Defining Database Drivers

Database vendors, such as Microsoft and Oracle, implement their database systems using technologies that vary depending on customer needs, market demands, and other factors. Software applications written in popular programming languages, such as C, C++, and Java, need a way to communicate with these databases. Open Database Connectivity (ODBC) and Java Database Connectivity (JDBC) are standards for drivers that enable programmers to write database-agnostic software applications. ODBC and JDBC provide a set of rules recommended for efficient communication with a database. The database vendor is responsible for implementing and providing drivers that follow these rules.

Deciding Between ODBC and JDBC Drivers

ODBC is a standard Microsoft Windows interface that enables communication between database management systems and applications typically written in C or C++.

JDBC is a standard interface that enables communication between database management systems and applications written in Oracle Java.

Database Toolbox has a C++ library that connects natively to an ODBC driver. Database Toolbox has a Java library that connects directly to a pure JDBC driver.

Depending on your environment and what you want to accomplish, decide whether using an ODBC driver or a JDBC driver meets your needs.

Use native ODBC for:

- Fastest performance for data imports and exports
- Memory-intensive data imports and exports
- All functionality except the `runstoredprocedure` function

Use JDBC for:

- Platform independence, allowing you to work with any operating system (including Mac and Linux), driver version, or bitness
- Access to all Database Toolbox functions

The only limitation for these drivers is memory performance. MATLAB memory restricts the native ODBC driver. However, both MATLAB and JVM® heap memory restrict the JDBC driver.

See Also

`database` | `close`

More About

- “Access Relational Database Data in MATLAB” on page 2-2
- “Connection Options” on page 2-8
- “Configure Driver and Data Source” on page 2-14

- “Connect to Database” on page 2-129
- “Working with Large Data Sets” on page 2-135

Configure Driver and Data Source

Database Toolbox enables you to create a connection to a database installed on a machine or located in the cloud. You can connect to relational databases using ODBC and JDBC drivers, or you can connect to some databases using native interfaces. This topic provides information about configuring a driver and creating a data source for connecting to a relational database using a driver. For details about connecting to a database using a native interface, see "Connection Options" on page 2-8.

To connect to an installed database, first install the driver. For all databases, define a data source for an ODBC or JDBC driver. If you do not have an installed database and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see "Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5.

ODBC uses a Data Source Name (DSN) that is the logical name to refer to the driver and other required information for accessing data. This name is used to connect to an ODBC data source, such as a Microsoft SQL Server database.

Configure Driver and Create Data Source

Find your database environment in the following table by choosing your platform across the top and your database on the left. The link brings you to a page that has all the required steps for connecting to your database.

Database	**Platform**		
	Windows	**macOS 64-bit**	**Linux 64-bit**
Microsoft Access	"Microsoft Access ODBC for Windows" on page 2-19	Not supported	Not supported
Microsoft SQL Server	"Microsoft SQL Server ODBC for Windows" on page 2-23 "Microsoft SQL Server ODBC for Windows DSN-Less Connection" on page 2-28 "Microsoft SQL Server JDBC for Windows" on page 2-29	"Microsoft SQL Server JDBC for macOS" on page 2-70 "Microsoft SQL Server ODBC for macOS" on page 2-79 "Microsoft SQL Server ODBC for macOS DSN-Less Connection" on page 2-81	"Microsoft SQL Server ODBC for Linux" on page 2-78 "Microsoft SQL Server ODBC for Linux DSN-Less Connection" on page 2-87 "Microsoft SQL Server JDBC for Linux" on page 2-74
Oracle	"Oracle ODBC for Windows" on page 2-36 "Oracle JDBC for Windows" on page 2-41	"Oracle JDBC for macOS" on page 2-88	"Oracle JDBC for Linux" on page 2-93

Database	Platform		
	Windows	**macOS 64-bit**	**Linux 64-bit**
MySQL	“MySQL ODBC for Windows” on page 2-47 “MySQL ODBC for Windows DSN-Less Connection” on page 2-51 “MySQL JDBC for Windows” on page 2-52	“MySQL JDBC for macOS” on page 2-98 “MySQL ODBC for macOS” on page 2-82 “MySQL ODBC for macOS DSN-Less Connection” on page 2-84	“MySQL ODBC for Linux” on page 2-102 “MySQL ODBC for Linux DSN-Less Connection” on page 2-103 “MySQL JDBC for Linux” on page 2-104
PostgreSQL	“PostgreSQL ODBC for Windows” on page 2-56 “PostgreSQL ODBC for Windows DSN-Less Connection” on page 2-60 “PostgreSQL JDBC for Windows” on page 2-61	“PostgreSQL JDBC for macOS” on page 2-108 “PostgreSQL ODBC for macOS” on page 2-85 “PostgreSQL ODBC for macOS DSN-Less Connection” on page 2-86	“PostgreSQL ODBC for Linux” on page 2-112 “PostgreSQL ODBC for Linux DSN-Less Connection” on page 2-113 “PostgreSQL JDBC for Linux” on page 2-114
SQLite	“SQLite JDBC for Windows” on page 2-65	“SQLite JDBC for macOS” on page 2-118	“SQLite JDBC for Linux” on page 2-122

For ODBC-compliant or JDBC-compliant databases that are not listed in the table, see “Other ODBC-Compliant or JDBC-Compliant Databases” on page 2-126.

Limitations

The ODBC database connection on the Linux and macOS platform does not support the following:

- `select` function
- ODBC database connection using the Database Explorer app
- MySQL ODBC driver 8.0 and higher

See Also

`database` | `close`

More About

- “Access Relational Database Data in MATLAB” on page 2-2
- “Setup Requirements for Database Connection” on page 2-11
- “Choose Between ODBC and JDBC Drivers” on page 2-12

- “Connect to Database” on page 2-129
- “Modify and Delete Data Sources” on page 4-17
- “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5

Create JDBC Data Source and Set Options Programmatically

This example shows how to create a JDBC data source at the command line, set the JDBC connection options, and save the data source. The example configures a data source for a Microsoft® SQL Server® database.

Create JDBC Data Source

Create an SQL Server data source for a JDBC database connection.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor)
```

```
opts =
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Microsoft SQL Server"

         JDBCDriverLocation: ""
              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 1433
         AuthenticationType: "Server"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Set JDBC Connection Options

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and Windows® authentication. Also, set driver-specific connection options to specify a timeout value for establishing the database connection, and to disable SSL encryption.

```
opts = setoptions(opts, ...
    "DataSourceName","SQLServerDataSource", ...
    "JDBCDriverLocation", ...
    "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    "DatabaseName","toystore_doc", ...
    "Server","dbtb04","PortNumber",54317, ...
    "AuthenticationType","Windows","loginTimeout","20", ...
    "encrypt","false")
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Windows"

    Additional Connection Options:

                   encrypt: "false"
              loginTimeout: "20"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object. The driver-specific connection options appear below the other connection options.

Test and Save JDBC Data Source

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)

status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `setoptions` | `saveAsDataSource` | `database` | `testConnection`

More About

- “Modify and Delete Data Sources” on page 4-17
- “Configure Driver and Data Source” on page 2-14

Microsoft Access ODBC for Windows

This tutorial shows how to set up a data source and connect to a Microsoft Access database using the Database Explorer app or the command line. This tutorial uses the Microsoft Access Driver (*.mdb, *accdb) to connect to a sample Microsoft Access 2016 database.

Step 1. Set up the sample Access database.

You can access the sample database file, `tutorial.accdb`, in the folder returned by entering this code at the command line.

```
fullfile(matlabroot,'toolbox','database','dbdata')
```

Copy this database file into a folder where you have permission to write. Ensure that the database file is writable by verifying its properties:

1. Right-click the database file and select **Properties**.
2. On the **General** tab, if the **Read-only** option is selected, clear it.

Note To write data to the sample database, ensure that you run MATLAB as an administrator.

Note Depending on the Access version you are running, you might need to convert the database to that version. For example, beginning in Access 2007, the software includes the option to save as `*.accdb`. For details, consult your database administrator.

Step 2. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

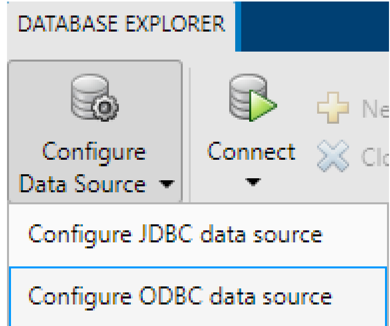
Note Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of Access. Or, to connect to the 32-bit version of Access, see https://www.mathworks.com/matlabcentral/answers/235949-how-to-connect-to-32-bit-microsoft-access-database-from-64-bit-matlab. For details about working with the 64-bit version of Windows, see Using Previous MATLAB Releases.

Step 3. Set up the data source using the Database Explorer app.

Set up the sample Access database as the data source by using the Database Explorer app. You can locate the target database on a PC running the Windows operating system or on another system to which the PC is networked. These instructions use the Microsoft ODBC Data Source Administrator Version 10.0.16299.15 for the US English version of Microsoft Access 2016 for Windows systems.

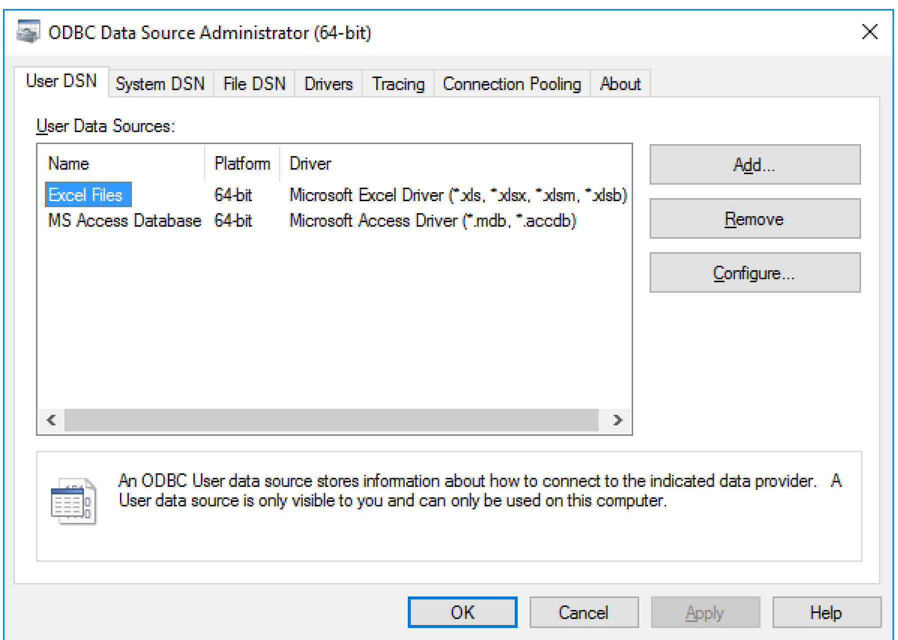
The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1. Close any open Access databases.
2. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
3. In the **Data Source** section, select **Configure Data Source** > **Configure ODBC data source**.



In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

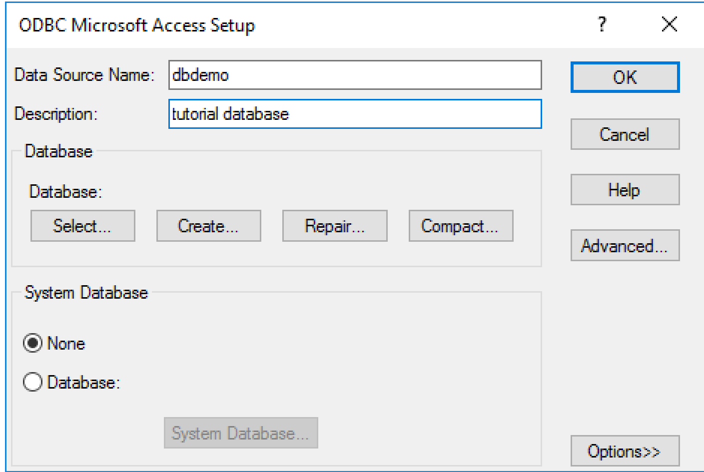
Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.



4. On the **User DSN** tab, click **Add**. The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

5 Select `Microsoft Access Driver (*.mdb, *.accdb)` and click **Finish**.

6 In the ODBC Microsoft Access Setup dialog box for your driver, enter `dbdemo` as the data source name. Enter `tutorial database` as the description.



7 Click **Select** to open the Select Database dialog box, where you specify the database you want to use. For the `dbdemo` data source, select `tutorial.accdb`. If the database is on a system to which your PC is connected:

   a Click **Network**.

   b In the Map Network Drive dialog box, specify the folder containing the database you want to use. Ensure that you map to the *folder* and not the database file.

   c Click **Finish**.

8 Click **OK** to close the Select Database dialog box. In the ODBC Microsoft Access Setup dialog box, click **OK**. The ODBC Data Source Administrator dialog box displays the `dbdemo` data source and any additional data sources that you added on the **User DSN** tab. Click **OK** to close the dialog box.

After you complete the data source setup, connect to the Access database using the Database Explorer app or the command line with the native ODBC connection.

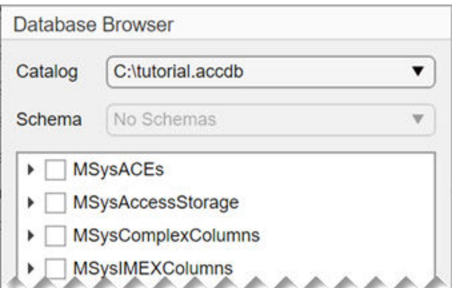
Step 4. Connect using the Database Explorer app or the command line.

Connect to Access Using Database Explorer App

1 On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.

2 In the connection dialog box, leave the **Username** and **Password** boxes blank, and click **Connect**.

   The app connects to the database and displays a list of its objects, such as tables, in the **Data Browser** pane. The data source tab named **dbdemo** appears to the right of the pane. The data source tab contains empty **SQL Query** and **Data Preview** panes.



3. Select tables in the **Data Browser** pane to query the database.
4. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to Access Using ODBC Driver and Command Line

1. Connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

Microsoft SQL Server ODBC for Windows

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the Database Explorer app or the command line. The tutorial uses the Microsoft ODBC Driver 13.1 for SQL Server to connect to a Microsoft SQL Server 2016 Express database. Also, you can use these steps to configure Azure® Synapse SQL.

Step 1. Verify the driver installation.

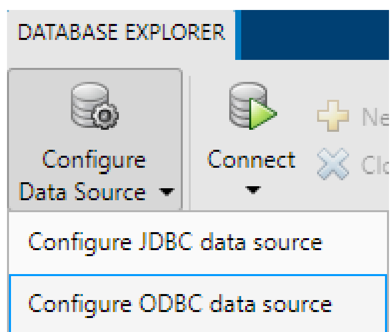
The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

Note Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of SQL Server. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see "Microsoft SQL Server JDBC for Windows" on page 2-29. For details about working with the 64-bit version of Windows, see Using Previous MATLAB Releases.

Step 2. Set up the data source using the Database Explorer app.

The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2 In the **Data Source** section, select **Configure Data Source** > **Configure ODBC data source**.

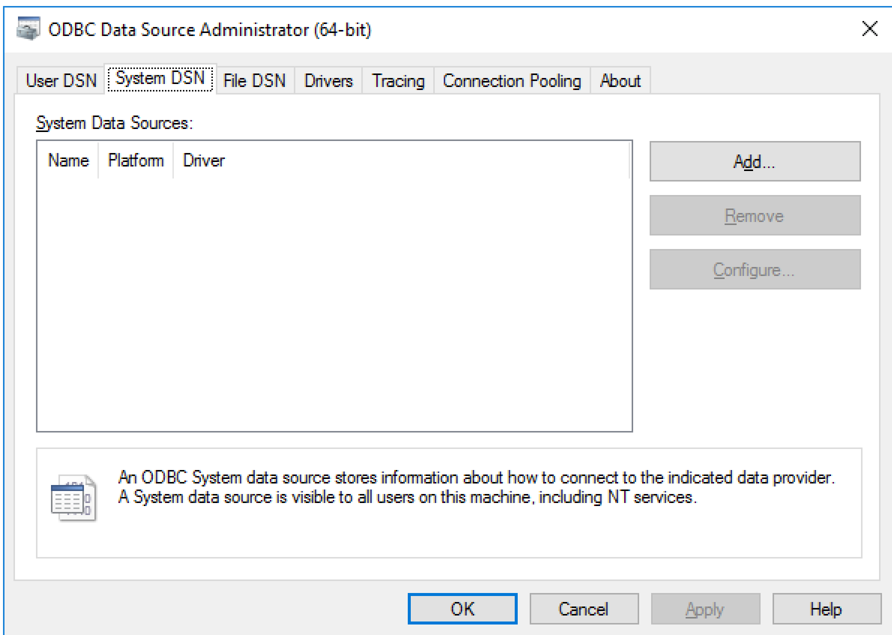


In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the

database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.

3 Click the **System DSN** tab, and then click **Add**.



The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

4 Select `SQL Server Native Client 11.0`.

Note The name of the ODBC driver can vary.

Click **Finish**.

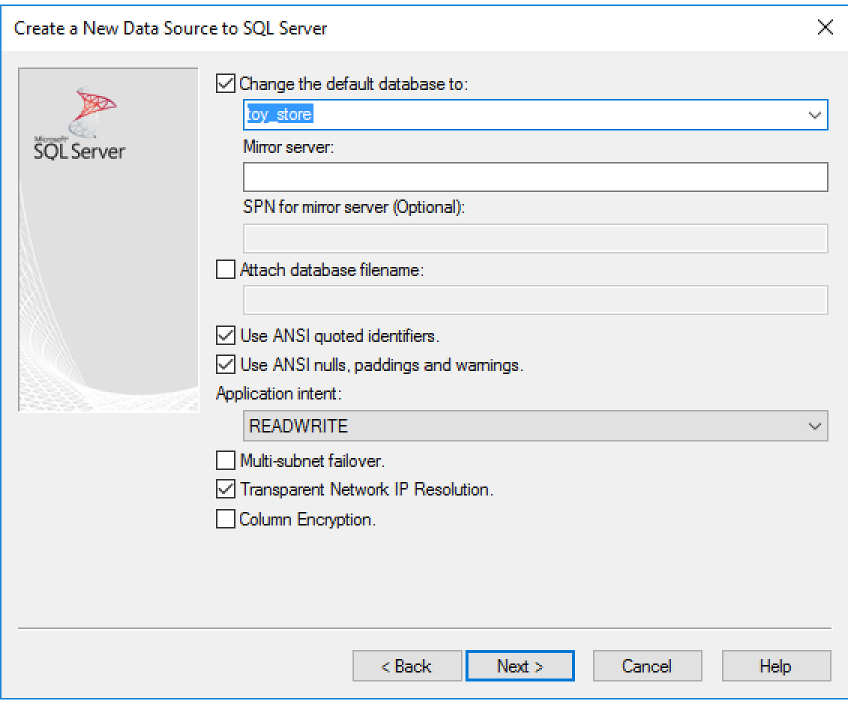
5 In the Create a New Data Source to SQL Server dialog box, enter an appropriate name for the data source. You use this name to establish a connection to your database. Here, in the **Name** box, enter `MS SQL Server` as the data source name. In the **Description** box, enter `Microsoft SQL Server` as the description. From the **Server** list, select the database server for this data source to use. Consult your database administrator for the name of your database server. Click **Next**.

6 You can set up an ODBC data source with or without Windows authentication.

If you want to connect to SQL Server using Windows authentication, select **With Integrated Windows Authentication**. Then click **Next**.

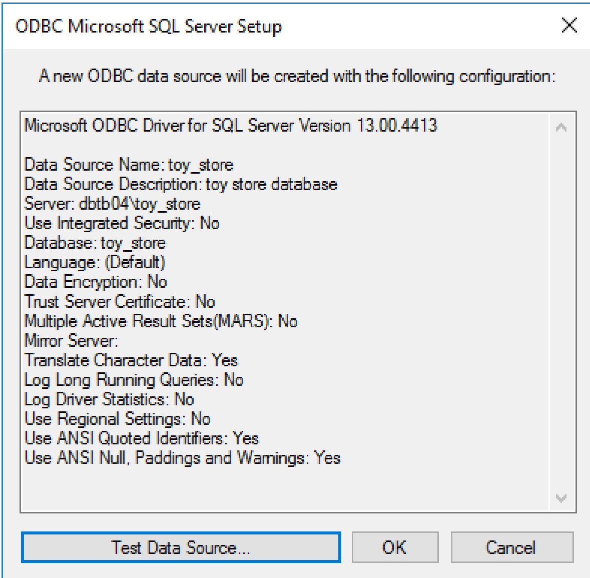
Or, if you want to connect to SQL Server without Windows authentication, select **With SQL Server authentication using a login ID and password entered by the user**. Enter your user name in the **Login ID** box and your password in the **Password** box. Then click **Next**.

7 In the Create a New Data Source to SQL Server dialog box, select **Change the default database to** and enter the name of the default database on the database server for connection. Here, use the database `toy_store`. Then click **Next**.

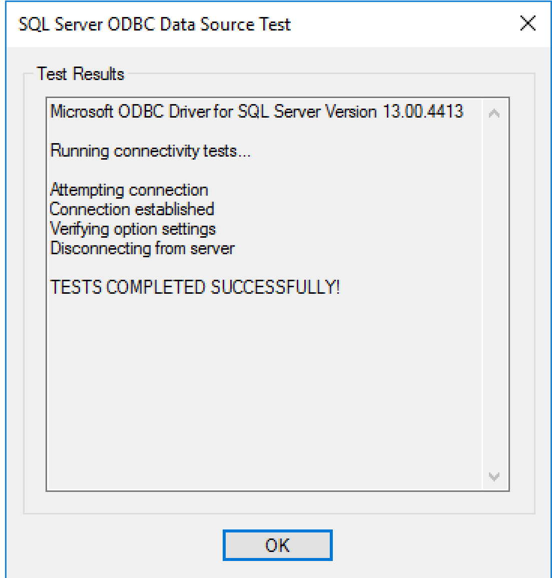


8 Click **Finish** to accept the default settings.

9 In the ODBC Microsoft SQL Server Setup dialog box, test your connection by clicking **Test Data Source**.



10 If the connection succeeds, the SQL Server ODBC Data Source Test dialog box opens and displays a message indicating the tests completed successfully. Click **OK** to close this dialog box. Click **OK** to close the ODBC Microsoft SQL Server Setup dialog box.



11 The ODBC Data Source Administrator dialog box shows the new data source under System Data Sources on the **System DSN** tab. Click **OK** to close the ODBC Data Source Administrator dialog box.

   After you complete the data source setup, connect to the SQL Server database using the Database Explorer app or the command line with the native ODBC connection.

Step 3. Connect using the Database Explorer app or the command line.

Connect to SQL Server Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. If you create a connection with Windows authentication, leave the **Username** and **Password** boxes blank in the connection dialog box, and click **Connect**. Otherwise, enter a user name and password, and click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to SQL Server Using ODBC Driver and Command Line

1. To connect with Windows authentication, connect to the database with the authenticated ODBC data source name and a blank user name and password. For example, this code assumes that you are connecting to a data source named `MS SQL Server Auth`.

   ```
   conn = database('MS SQL Server Auth','','');
   ```

   Or, to connect without Windows authentication, connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `MS SQL Server` with the user name `username` and the password `pwd`.

   ```
   conn = database('MS SQL Server','username','pwd');
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`database` | `close`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

Microsoft SQL Server ODBC for Windows DSN-Less Connection

This tutorial shows how to verify your driver installation and connect to a Microsoft SQL Server database using a DSN-less connection string at the command line. (DSN is a data source name.) The tutorial uses the Microsoft ODBC Driver 13.1 for SQL Server to connect to a Microsoft SQL Server 2016 Express database on the Windows platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

Note Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of SQL Server. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see "Microsoft SQL Server JDBC for Windows" on page 2-29. For details about working with the 64-bit version of Windows, see Using Previous MATLAB Releases.

Step 2. Connect using the DSN-less connection string and command line.

1. Connect to the database using the DSN-less connection string with the `odbc` function. For example, this code assumes that you are connecting to the local database server, port number `1433`, database name `toystore_doc`, user name `username`, and password `pwd`.

```
dsnless = strcat("Driver={SQL Server Native Client 13.1}; Server=localhost\toystore_doc;", ..
   "Port=1433; Database=toystore_doc; UID=username; PWD=pwd");
conn = odbc(dsnless);
```

2. Close the database connection.

```
close(conn)
```

See Also

`odbc` | `close`

Related Examples

- "Configure Driver and Data Source" on page 2-14
- "Microsoft SQL Server ODBC for Windows" on page 2-23
- "Microsoft SQL Server ODBC for Linux DSN-Less Connection" on page 2-87
- "Database Connection Error Messages" on page 3-7

Microsoft SQL Server JDBC for Windows

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the Database Explorer app or the command line. This tutorial uses the Microsoft JDBC Driver 4.0 for Microsoft SQL Server to connect to a Microsoft SQL Server 2016 Express database.

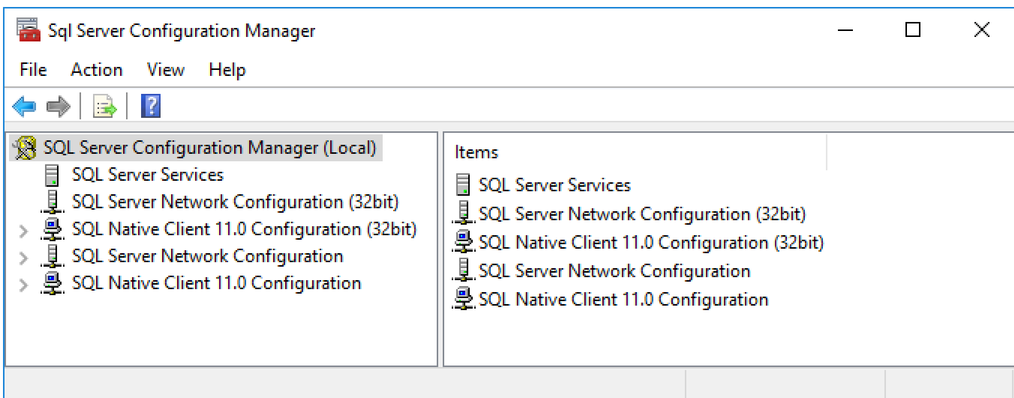
Step 1. Verify the driver installation.

If the JDBC driver for Microsoft SQL Server is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Verify the port number.

Complete the following steps on the machine where SQL Server is installed to find your port number for database connection. If you experience connection issues with the port number that you find, contact your database administrator.

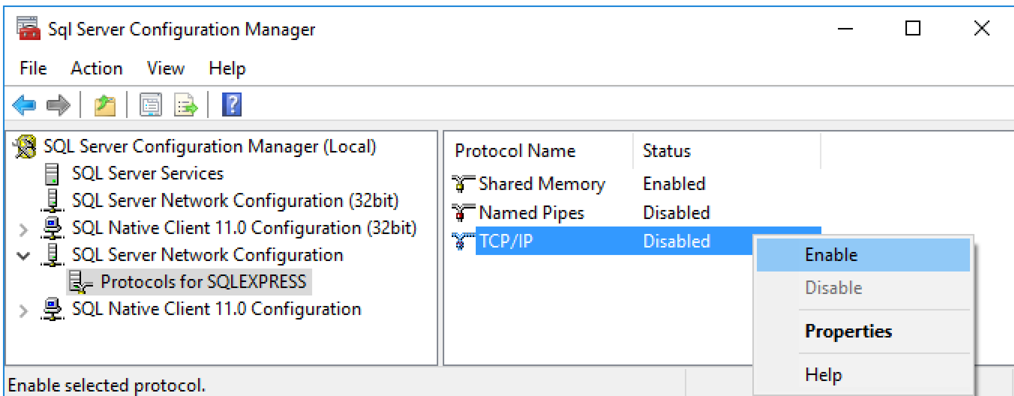
1 On the machine where your SQL Server database is installed, click **Start**. Select your Microsoft SQL Server version folder and click **SQL Server Configuration Manager**.



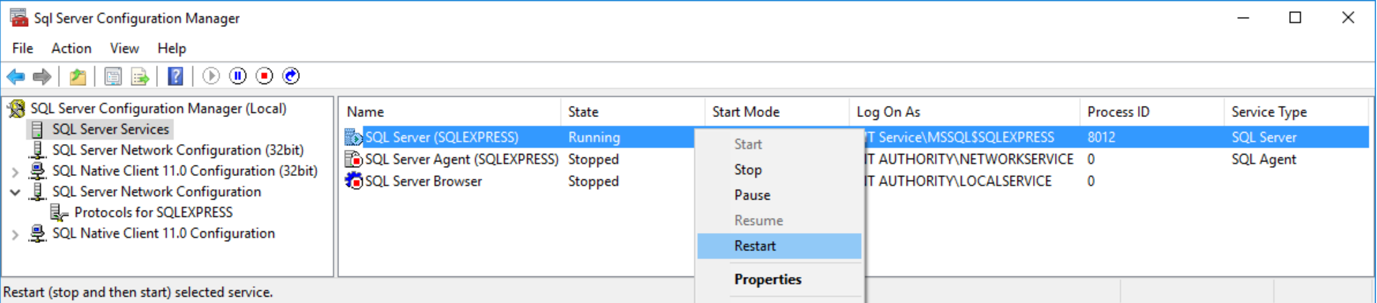
2 On the left of the Sql Server Configuration Manager window, click **SQL Server Network Configuration**. Double-click **Protocols for SQLEXPRESS**.

3 See if TCP/IP is enabled. If so, skip steps 4 and 5.

4 If TCP/IP is disabled, right-click **TCP/IP** and select **Enable**.

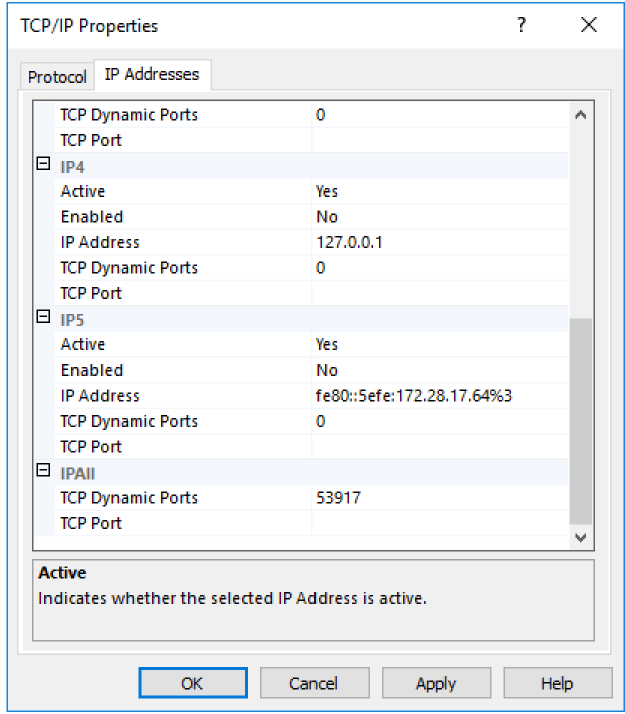


5 To finish the process of enabling the TCP/IP protocol, restart the server. On the left side of the window, click **SQL Server Services**. Right-click **SQL Server (SQLEXPRESS)** and click **Restart**. The server restarts, enabling TCP/IP.



6 Click **Protocols for SQLEXPRESS** and right-click **TCP/IP**. Select **Properties**.

7 In the TCP/IP Properties dialog box, scroll to the bottom on the **IP Addresses** tab until you see the **IPAll** group. The number next to **TCP Dynamic Ports** is the port number. Use this port number in the JDBC Data Source Configuration dialog box when configuring a data source using the Database Explorer app. Or, enter this port number as an input argument of the `database` function at the command line. Here, the port number is `53917`. If this number is `0` or if you want to configure your SQL Server database server to listen to a specific port, delete the entry in the **TCP Dynamic Ports** box. Then, enter another port number in the **TCP Port** box.



8 Click **Apply** and click **OK** to close the TCP/IP Properties dialog box. Then, close the Sql Server Configuration Manager dialog box.

Step 3. Set up the operating system authentication.

Windows authentication enables you to connect to a database using your Windows user account. In this case, Windows performs user validation, and the database does not require a different user name and password. Windows authentication facilitates the maintenance of database access credentials. After you add the required libraries to the system path, the Microsoft SQL Server JDBC driver enables connectivity using Windows authentication. The following steps show how to add these libraries to the Java library path in MATLAB. For details about Java libraries, see “Java Class Path”.

1. Ensure that you have the latest Java driver library installed on your computer. To install the latest library, see Driver Installation.
2. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
3. Close MATLAB.
4. Navigate to the folder from step 2, and create a file named `javalibrarypath.txt` in the folder.
5. Open `javalibrarypath.txt` and insert the path to the Java library file `sqljdbc_auth.dll`. This file is installed in the following location:

   ```
   <installation>\sqljdbc_<version>\<language>\auth\<arch>
   ```

   `<installation>` is the installation folder of the Microsoft SQL Server JDBC driver, `<version>` is the JDBC driver version, `<language>` is the JDBC driver language, and `<arch>` is the architecture.

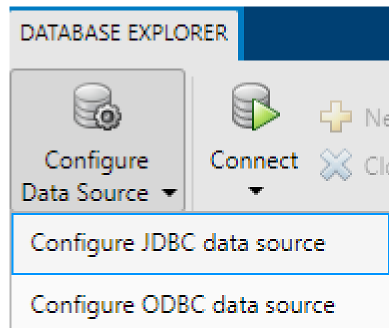
   Use the x64 folder. In the entry, include the full path to the library file. Do not include the library file name. The following is an example of the path: `C:\DB_Drivers\sqljdbc_4.0\enu\auth\x64`. Save and close `javalibrarypath.txt`.
6. Restart MATLAB.

Step 4. Set up the data source.

You set up a data source using the Database Explorer app or the command line.

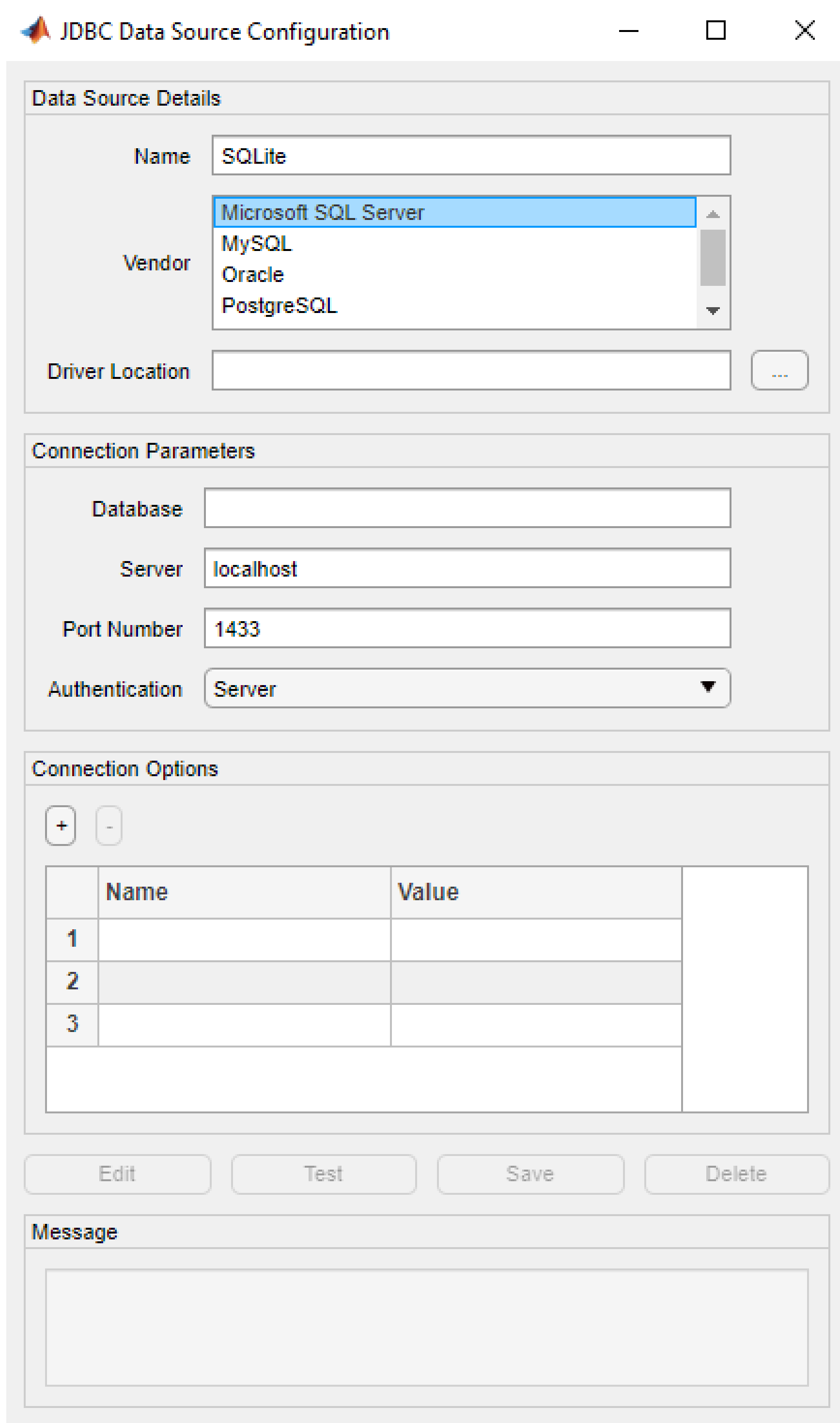
Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.

3 In the **Name** box, enter a name for your data source. You use this name to establish a connection to your database.
4 From the **Vendor** list, select `Microsoft SQL Server`.



5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.
7. To establish the data source with Windows authentication, set **Authentication** to `Windows`.

   Or, to establish the data source without Windows authentication, set **Authentication** to `Server`.
8. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
9. Click **Test**. The Test Connection dialog box opens. If you are connecting without Windows authentication, then enter the user name and password for your database. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
10. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for an SQL Server database.

   ```
   vendor = "Microsoft SQL Server";
   opts = databaseConnectionOptions("jdbc",vendor);
   ```
2. Set the JDBC connection options. To set the connection options with Windows authentication, use the `'AuthenticationType'` name-value pair argument. For example, this code assumes that you are connecting to a JDBC data source named `MSSQLServer`, full path of the JDBC driver file `C:\Drivers\sqljdbc4.jar`, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and authentication type `Windows`.

   ```
   opts = setoptions(opts, ...
       'DataSourceName',"MSSQLServer", ...
       'JDBCDriverLocation',"C:\Drivers\sqljdbc4.jar", ...
       'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
       'PortNumber',54317,'AuthenticationType',"Windows");
   ```

   To set the connection options without Windows authentication, omit the `'AuthenticationType'` name-value pair argument.
3. For a data source with Windows authentication, test the database connection by leaving the user name and password blank.

   ```
   username = "";
   password = "";
   status = testConnection(opts,username,password);
   ```

   To test without Windows authentication, specify a user name and password.
4. Save the JDBC data source.

   ```
   saveAsDataSource(opts)
   ```

After you complete the data source setup, connect to the SQL Server database using the Database Explorer app or the JDBC driver and command line.

Step 5. Connect using the Database Explorer app or the command line.

Connect to SQL Server Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. If you create a connection with Windows authentication, leave the **Username** and **Password** boxes blank in the connection dialog box, and click **Connect**. Otherwise, enter a user name and password, and click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to SQL Server Using JDBC Driver and Command Line

1. To connect with Windows authentication, use the configured JDBC data source and specify a blank user name and password. For example, this code assumes that you are connecting to a JDBC data source named `MSSQLServerAuth`.

```
datasource = "MSSQLServerAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

   Or, to connect without Windows authentication, use the configured JDBC data source and specify the user name `username` and the password `pwd`. For example, this code assumes that you are connecting to a JDBC data source named `MSSQLServer`.

```
datasource = "MSSQLServer";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

Oracle ODBC for Windows

This tutorial shows how to set up a data source and connect to an Oracle database using the Database Explorer app or the command line. This tutorial uses the OraClient11g_home1 ODBC driver to connect to an Oracle 11g Enterprise Edition database.

Step 1. Verify the driver installation.

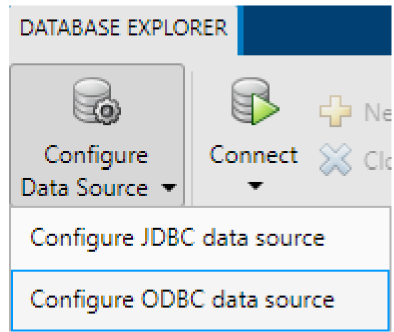
The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

Note: Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of Oracle. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see "Oracle JDBC for Windows" on page 2-41. For details about working with the 64-bit version of Windows, see Using Previous MATLAB Releases.

Step 2. Set up the data source using the Database Explorer app.

The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2 In the **Data Source** section, select **Configure Data Source** > **Configure ODBC data source**.

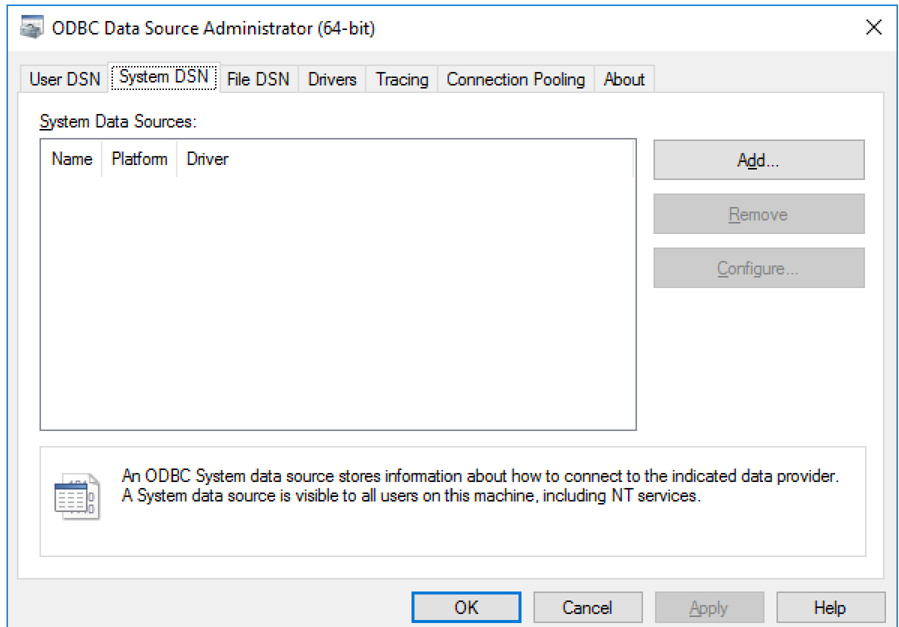


In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the

database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.

3 Click the **System DSN** tab, and then click **Add**.

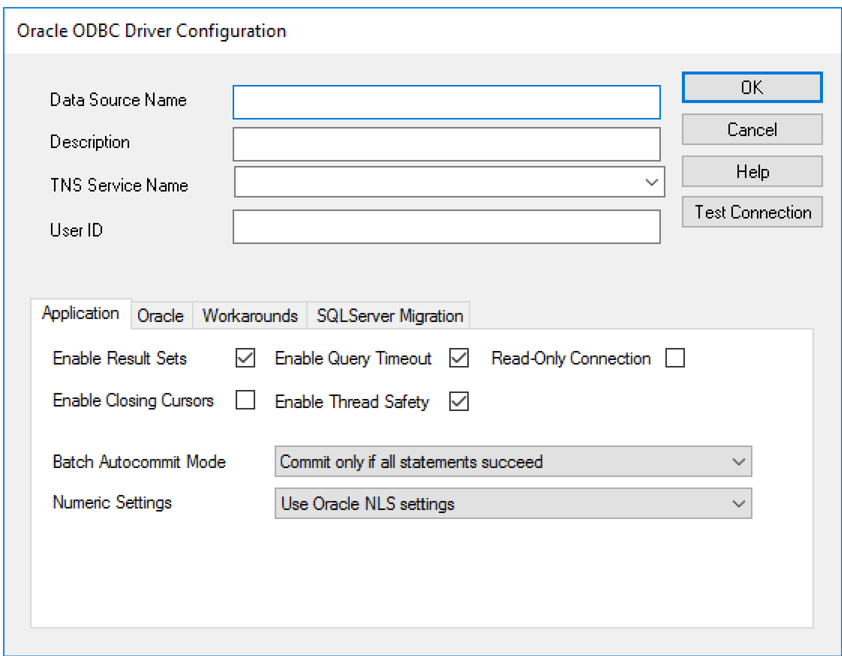


The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

4 Select the ODBC driver `Oracle in OraClient11g_home1`.

Note The name of the ODBC driver can vary.

Click **Finish**.



5 In the Oracle ODBC Driver Configuration dialog box, enter an appropriate name for the data source. You use this name to establish a connection to your database. Here, in the **Data Source Name** box, enter `ORA` as the data source name. In the **Description** box, enter a description for this data source, such as `Oracle database`. In the **TNS Service Name** box, enter the name of your database.

6 You can set up an ODBC data source with or without Windows authentication.

   To establish the data source without Windows authentication, enter your user name in the **User ID** box. Or, to establish the data source with Windows authentication, leave this box blank. Leave the **Application**, **Oracle**, **Workarounds**, and **SQLServer Migration** tabs with the default settings.

7 Click **Test Connection** to test the connection to your database. The Oracle ODBC Driver Connect dialog box opens. If you are establishing the data source with Windows authentication, the Testing Connection dialog box opens.

8 Enter your password in the **Password** box. Your database name and user name are automatically entered in the **Service Name** and **User Name** boxes. Click **OK**. If your computer successfully connects to the database, the Testing Connection dialog box displays a message indicating the connection is successful. Click **OK**.

9 Click **OK** in the Oracle ODBC Driver Configuration dialog box. The ODBC Data Source Administrator dialog box shows the ODBC data source `ORA`.

   After you complete the data source setup, connect to the Oracle database using the Database Explorer app or the command line with the native ODBC connection.

Step 3. Connect using the Database Explorer app or the command line.

Connect to Oracle Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. If you create a connection with Windows authentication, leave the **Username** and **Password** boxes blank in the connection dialog box, and click **Connect**. Otherwise, enter a user name and password, and click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Schema** list, select the schema. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to Oracle Using ODBC Driver and Command Line

1. To connect with Windows authentication, connect to the database with the authenticated ODBC data source name and a blank user name and password. For example, this code assumes that you are connecting to a data source named `Oracle_Auth`.

   ```
   conn = database('Oracle_Auth','','');
   ```

   Or, to connect without Windows authentication, connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `Oracle` with the user name `username` and the password `pwd`.

   ```
   conn = database('Oracle','username','pwd');
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`database` | `close`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

Oracle JDBC for Windows

This tutorial shows how to set up a data source and connect to an Oracle database using the Database Explorer app or the command line. This tutorial uses the Oracle Database 11g Release 2 (11.2.0.3) JDBC driver for use with JDK™ 1.6 to connect to an Oracle 11g Enterprise Edition Release 11.2.0.1.0 database.

Step 1. Verify the driver installation.

If the JDBC driver for Oracle is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the operating system authentication.

Windows authentication enables you to connect to a database using your system or network user name and password. In this case, the database does not require a different user name and password. Windows authentication facilitates connecting to the database and maintaining database access credentials. After you add the required libraries to the system path, the Oracle JDBC driver enables connectivity using Windows authentication. The following steps show how to add these libraries to the Java library path in MATLAB. For details about Java libraries, see “Java Class Path”.

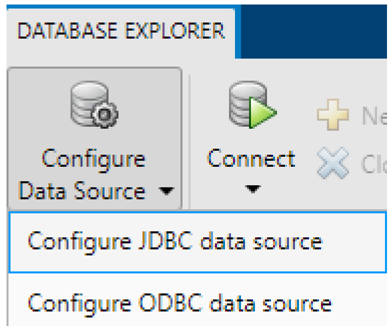
1. Ensure that you have the latest Oracle OCI libraries installed on your computer. To install the latest library, see Driver Installation.
2. Run the `prefdir` function in the Command Window. The output of this command is a file path to the MATLAB preferences folder on your computer. For details, see `prefdir`.
3. Close MATLAB.
4. Navigate to the folder from step 2, and create a file named `javalibrarypath.txt` in the folder.
5. Open `javalibrarypath.txt` and insert the path to the Oracle OCI libraries. The entry must include the full path to the library files. The entry must not contain the library file names. The following is an example of the path: `C:\DB_Libraries\instantclient_11_2`. Save and close `javalibrarypath.txt`.
6. In the environment variables of the advanced system settings, add the Oracle OCI library full path to the Windows Path environment variable.
7. Restart MATLAB.

Step 3. Set up the data source.

You set up a data source using the Database Explorer app or the command line.

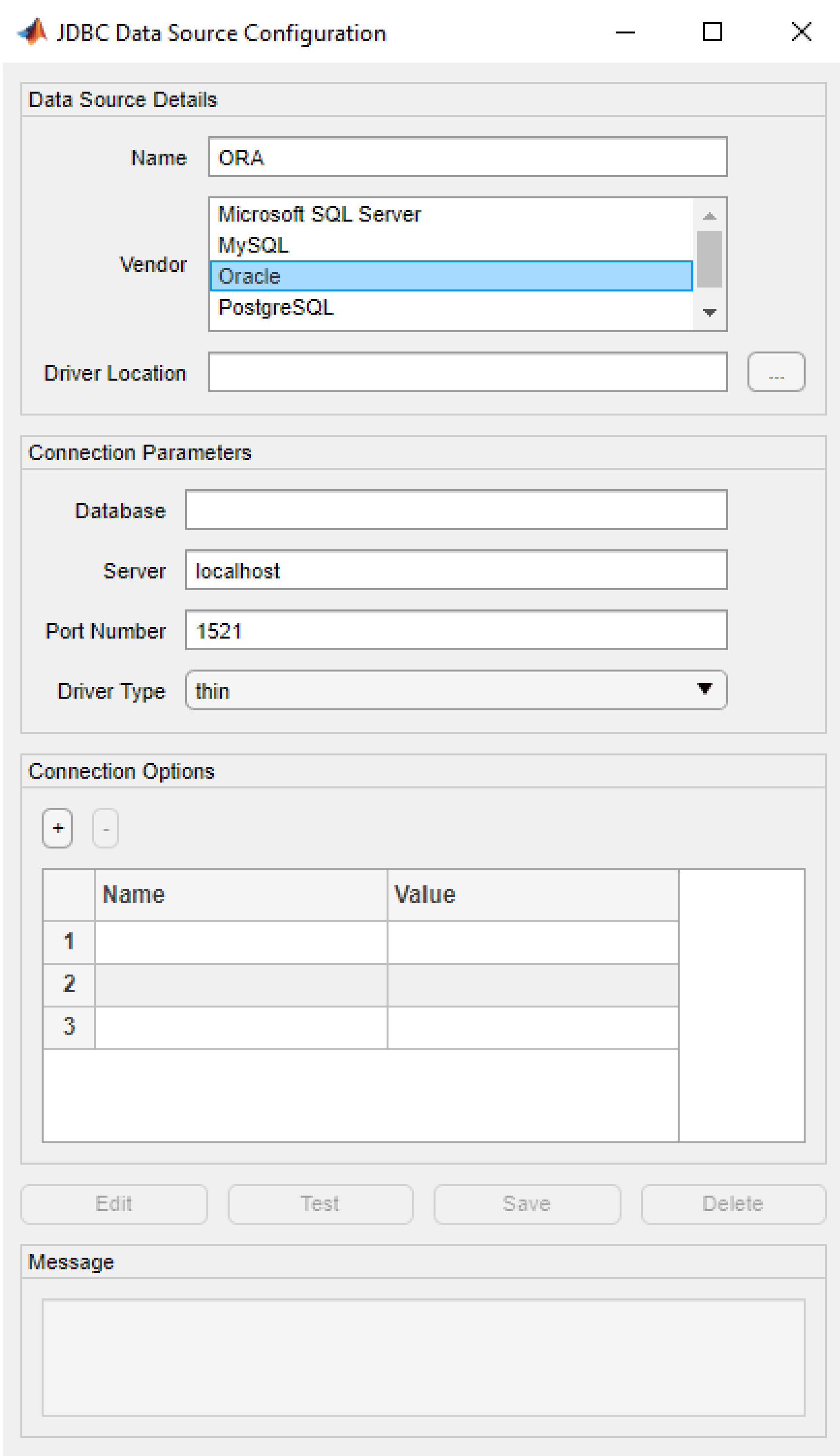
Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.

3. In the **Name** box, enter the name of your data source. (This example uses a data source named `ORA`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `Oracle`.



Note To use the full entry from your `tnsnames.ora` file, select `Other` instead and enter the full entry in the resulting **URL** box. Then, enter the full path to the JDBC driver file in the **Driver Location** box and the name of the driver in the resulting **Driver** box. Save the JDBC data source.

For details about these steps, see “Other ODBC-Compliant or JDBC-Compliant Databases” on page 2-126.

5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database.

   The name can be the service name or the Oracle system identifier (SID), depending on your specific Oracle database setup. For details, see your `tnsnames.ora` file, which is often stored in `<ORACLE_HOME>\NETWORK\ADMIN`, where `<ORACLE_HOME>` is the folder containing the installed database or Oracle client.
7. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.
8. To establish the data source with Windows authentication, set **Driver Type** to `oci`.

   Or, to establish the data source without Windows authentication, set **Driver Type** to `thin`.
9. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
10. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database. If you are connecting with Windows authentication, then leave these boxes blank. Click **Test**.

    If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
11. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for an Oracle database.

```
vendor = "Oracle";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. To set the connection options with Windows authentication, use the `'DriverType'` name-value pair argument. For example, this code assumes that you are connecting to a JDBC data source named `ORA`, full path of the JDBC driver file `C:\Drivers\ojdbc7.jar`, database name `toystore_doc`, database server `dbtb05`, port number `1521`, and driver type `oci` (for Windows authentication).

```
opts = setoptions(opts, ...
    'DataSourceName',"ORA", ...
    'JDBCDriverLocation',"C:\Drivers\ojdbc7.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb05", ...
    'PortNumber',1521,'DriverType',"oci");
```

   To set the connection options without Windows authentication, omit the `'DriverType'` name-value pair argument.

3. For a data source with Windows authentication, test the database connection by leaving the user name and password blank.

```
username = "";
password = "";
status = testConnection(opts,username,password);
```

To test without Windows authentication, specify a user name and password.

4 Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the Oracle database using the Database Explorer app or the JDBC driver and command line.

Step 4. Connect using the Database Explorer app or the command line.

Connect to Oracle Using Database Explorer App

1 On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.

2 If you create a connection with Windows authentication, leave the **Username** and **Password** boxes blank in the connection dialog box, and click **Connect**. Otherwise, enter a user name and password, and click **Connect**.

   The Catalog and Schema dialog box opens.

3 In the **Schema** list, select the schema. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to Oracle Using JDBC Driver and Command Line

1 To connect with Windows authentication, use the configured JDBC data source and specify a blank user name and password. For example, this code assumes that you are connecting to a JDBC data source named `ORA_Auth`.

```
datasource = "ORA_Auth";
username = "";
password = "";
conn = database(datasource,username,password);
```

   Or, to connect without Windows authentication, use the configured JDBC data source and specify the user name `username` and the password `pwd`. For example, this code assumes that you are connecting to a JDBC data source named `ORA`.

```
datasource = "ORA";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

If you have trouble using the `database` function, use the full entry from your `tnsnames.ora` file in the URL string as one consecutive line. Leave the first argument blank. For example, this code assumes that the value of the `'URL'` name-value pair argument is set to the specified `tnsnames.ora` file entry for an Oracle database.

```
conn = database('','username','pwd', ...
    'Vendor','Oracle', ...
    'URL',['jdbc:oracle:thin:@(DESCRIPTION = ' ...
    '(ADDRESS = (PROTOCOL = TCP)(HOST = sname)' ...
    '(PORT = 123456)) (CONNECT_DATA = ' ...
    '(SERVER = DEDICATED) (SERVICE_NAME = dbname) ) )']);
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

MySQL ODBC for Windows

This tutorial shows how to set up a data source and connect to a MySQL database using the Database Explorer app or the command line. The tutorial uses a MySQL ODBC 5.3 Driver to connect to the MySQL database.

Step 1. Verify the driver installation.

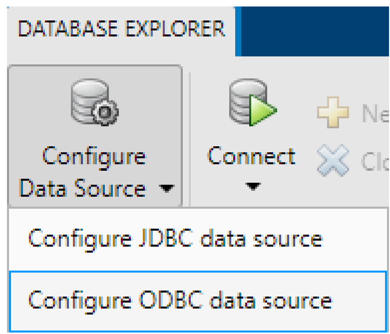
The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

Note: Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of MySQL. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see "MySQL JDBC for Windows" on page 2-52. For details about working with the 64-bit version of Windows, see Using Previous MATLAB Releases.

Step 2. Set up the data source using the Database Explorer app.

The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure ODBC data source**.

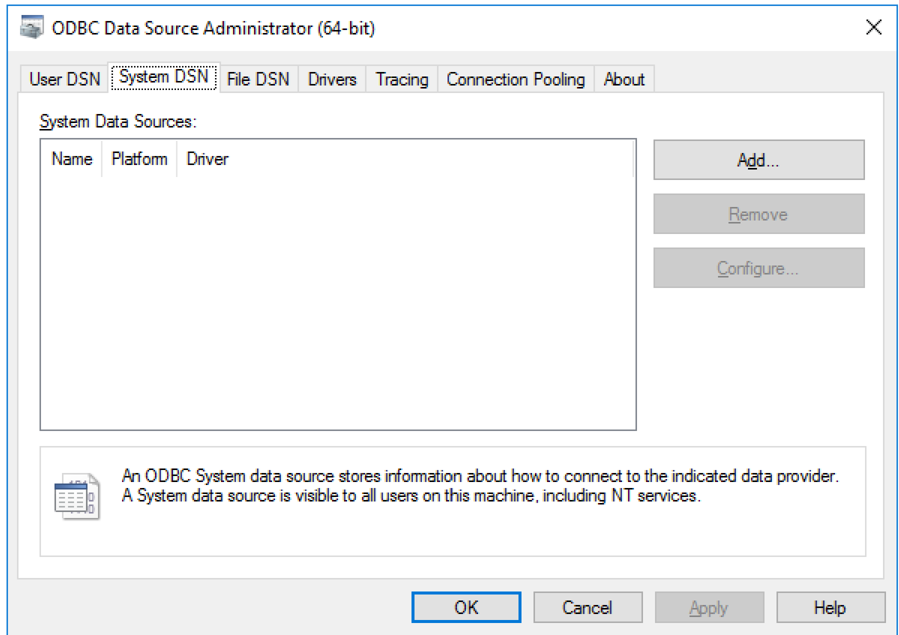


In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the

database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.

3 Click the **System DSN** tab, and then click **Add**.



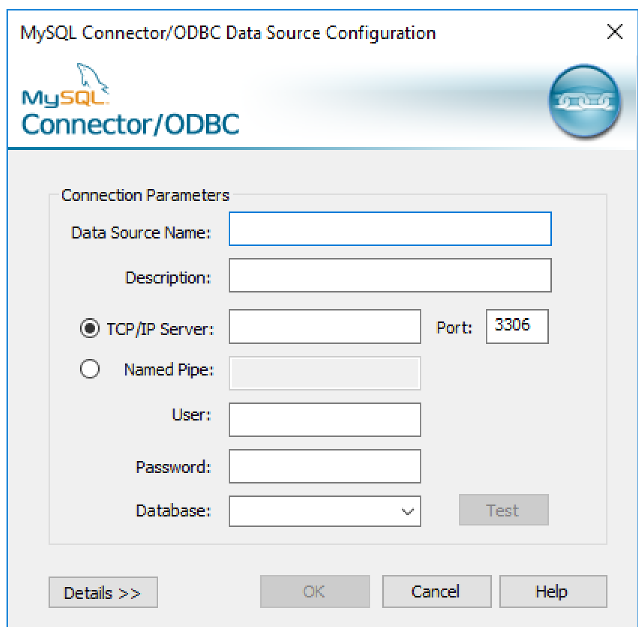
The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

4 Select the ODBC driver `MySQL ODBC 5.2a Driver`.

Note The name of the ODBC driver can vary.

Click **Finish**.

5 In the MySQL Connector/ODBC Data Source Configuration dialog box, fill out the boxes.



- In the **Data Source Name** box, enter an appropriate name for the data source, such as `MySQL`. You use this name to establish a connection to your database.
- In the **Description** box, enter a description for this data source, such as `MySQL database`.
- In the **TCP/IP Server** box, enter the name of your database server. Consult your database administrator for the name of your database server.
- In the **Port** box, enter the port number. The default port number is `3306`.
- In the **User** box, enter your user name.
- In the **Password** box, enter your password.
- In the **Database** box, enter the name of your database.

6. Click **Test** to test the connection to your database. If your computer successfully connects to the database, the Test Result dialog box opens and displays a message indicating the connection is successful.
7. Click **OK** in the MySQL Connector/ODBC Data Source Configuration dialog box. The ODBC Data Source Administrator dialog box shows the ODBC data source `MySQL`.

   After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the command line with the native ODBC connection.

Step 3. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3. In the **Catalog** list, select the catalog. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to MySQL Using ODBC Driver and Command Line

1. Connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `MySQL` with the user name `username` and the password `pwd`.

   ```
   conn = database('MySQL','username','pwd');
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`database` | `close`

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14
- "Modify and Delete Data Sources" on page 4-17
- "Database Explorer App Error Messages" on page 3-14
- "Database Connection Error Messages" on page 3-7

MySQL ODBC for Windows DSN-Less Connection

This tutorial shows how to verify your driver installation and connect to a MySQL database using a DSN-less connection string at the command line. (DSN is a data source name.) The tutorial uses a MySQL ODBC 5.3 Driver to connect to the MySQL database on the Windows platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

Step 2. Connect using the DSN-less connection string and command line.

1 Connect to the database using the DSN-less connection string with the `odbc` function. For example, this code assumes that you are connecting to the local database server, database name `toystore_doc`, user name `username`, and password `pwd`.

```
dsnless = strcat("Driver={MySQL ODBC 5.3 Ansi Driver}; Server=localhost; ", ...
   "Database=toystore_doc; UID=username; PWD=pwd");
conn = odbc(dsnless);
```

2 Close the database connection.

```
close(conn)
```

See Also

`odbc` | `close`

Related Examples

- "Configure Driver and Data Source" on page 2-14
- "MySQL ODBC for Windows" on page 2-47
- "MySQL ODBC for Linux DSN-Less Connection" on page 2-103
- "Database Connection Error Messages" on page 3-7

MySQL JDBC for Windows

This tutorial shows how to set up a data source and connect to a MySQL database using the Database Explorer app or the command line. This tutorial uses the MySQL Connector/J 5.1.46 driver to connect to a MySQL Version 5.5.16 database.

Step 1. Verify the driver installation.

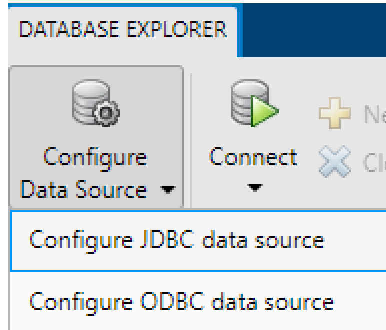
If the JDBC driver for MySQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

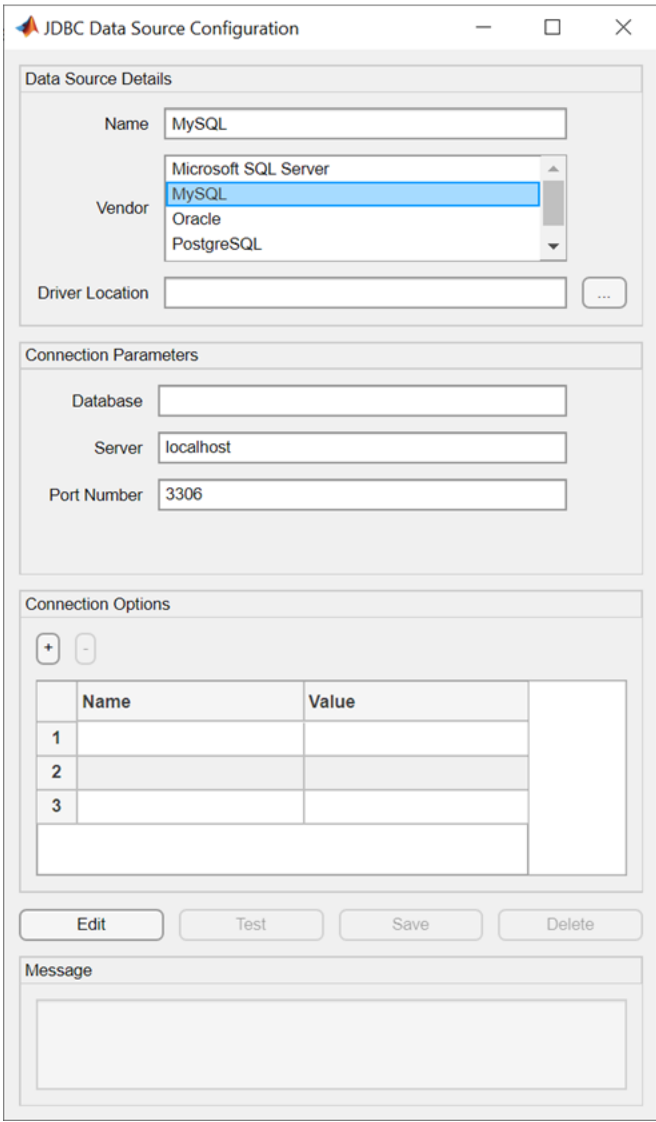
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2 In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.
3 In the **Name** box, enter the name of your data source. (This example uses a data source named `MySQL`.) You use this name to establish a connection to your database.
4 From the **Vendor** list, select `MySQL`.



5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.
7. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
8. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
9. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for a MySQL database.

```
vendor = "MySQL";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `MySQL`, full path of the JDBC driver file `C:\Drivers\mysql-connector-java-5.1.34-bin.jar`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQL", ...
    'JDBCDriverLocation',"C:\Drivers\mysql-connector-java-5.1.34-bin.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306);
```

3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4. Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Catalog** list, select the catalog. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to MySQL Using JDBC Driver and Command Line

1. Connect to a MySQL database using the configured JDBC data source, user name `username`, and password `pwd`.

```
datasource = "MySQL";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- "Create JDBC Data Source and Set Options Programmatically" on page 2-17
- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14
- "Modify and Delete Data Sources" on page 4-17
- "Database Explorer App Error Messages" on page 3-14
- "Database Connection Error Messages" on page 3-7

PostgreSQL ODBC for Windows

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the Database Explorer app or the command line. This tutorial uses the PostgreSQL ANSI(x64) driver to connect to a PostgreSQL 9.2 database.

Step 1. Verify the driver installation.

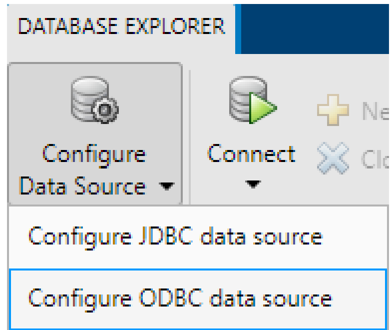
The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers. For information about the Microsoft ODBC Data Source Administrator, see Driver Installation.

Note: Database Toolbox no longer supports connecting to a database using a 32-bit driver. Use the 64-bit version of PostgreSQL. If you have issues working with the ODBC driver, use the JDBC driver instead. For details, see “PostgreSQL JDBC for Windows” on page 2-61. For details about working with the 64-bit version of Windows, see Using Previous MATLAB Releases.

Step 2. Set up the data source using the Database Explorer app.

The Database Explorer app accesses the Microsoft ODBC Data Source Administrator automatically when you configure an ODBC data source. Alternatively, you can access the Microsoft ODBC Data Source Administrator using the `configureODBCDataSource` function.

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure ODBC data source**.

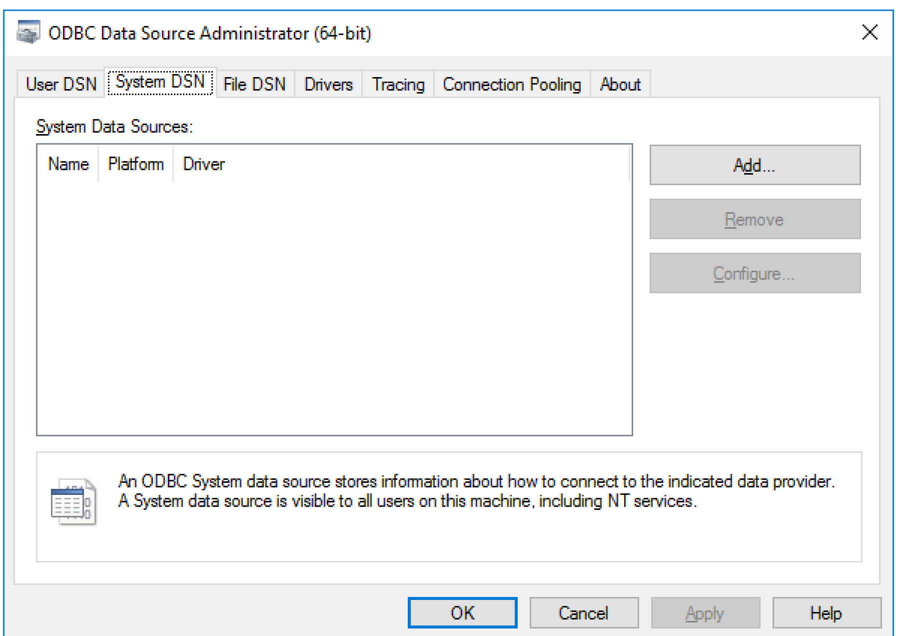


In the ODBC Data Source Administrator dialog box, you define the ODBC data source.

Tip When setting up an ODBC data source, you can specify a user data source name (DSN) or a system DSN. A user DSN is specific to the person logged into a machine. Only this person sees the data sources that are defined on the user DSN tab. A system DSN is not specific to the person logged into a machine. Any person who logs into the machine can see the data sources that are defined on the system DSN tab. Your ability to set up a user DSN or system DSN depends on the

database and ODBC driver you are using. For details, contact the database administrator or refer to the ODBC driver documentation.

3 Click the **System DSN** tab, and then click **Add**.



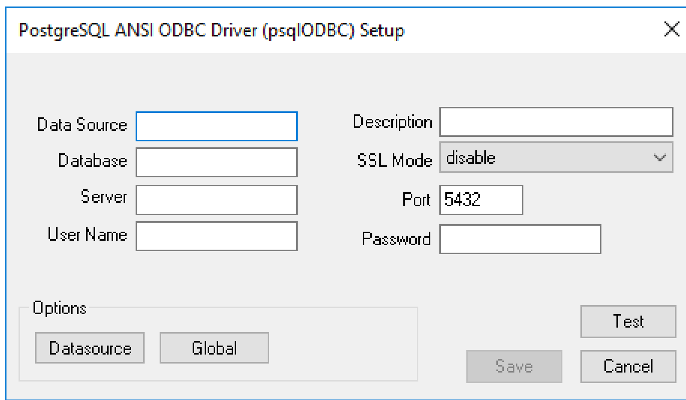
The Create New Data Source dialog box opens and displays a list of installed ODBC drivers.

4 Select the ODBC driver `PostgreSQL ANSI(x64)`.

Note The name of the ODBC driver can vary.

Click **Finish**.

5 In the PostgreSQL ANSI ODBC Driver (psqlODBC) Setup dialog box, fill out the boxes.



- In the **Data Source** box, enter an appropriate name for the data source, such as `PostgreSQL`. You use this name to establish a connection to your database.
- In the **Description** box, enter a description for this data source, such as `PostgreSQL database`.

- In the **Database** box, enter the name of your database.
- In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server.
- In the **Port** box, enter the port number. The default port number is `5432`.
- In the **User Name** box, enter your user name.
- In the **Password** box, enter your password.

6. Click **Test** to test the connection to your database. If your computer successfully connects to the database, the Connection Test dialog box opens and displays a message indicating the connection is successful.
7. Click **Save** in the PostgreSQL ANSI ODBC Driver (psqlODBC) Setup dialog box. The ODBC Data Source Administrator dialog box shows the ODBC data source `PostgreSQL30`.

   After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the command line with the native ODBC connection.

Step 3. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to PostgreSQL Using ODBC Driver and Command Line

1. Connect to the database with the ODBC data source name. For example, this code assumes that you are connecting to a data source named `PostgreSQL` with the user name `username` and the password `pwd`.

```
conn = database('PostgreSQL','username','pwd');
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

PostgreSQL ODBC for Windows DSN-Less Connection

This tutorial shows how to verify your driver installation and connect to a PostgreSQL database using a DSN-less connection string at the command line. (DSN is a data source name.) The tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database on the Windows platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

Step 2. Connect using the DSN-less connection string and command line.

1 Connect to the database using the DSN-less connection string with the `odbc` function. For example, this code assumes that you are connecting to the local database server, database name `toystore_doc`, user name `username`, and password `pwd`.

```
dsnless = strcat("Driver={PostgreSQL ANSI(x64)}; Server=localhost; ", ...
   "Database=toystore_doc; UID=username; PWD=pwd");
conn = odbc(dsnless);
```

2 Close the database connection.

```
close(conn)
```

See Also

`odbc` | `close`

Related Examples

- “Configure Driver and Data Source” on page 2-14
- “PostgreSQL ODBC for Windows” on page 2-56
- “PostgreSQL ODBC for Linux” on page 2-112
- “Database Connection Error Messages” on page 3-7

PostgreSQL JDBC for Windows

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the Database Explorer app or the command line. This tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database.

Step 1. Verify the driver installation.

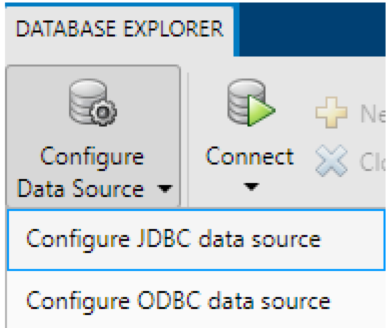
If the JDBC driver for PostgreSQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

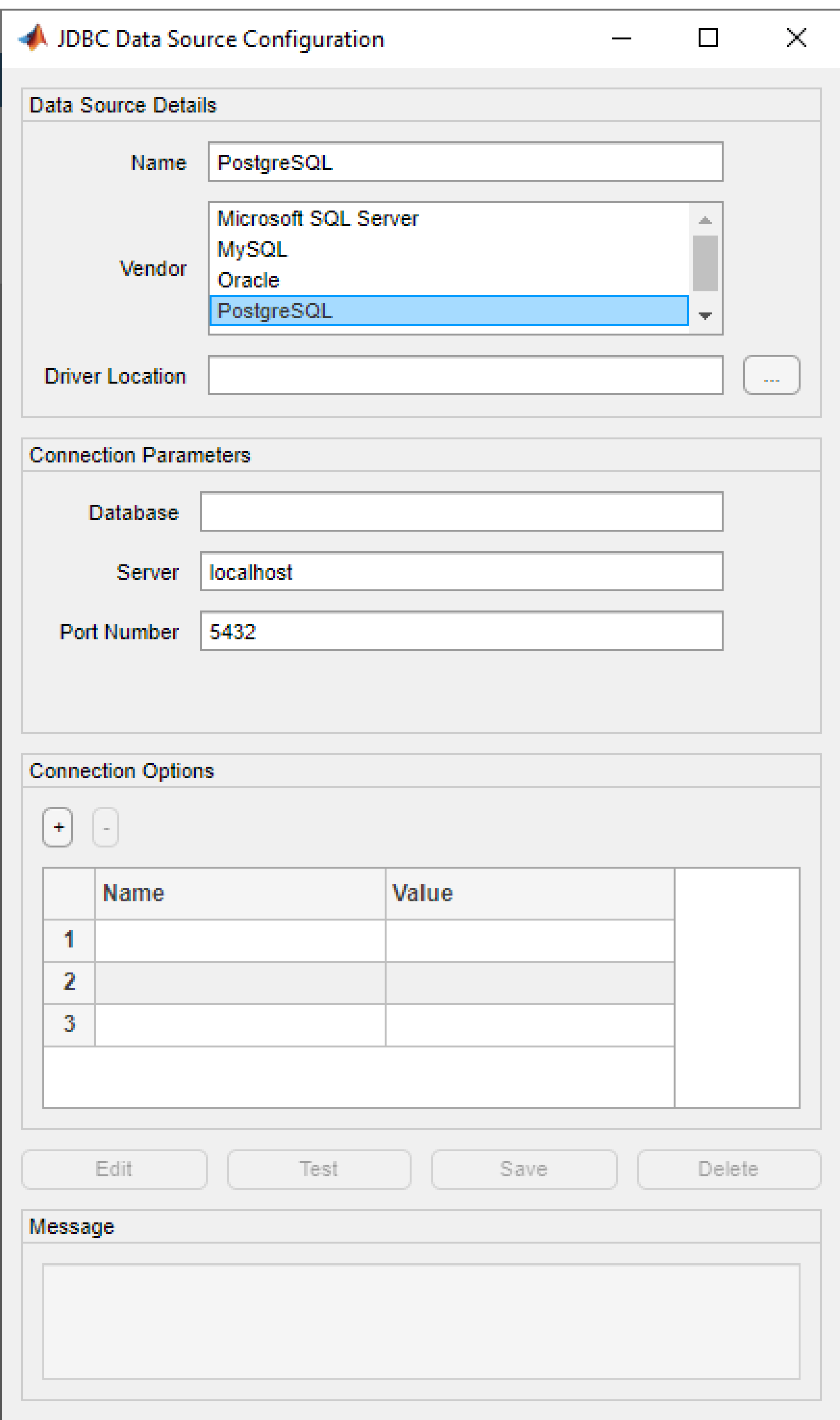
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `PostgreSQL`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `PostgreSQL`.



5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

7. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
8. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
9. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for a PostgreSQL database.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `PostgreSQL`, full path of the JDBC driver file `C:\Drivers\postgresql-8.4-702.jdbc4.jar`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQL", ...
    'JDBCDriverLocation',"C:\Drivers\postgresql-8.4-702.jdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432);
```

3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4. Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to PostgreSQL Using JDBC Driver and Command Line

1. Connect to a PostgreSQL database using the configured JDBC data source, user name `username`, and password `pwd`.

```
datasource = "PostgreSQL";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

SQLite JDBC for Windows

This tutorial shows how to set up a data source and connect to an SQLite database using the Database Explorer app or the command line. This tutorial uses the SQLite JDBC 3.7.2 Driver to connect to an SQLite Version 3.7.17 database.

Step 1. Verify the driver installation.

If the JDBC driver for SQLite is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

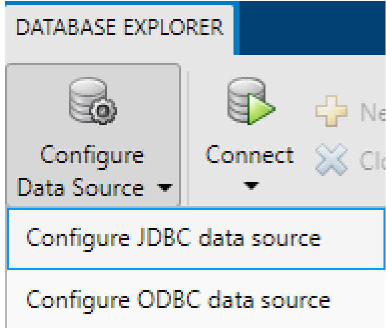
If you do not want to install a driver and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

Step 2. Set up the data source.

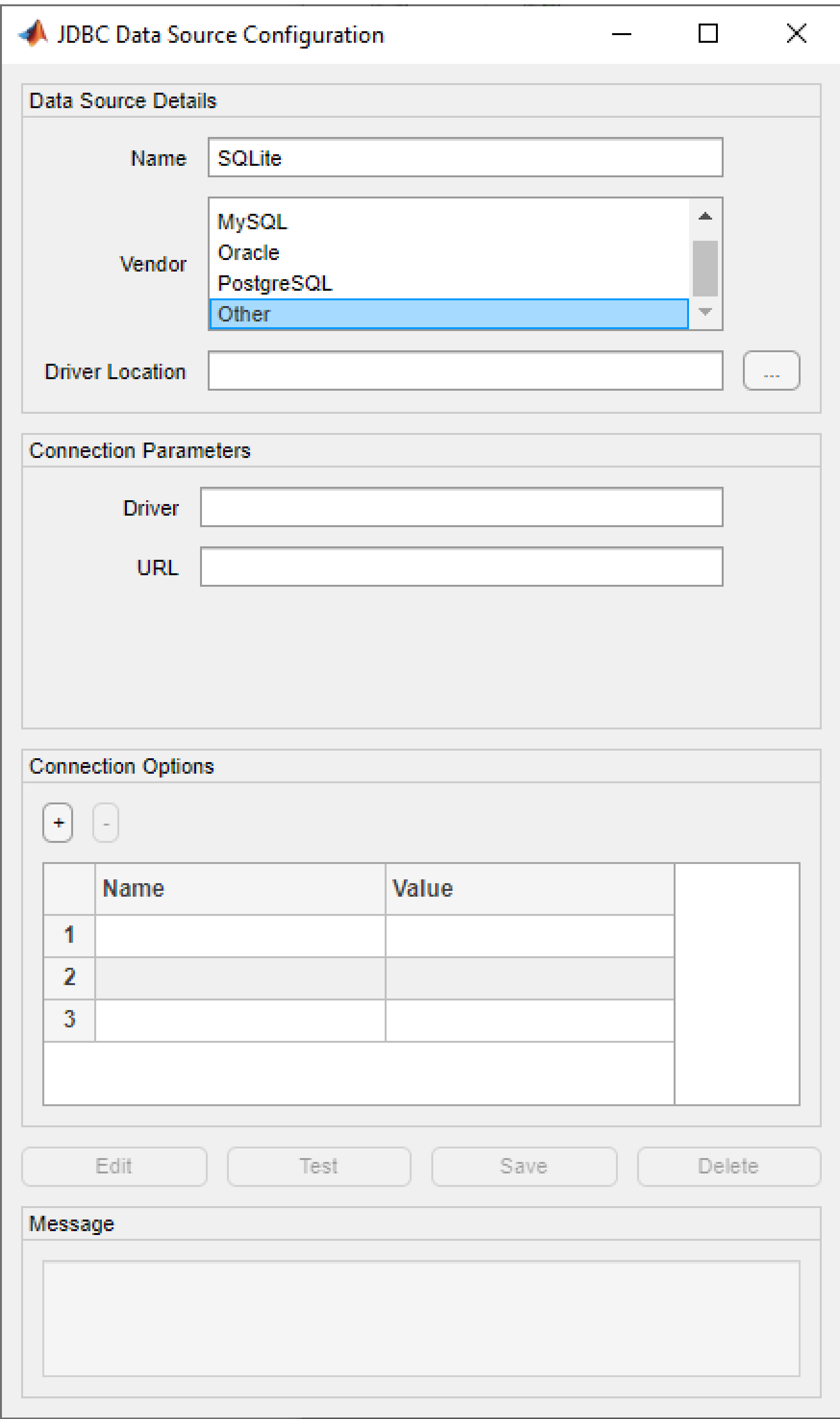
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `SQLite`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `Other`.



5 In the **Driver Location** box, enter the full path to the JDBC driver file.

6 In the **Driver** box, enter the SQLite driver Java class object. Here, use `org.sqlite.JDBC`.

Note Your entries for **Driver** and **URL** can vary depending on the type and version of the JDBC driver and your database. For details, see the JDBC driver documentation for your database.

7. Connect to the SQLite database by creating a URL string using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string remains constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. For SQLite, `subname` contains the location of the database. For example, your URL string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer. Enter your string in the **URL** box and press **Enter**.
8. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
9. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
10. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for an SQLite database.

```
vendor = "Other";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `SQLite`, full path of the SQLite driver location `C:\Drivers\sqlite-jdbc-3.8.11.2.jar`, SQLite driver Java class object `org.sqlite.JDBC`, and URL string `jdbc:sqlite:C:\Databases\sqlite.db`.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLite", ...
    'JDBCDriverLocation',"C:\Drivers\sqlite-jdbc-3.8.11.2.jar", ...
    'Driver',"org.sqlite.JDBC", ...
    'URL',"jdbc:sqlite:C:\Databases\sqlite.db");
```

3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4. Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the SQLite database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to SQLite Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
3. Select tables in the **Data Browser** pane to query the database.
4. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

   Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to SQLite Using JDBC Driver and Command Line

1. Connect to an SQLite database using the configured JDBC data source, user name `username`, and password `pwd`.

   ```
   datasource = "SQLite";
   username = "username";
   password = "pwd";
   conn = database(datasource,username,password);
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- "Create JDBC Data Source and Set Options Programmatically" on page 2-17
- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14

- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

Microsoft SQL Server JDBC for macOS

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the Database Explorer app or the command line. This tutorial uses the Microsoft JDBC Driver 4.0 for Microsoft SQL Server to connect to a Microsoft SQL Server 2016 Express database.

Step 1. Verify the driver installation.

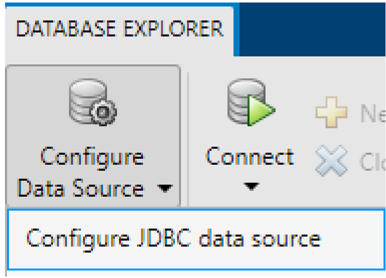
If the JDBC driver for SQL Server is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. You use this name to establish a connection to your database.
4. From the **Vendor** list, select `Microsoft SQL Server`.

5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.
7. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
8. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

9 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1 Create a JDBC data source for an SQL Server database.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
```

2 Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `MSSQLServer`, full path of the JDBC driver file `/home/user/DB_Drivers/sqljdbc4.jar`, database name `toystore_doc`, database server `dbtb04`, and port number `54317`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MSSQLServer", ...
    'JDBCDriverLocation',"/home/user/DB_Drivers/sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317);
```

3 Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4 Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the SQL Server database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to SQL Server Using Database Explorer App

1 On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.

2 In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to SQL Server Using JDBC Driver and Command Line

1. Connect to an SQL Server database using the configured JDBC data source, user name `username`, and password `pwd`. For example, this code assumes that you are connecting to a JDBC data source named `MSSQLServer`.

   ```
   datasource = "MSSQLServer";
   username = "username";
   password = "pwd";
   conn = database(datasource,username,password);
   ```

2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- "Create JDBC Data Source and Set Options Programmatically" on page 2-17
- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14
- "Modify and Delete Data Sources" on page 4-17
- "Database Explorer App Error Messages" on page 3-14
- "Database Connection Error Messages" on page 3-7

Microsoft SQL Server JDBC for Linux

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the Database Explorer app or the command line. This tutorial uses the Microsoft JDBC Driver 4.0 for Microsoft SQL Server to connect to a Microsoft SQL Server 2016 Express database.

Step 1. Verify the driver installation.

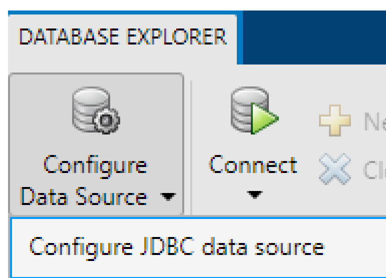
If the JDBC driver for Microsoft SQL Server is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. You use this name to establish a connection to your database.
4. From the **Vendor** list, select `Microsoft SQL Server`.

5 In the **Driver Location** box, enter the full path to the JDBC driver file.

6 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

7 Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.

8 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

9 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1 Create a JDBC data source for an SQL Server database.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
```

2 Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `MSSQLServer`, full path of the JDBC driver file `/home/user/DB_Drivers/sqljdbc4.jar`, database name `toystore_doc`, database server `dbtb04`, and port number `54317`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MSSQLServer", ...
    'JDBCDriverLocation',"/home/user/DB_Drivers/sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317);
```

3 Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4 Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the SQL Server database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to SQL Server Using Database Explorer App

1 On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.

2 In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.
5 Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to SQL Server Using JDBC Driver and Command Line

1 Connect to an SQL Server database using the configured JDBC data source, user name `username`, and password `pwd`. For example, this code assumes that you are connecting to a JDBC data source named `MSSQLServer`.

```
datasource = "MSSQLServer";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- "Create JDBC Data Source and Set Options Programmatically" on page 2-17
- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14
- "Modify and Delete Data Sources" on page 4-17
- "Database Explorer App Error Messages" on page 3-14
- "Database Connection Error Messages" on page 3-7

Microsoft SQL Server ODBC for Linux

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the command line. The tutorial uses the Microsoft ODBC Driver 13.1 for Microsoft SQL Server to connect to a Microsoft SQL Server 2016 Express database on the Linux platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

If you need to install an ODBC driver, contact your database administrator or see Install the Microsoft ODBC Driver for SQL Server (Linux).

Step 2. Set up the data source.

Follow the instructions in Connecting to SQL Server to create a data source name (DSN).

Step 3. Connect using the command line.

1 Connect to the database using the configured DSN, user name `username`, and password `pwd` with the `odbc` function. For example, this code assumes that you are connecting to an ODBC data source `MSSQL`.

```
datasource = "MSSQL";
username = "username";
password = "pwd";
conn = odbc(datasource,username,password);
```

2 Close the database connection.

```
close(conn)
```

See Also

Functions
`odbc` | `close`

More About

- “Configure Driver and Data Source” on page 2-14
- “Microsoft SQL Server ODBC for Linux DSN-Less Connection” on page 2-87
- “Modify and Delete Data Sources” on page 4-17
- “Database Connection Error Messages” on page 3-7

Microsoft SQL Server ODBC for macOS

This tutorial shows how to set up a data source and connect to a Microsoft SQL Server database using the command line. The tutorial uses the Microsoft ODBC Driver 18.1 for Microsoft SQL Server to connect to a Microsoft SQL Server 2016 Express database on the Apple macOS platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. To verify that your computer has the driver, look for the `libmsodbcsql.18.dylib` driver in the folder `/usr/local/Cellar/msodbcsql18/18.1.2.1/lib/`. If you need to install an ODBC driver, contact your database administrator or see Install the Microsoft ODBC Driver for SQL Server on the Microsoft website. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

To create a data source on your Mac computer, you need the unixODBC driver manager. You can download and install the unixODBC driver manager from Homebrew: `https://formulae.brew.sh/formula/unixodbc`.

Step 2. Set up the data source.

Set up the data source by creating the file `~/.odbc.ini` (if it does not exist) and by adding the data source information. This example assumes that you are connecting to a database server `dbtb12`, the port number is `54317`, and `toy_store` is the database name.

```
[mssql-server-data-source]
Description = Connect to Microsoft SQL server using Microsoft SQL server ODBC driver
Driver = /usr/local/Cellar/msodbcsql18/18.1.2.1/lib/libmsodbcsql.18.dylib
Server = dbtb12,54317
Database = toy_store
```

Step 3. Connect using the command line.

MATLAB supports the unixODBC driver manager through the entry-point functions `database` and `odbc`.

Use the command line to make the connection using either entry-point function.

```
conn = odbc("mssql-server-data-source","root","matlab");
conn = database("mssql-server-data-source","root","matlab");
```

See Also

Functions
`odbc` | `database`

More About

- “Configure Driver and Data Source” on page 2-14
- “Microsoft SQL Server ODBC for macOS DSN-Less Connection” on page 2-81

- “Modify and Delete Data Sources” on page 4-17
- “Database Connection Error Messages” on page 3-7

Microsoft SQL Server ODBC for macOS DSN-Less Connection

This tutorial shows how to verify your driver installation and connect to a Microsoft SQL Server database using a DSN-less connection string at the MATLAB command line. A DSN-less connection string enables you to make a connection to the database without specifying a data source name (DSN). The tutorial uses the Microsoft ODBC Driver 18.1 for SQL Server to connect to a Microsoft SQL Server 2016 Express database on the Apple macOS platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. To verify that your computer has the driver, look for the `libmsodbcsql.18.dylib` driver installation in the folder `/usr/local/Cellar/msodbcsql18/18.1.2.1/lib/`. If you need to install an ODBC driver, contact your database administrator or see Install the Microsoft ODBC Driver for SQL Server on the Microsoft website. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

Step 2. Connect using the DSN-less connection string and command line.

Connect to the database using the DSN-less connection string and the shipped ODBC driver with the `odbc` function. This example assumes that you are connecting to a database server `dbtb12`, the port number is `54317`, `toy_store` is the database name, `username` is the user name, `password` is the password, and `driverLocation` is the location of the shipped driver.

```
driverLocation = "/usr/local/Cellar/msodbcsql18/18.1.2.1/lib/libmsodbcsql.18.dylib";
dsnless = strcat("Driver=",driverLocation,";Server=dbtb12,54317;UID=username;PWD=password;Databas
conn = odbc(dsnless)
```

See Also

Functions
`odbc` | `database`

More About

- “Configure Driver and Data Source” on page 2-14
- “Microsoft SQL Server ODBC for macOS” on page 2-79
- “Database Connection Error Messages” on page 3-7

MySQL ODBC for macOS

This tutorial shows how to set up a data source and connect to a MySQL database using the MATLAB command line on the Apple macOS platform. You can use the shipped MariaDB® ODBC driver or the downloaded MySQL ODBC driver.

MariaDB ODBC Shipped Driver

1. To create a data source on your Mac computer using the MariaDB ODBC driver, you need the unixODBC driver manager. Verify the unixODBC driver manager is installed at `/usr/local/Cellar/unixodbc`. If you need install the unixODBC driver manager, you can download it from Homebrew: `https://formulae.brew.sh/formula/unixodbc`.
2. Set up the data source by creating the file `~/.odbc.ini` (if it does not exist) and by adding the data source information to the file. This example assumes that you are connecting to a database server `dbtb04`, the port number is `3306`, `toy_store` is the database name, and MATLAB is installed at the location `/Applications/MATLAB_R2023b.app`.

   ```
   [mysql-server-shipped-driver]
   Description=Connect to MySQL server using shipped MariaDB ODBC driver
   Driver=/Applications/MATLAB_R2023b.app/bin/maci64/libmaodbc.dylib
   Server=dbtb04
   Port=3306
   Database=toy_store
   ```
3. Use the command line to make the connection.

   ```
   conn = odbc("mysql-server-shipped-driver","root","matlab");
   ```

MySQL ODBC Downloaded Driver

1. To verify that your computer has the ODBC driver, look for the `libmyodbc8w.so` driver in the folder `/usr/local/mysql-connector-odbc-8.0.30-macos12-x86-64bit/lib/`.

   You can download and install the MySQL driver from MySQL Downloads on the Oracle website. To create a data source on your Mac computer using the MySQL ODBC driver, you need the iODBC driver manager. Verify the iODBC driver manager is installed at `/usr/local/iODBC`. If you need to install the iODBC driver manager, you can download it from the iodbc.org website.
2. Set up the data source by creating the file `~/.odbc.ini` (if it does not exist) and by adding the data source information to the file. This example assumes that you are connecting to a database server `dbtb04`, the port number is `3306`, `toy_store` is the database name, and `Driver` defines the ODBC driver location.

   ```
   [mysql-server]
   Description=Connect to MySQL server using MySQL ODBC driver
   Driver=/usr/local/mysql-connector-odbc-8.0.30-macos12-x86-64bit/lib/libmyodbc8w.so
   Server=dbtb04
   Port=3306
   DATABASE=toy_store
   ```
3. Use the command line to make the connection.

   ```
   conn = odbc("mysql-server","root","matlab","DriverManager","iODBC");
   ```

See Also

Functions
`odbc` | `database`

More About

- “Configure Driver and Data Source” on page 2-14
- “MySQL ODBC for macOS DSN-Less Connection” on page 2-84
- “Modify and Delete Data Sources” on page 4-17
- “Database Connection Error Messages” on page 3-7

MySQL ODBC for macOS DSN-Less Connection

This tutorial shows how to verify your driver installation on an Apple macOS platform and connect to an Oracle MySQL database using a connection string at the MATLAB command line. A DSN-less connection string enables you to make a connection to the database without specifying a data source name (DSN). For this type of connection, you can use the MariaDB OBDC driver that comes with MATLAB or the MySQL ODBC driver that you download.

MariaDB ODBC Shipped Driver

To make a DSN-less connection, enter the following code at the command line. This example assumes that you are connecting to a database server `dbtb04`, the port number is `3306`, `toy_store` is the database name, and `driverLocation` is the ODBC driver location.

```
driverLocation = fullfile(matlabroot,"bin","maci64","libmaodbc.dylib")
dsnless = strcat("Driver=",driverLocation,";Server=dbtb04;Port=3306;UID=username;PWD=password;Da
conn = odbc(dsnless)
```

MySQL ODBC Downloaded Driver

1. Download and install the MySQL ODBC driver from MySQL Community Downloads on the Oracle website. Verify the iODBC driver manager is installed at `/usr/local/iODBC`. If you need to install the iODBC driver manager, you can download it from the iodbc.org website.
2. Connect to the database using the DSN-less connection string and the driver with the `odbc` function. This example assumes that you are connecting to a database server `dbtb04`, the port number is `3306`, `toy_store` is the database name, `username` is the user name, and `password` is the password.

   ```
   dsnless = "Driver=/usr/local/mysql-connector-odbc-8.0.30-macos12-x86-64bit/lib/libmyodbc8w.so
   conn = odbc(dsnless,"DriverManager","iODBC")
   ```

See Also

Functions
`odbc`

More About

- "Configure Driver and Data Source" on page 2-14
- "MySQL ODBC for macOS" on page 2-82
- "Database Connection Error Messages" on page 3-7

PostgreSQL ODBC for macOS

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the MATLAB command line on the Apple macOS platform PostgreSQL ODBC driver that comes with MATLAB.

Step 1. Verify the driver manager installation.

To create a data source on your Mac computer using the PostgreSQL ODBC driver, you need the unixODBC driver manager. You can download and install the unixODBC driver manager from Homebrew: `https://formulae.brew.sh/formula/unixodbc`.

Step 2. Set up the data source.

Set up the data source by creating the file `~/.odbc.ini` (if it does not exist) and by adding the data source information or appending it at the end of the file. This example assumes that you are connecting to a database server `dbtb10`, the port number is `5432`, `toy_store` is the database name, and MATLAB is installed at the location `/Applications/MATLAB_R2023b.app`.

```
[postgresql-server]
Description=Connect to PostgreSQL
serverDriver=/Applications/MATLAB_R2023b.app/bin/maci64/psqlodbcw.so
Server=dbtb10
Port=5432
DATABASE=toy_store
```

Step 3. Connect using the command line.

Use the command line to make the connection.

```
conn = odbc("postgresql-server","dbdev","matlab");
```

See Also

Functions
`odbc` | `database`

More About

- “Configure Driver and Data Source” on page 2-14
- “PostgreSQL ODBC for macOS DSN-Less Connection” on page 2-86
- “Modify and Delete Data Sources” on page 4-17
- “Database Connection Error Messages” on page 3-7

PostgreSQL ODBC for macOS DSN-Less Connection

This tutorial shows how to connect to a PostgreSQL database using a DSN-less connection string at the MATLAB command line on the Apple macOS platform. A DSN-less connection string enables you to make a connection to the database without specifying a data source name (DSN). This tutorial uses the PostgreSQL ODBC driver that comes with MATLAB.

To connect to the database, use the DSN-less connection string and the shipped PostgreSQL ODBC driver with the `odbc` function. This example assumes that you are connecting to a database server `dbtb10`, the port number is `5432`, `toy_store` is the database name, `dbdev` is the username, `matlab` is the password, and `driverLocation` is the location of the ODBC driver.

```
driverLocation = fullfile(matlabroot,"bin","maci64","psqlodbcw.so")
dsnless = strcat("Driver=",driverLocation,";Server=dbtb10;Port=5432;UID=dbdev;PWD=matlab;Database
conn = odbc(dsnless)
```

See Also

Functions
`odbc`

More About

- “Configure Driver and Data Source” on page 2-14
- “PostgreSQL ODBC for macOS” on page 2-85
- “Database Connection Error Messages” on page 3-7

Microsoft SQL Server ODBC for Linux DSN-Less Connection

This tutorial shows how to verify your driver installation and connect to a Microsoft SQL Server database using a DSN-less connection string at the command line. (DSN is a data source name.) The tutorial uses the Microsoft ODBC Driver 13.1 for SQL Server to connect to a Microsoft SQL Server 2016 Express database on the Linux platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

If you need to install an ODBC driver, contact your database administrator or see Install the Microsoft ODBC Driver for SQL Server (Linux).

Step 2. Connect using the DSN-less connection string and command line.

1 Connect to the database using the DSN-less connection string with the `odbc` function. For example, this code assumes that you are connecting to the local database server, port number `1433`, database name `toystore_doc`, user name `username`, and password `pwd`.

```
dsnless = strcat("Driver={ODBC Driver 13.1 for SQL Server}; Server=localhost,1433;", ...
   "Database=toystore_doc; UID=username; PWD=pwd");
conn = odbc(dsnless);
```

2 Close the database connection.

```
close(conn)
```

See Also

`odbc` | `close`

Related Examples

• “Configure Driver and Data Source” on page 2-14
• “Microsoft SQL Server ODBC for Linux” on page 2-78
• “Database Connection Error Messages” on page 3-7

Oracle JDBC for macOS

This tutorial shows how to set up a data source and connect to an Oracle database using the Database Explorer app or the command line. This tutorial uses the Oracle Database 11g Release 2 (11.2.0.3) JDBC driver for use with JDK 1.6 to connect to an Oracle 11g Enterprise Edition Release 11.2.0.1.0 database.

Step 1. Verify the driver installation.

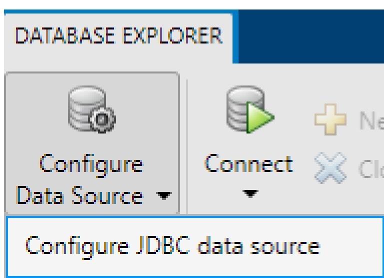
If the JDBC driver for Oracle is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

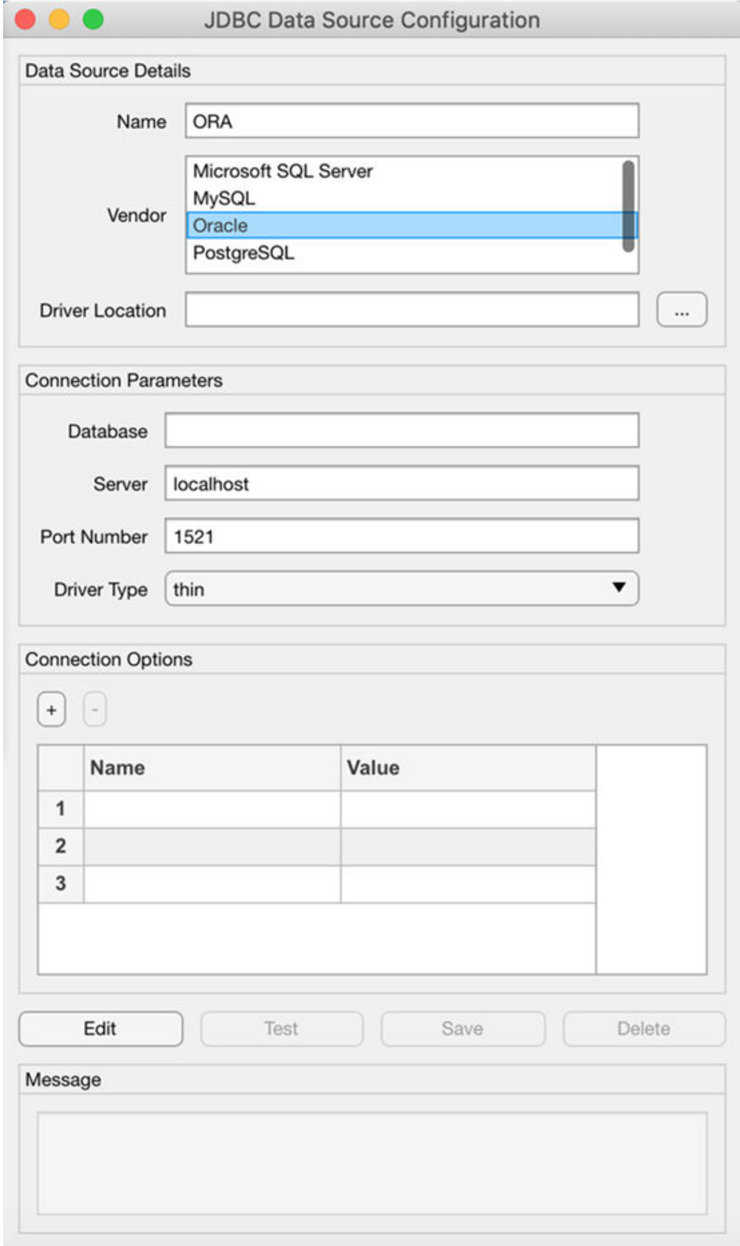
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1 Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2 In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.
3 In the **Name** box, enter a name for your data source. (This example uses a data source named `ORA`.) You use this name to establish a connection to your database.
4 From the **Vendor** list, select `Oracle`.



Note To use the full entry from your `tnsnames.ora` file, select `Other` instead and enter the full entry in the resulting **URL** box. Then, enter the full path to the JDBC driver file in the **Driver Location** box and the name of the driver in the resulting **Driver** box. Save the JDBC data source. For details about these steps, see "Other ODBC-Compliant or JDBC-Compliant Databases" on page 2-126.

5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server.

The name can be the service name or the Oracle system identifier (SID), depending on your specific Oracle database setup. For details, see your `tnsnames.ora` file, which is often stored in `<ORACLE_HOME>/NETWORK/ADMIN`, where `<ORACLE_HOME>` is the folder containing the installed database or the Oracle client.

7. In the **Port Number** box, enter the port number. From the **Driver Type** list, select `thin` or `oci`. (Use `thin` as the default driver. Use `oci` if you installed an OCI driver.)
8. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
9. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
10. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for an Oracle database.

```
vendor = "Oracle";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. To set the connection options with an OCI driver, use the `'DriverType'` name-value pair argument. For example, this code assumes that you are connecting to a JDBC data source named `ORA`, full path of the JDBC driver file `/home/user/DB_Drivers/ojdbc7.jar`, database name `toystore_doc`, database server `dbtb05`, port number `1521`, and driver type `oci`.

```
opts = setoptions(opts, ...
    'DataSourceName',"ORA", ...
    'JDBCDriverLocation',"/home/user/DB_Drivers/ojdbc7.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb05", ...
    'PortNumber',1521,'DriverType',"oci");
```

   To set the connection options without the OCI driver, omit the `'DriverType'` name-value pair argument.
3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4. Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the Oracle database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to Oracle Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Schema** list, select the schema. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to Oracle Using JDBC Driver and Command Line

1. Connect to an Oracle database using the configured JDBC data source, user name `username`, and password `pwd`.

   ```
   datasource = "ORA";
   username = "username";
   password = "pwd";
   conn = database(datasource,username,password);
   ```

   If you have trouble using the `database` function, use the full entry from your `tnsnames.ora` file in the URL string as one consecutive line. Leave the first argument blank. For example, this code assumes that the value of the `'URL'` name-value pair argument is set to the specified `tnsnames.ora` file entry for an Oracle database.

   ```
   conn = database('','username','pwd', ...
       'Vendor','Oracle', ...
       'URL',['jdbc:oracle:thin:@(DESCRIPTION = ' ...
       '(ADDRESS = (PROTOCOL = TCP)(HOST = sname)' ...
       '(PORT = 123456)) (CONNECT_DATA = ' ...
       '(SERVER = DEDICATED) (SERVICE_NAME = dbname) ) )']);
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

Oracle JDBC for Linux

This tutorial shows how to set up a data source and connect to a Oracle database using the Database Explorer app or the command line. This tutorial uses the Oracle Database 11g Release 2 (11.2.0.3) JDBC driver for use with JDK 1.6 to connect to a Oracle 11g Enterprise Edition Release 11.2.0.1.0 database.

Step 1. Verify the driver installation.

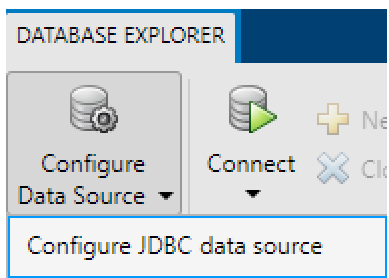
If the JDBC driver for Oracle is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

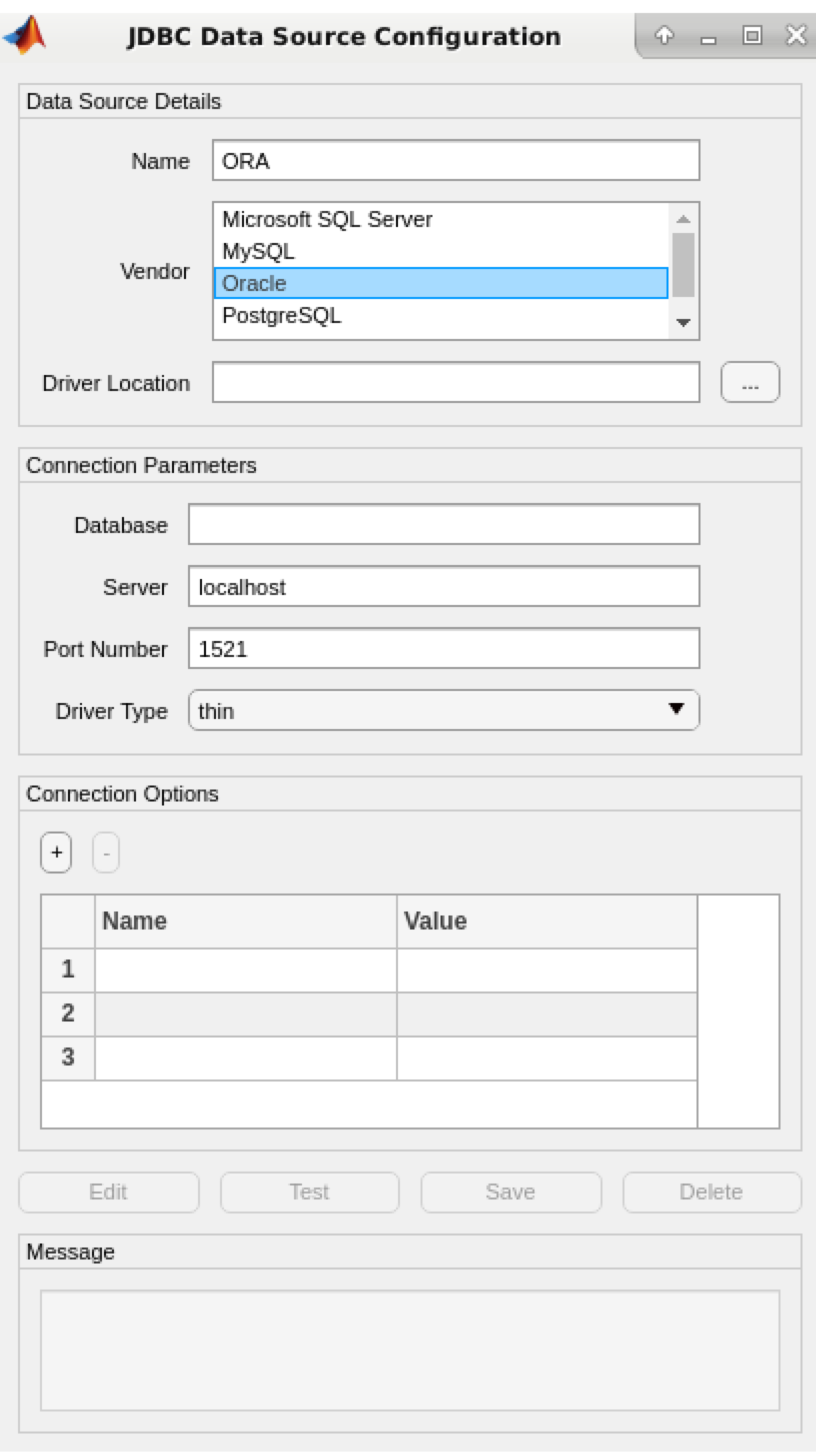
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `ORA`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `Oracle`.



Note To use the full entry from your `tnsnames.ora` file, select `Other` instead and enter the full entry in the resulting **URL** box. Then, enter the full path to the JDBC driver file in the **Driver Location** box and the name of the driver in the resulting **Driver** box. Save the JDBC data source. For details about these steps, see "Other ODBC-Compliant or JDBC-Compliant Databases" on page 2-126.

5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database.

   The name can be the service name or the Oracle system identifier (SID), depending on your specific Oracle database setup. For details, see your `tnsnames.ora` file, which is often stored in `<ORACLE_HOME>/NETWORK/ADMIN`, where `<ORACLE_HOME>` is the folder containing the installed database or the Oracle client.
7. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number. From the **Driver Type** list, select `thin` or `oci`. (Use `thin` as the default driver. Use `oci` if you installed an OCI driver.)
8. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
9. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
10. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for an Oracle database.

```
vendor = "Oracle";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. To set the connection options with an OCI driver, use the `'DriverType'` name-value pair argument. For example, this code assumes that you are connecting to a JDBC data source named `ORA`, full path of the JDBC driver file `/home/user/DB_Drivers/ojdbc7.jar`, database name `toystore_doc`, database server `dbtb05`, port number `1521`, and driver type `oci`.

```
opts = setoptions(opts, ...
    'DataSourceName',"ORA", ...
    'JDBCDriverLocation',"/home/user/DB_Drivers/ojdbc7.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb05", ...
    'PortNumber',1521,'DriverType',"oci");
```

   To set the connection options without the OCI driver, omit the `'DriverType'` name-value pair argument.
3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4. Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the Oracle database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to Oracle Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Schema** list, select the schema. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

   Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to Oracle Using JDBC Driver and Command Line

1. Connect to an Oracle database using the configured JDBC data source, user name `username`, and password `pwd`.

   ```
   datasource = "ORA";
   username = "username";
   password = "pwd";
   conn = database(datasource,username,password);
   ```

   If you have trouble using the `database` function, use the full entry from your `tnsnames.ora` file in the URL string as one consecutive line. Leave the first argument blank. For example, this code assumes that the value of the `'URL'` name-value pair argument is set to the specified `tnsnames.ora` file entry for an Oracle database.

   ```
   conn = database('','username','pwd', ...
       'Vendor','Oracle', ...
       'URL',['jdbc:oracle:thin:@(DESCRIPTION = ' ...
       '(ADDRESS = (PROTOCOL = TCP)(HOST = sname)' ...
       '(PORT = 123456)) (CONNECT_DATA = ' ...
       '(SERVER = DEDICATED) (SERVICE_NAME = dbname) ) )']);
   ```
2. Close the database connection.

   ```
   close(conn)
   ```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

MySQL JDBC for macOS

This tutorial shows how to set up a data source and connect to a MySQL database using the Database Explorer app or the command line. This tutorial uses the MySQL Connector/J 5.1.46 driver to connect to a MySQL Version 5.5.16 database.

Step 1. Verify the driver installation.

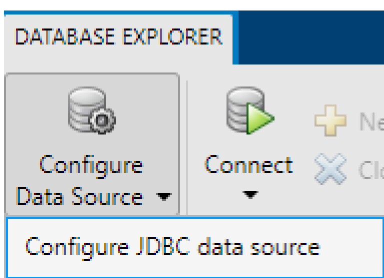
If the JDBC driver for MySQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

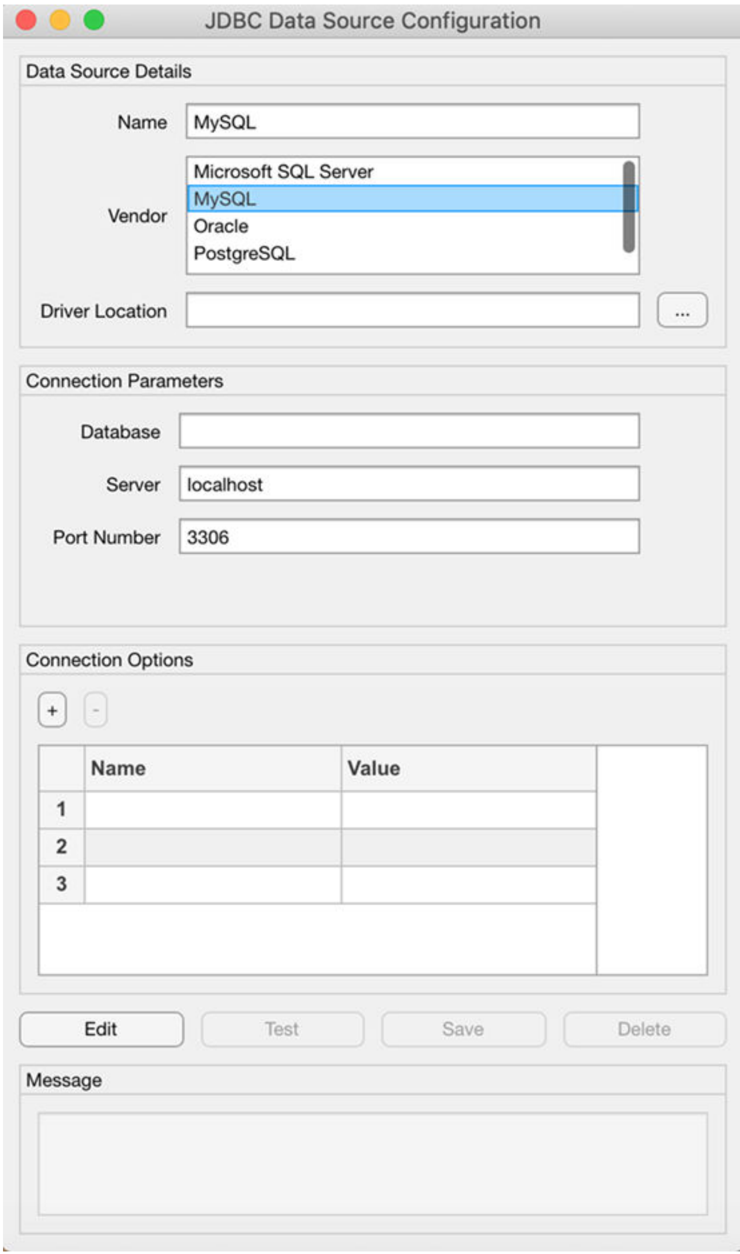
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.



The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `MySQL`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `MySQL`.



5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.
7. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
8. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

9 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1 Create a JDBC data source for a MySQL database.

```
vendor = "MySQL";
opts = databaseConnectionOptions("jdbc",vendor);
```

2 Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `MySQL`, full path of the JDBC driver file `/home/user/DB_Drivers/mysql-connector-java-5.1.17-bin.jar`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQL", ...
    'JDBCDriverLocation',"/home/user/DB_Drivers/mysql-connector-java-5.1.17-bin.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306);
```

3 Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4 Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1 On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.

2 In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.

3 In the **Catalog** list, select the catalog. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4 Select tables in the **Data Browser** pane to query the database.

5 Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to MySQL Using JDBC Driver and Command Line

1. Connect to a MySQL database using the configured JDBC data source, user name `username`, and password `pwd`.

```
datasource = "MySQL";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

MySQL ODBC for Linux

This tutorial shows how to set up a data source and connect to a MySQL database using the command line. The tutorial uses the MySQL Connector/J 5.1.46 driver to connect to a MySQL Version 5.5.16 database on the Linux platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

If you need to install an ODBC driver, contact your database administrator or see Installing Connector/ODBC on Unix-Like Systems.

Step 2. Set up the data source.

Follow the instructions in Configuring a Connector/ODBC DSN on Unix to create a data source name (DSN).

Step 3. Connect using the command line.

1. Connect to the database using the configured DSN, user name `username`, and password `pwd` with the `odbc` function. For example, this code assumes that you are connecting to an ODBC data source `MySQL`.

```
datasource = "MySQL";
username = "username";
password = "pwd";
conn = odbc(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Functions
`odbc` | `close`

More About

- “Configure Driver and Data Source” on page 2-14
- “MySQL ODBC for Linux DSN-Less Connection” on page 2-103
- “Modify and Delete Data Sources” on page 4-17
- “Database Connection Error Messages” on page 3-7

MySQL ODBC for Linux DSN-Less Connection

This tutorial shows how to verify your driver installation and connect to a MySQL database using a DSN-less connection string at the command line. (DSN is a data source name.) The tutorial uses the MySQL Connector/J 5.3 driver to connect to a MySQL Version 5.5.16 database on the Linux platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

If you need to install an ODBC driver, contact your database administrator or see Installing Connector/ODBC on Unix-Like Systems.

Step 2. Connect using the DSN-less connection string and command line.

1. Connect to the database using the DSN-less connection string with the `odbc` function. For example, this code assumes that you are connecting to the local database server, database name `toystore_doc`, user name `username`, and password `pwd`.

```
dsnless = strcat("Driver={MySQL ODBC 5.3 Ansi Driver}; Server=localhost; ", ...
   "Database=toystore_doc; UID=username; PWD=pwd");
conn = odbc(dsnless);
```

2. Close the database connection.

```
close(conn)
```

See Also

`odbc` | `close`

Related Examples

- "Configure Driver and Data Source" on page 2-14
- "MySQL ODBC for Linux" on page 2-102
- "Database Connection Error Messages" on page 3-7

MySQL JDBC for Linux

This tutorial shows how to set up a data source and connect to a MySQL database using the Database Explorer app or the command line. This tutorial uses the MySQL Connector/J 5.1.46 driver to connect to a MySQL Version 5.5.16 database.

Step 1. Verify the driver installation.

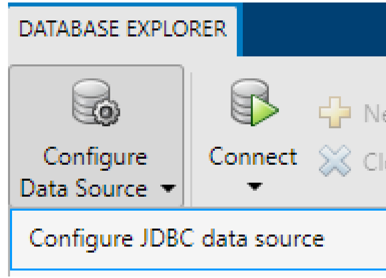
If the JDBC driver for MySQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

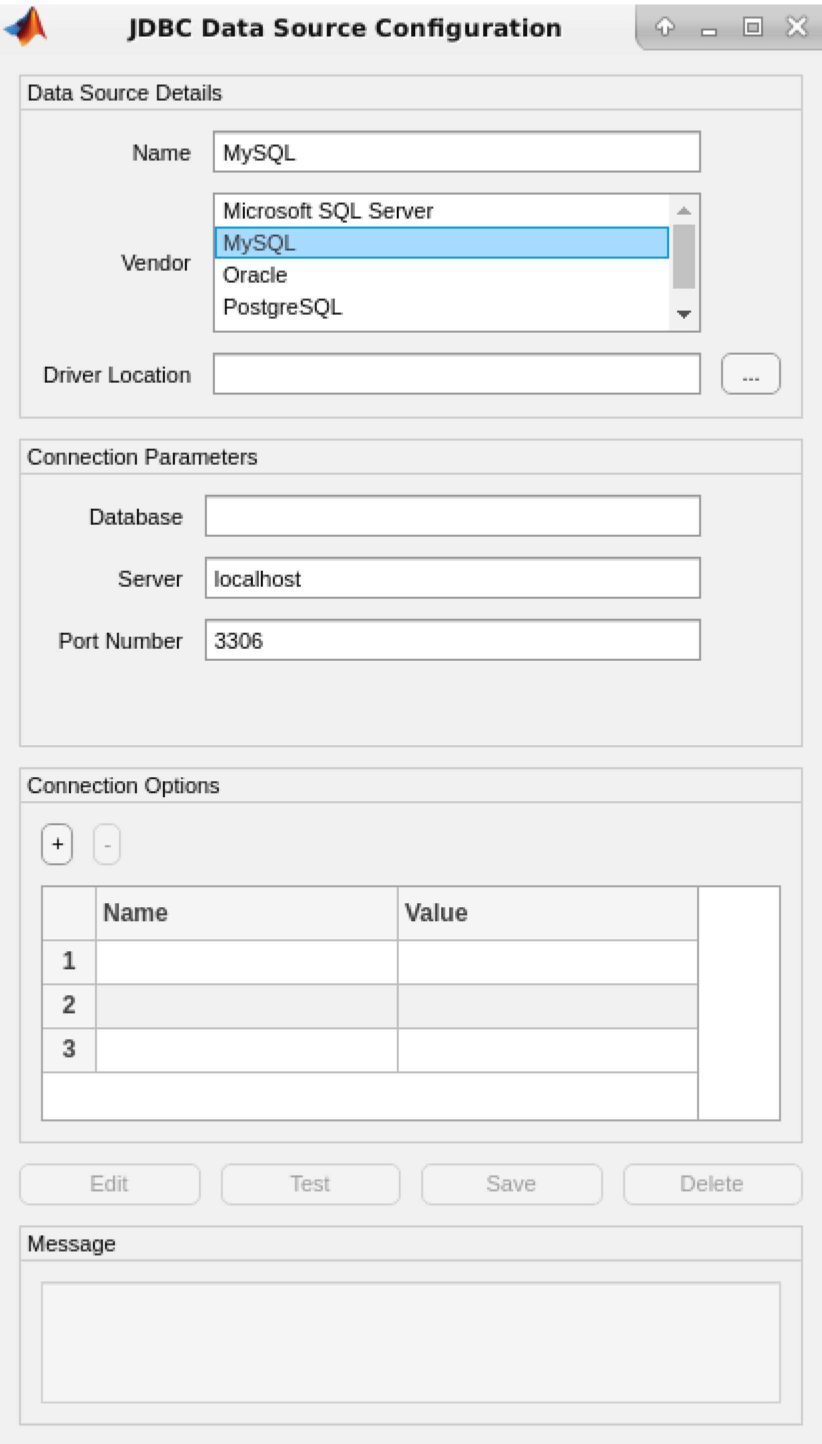
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.



   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `MySQL`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `MySQL`.



5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

7 Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
8 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
9 Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1 Create a JDBC data source for a MySQL database.

```
vendor = "MySQL";
opts = databaseConnectionOptions("jdbc",vendor);
```

2 Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `MySQL`, full path of the JDBC driver file `/home/user/DB_Drivers/mysql-connector-java-5.1.17-bin.jar`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQL", ...
    'JDBCDriverLocation',"/home/user/DB_Drivers/mysql-connector-java-5.1.17-bin.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306);
```

3 Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4 Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1 On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2 In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3 In the **Catalog** list, select the catalog. Click **OK**.

The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to MySQL Using JDBC Driver and Command Line

1. Connect to a MySQL database using the configured JDBC data source, user name `username`, and password `pwd`.

```
datasource = "MySQL";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

PostgreSQL JDBC for macOS

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the Database Explorer app or the command line. This tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database.

Step 1. Verify the driver installation.

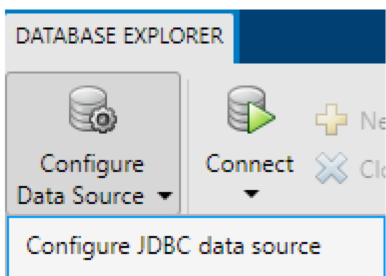
If the JDBC driver for PostgreSQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

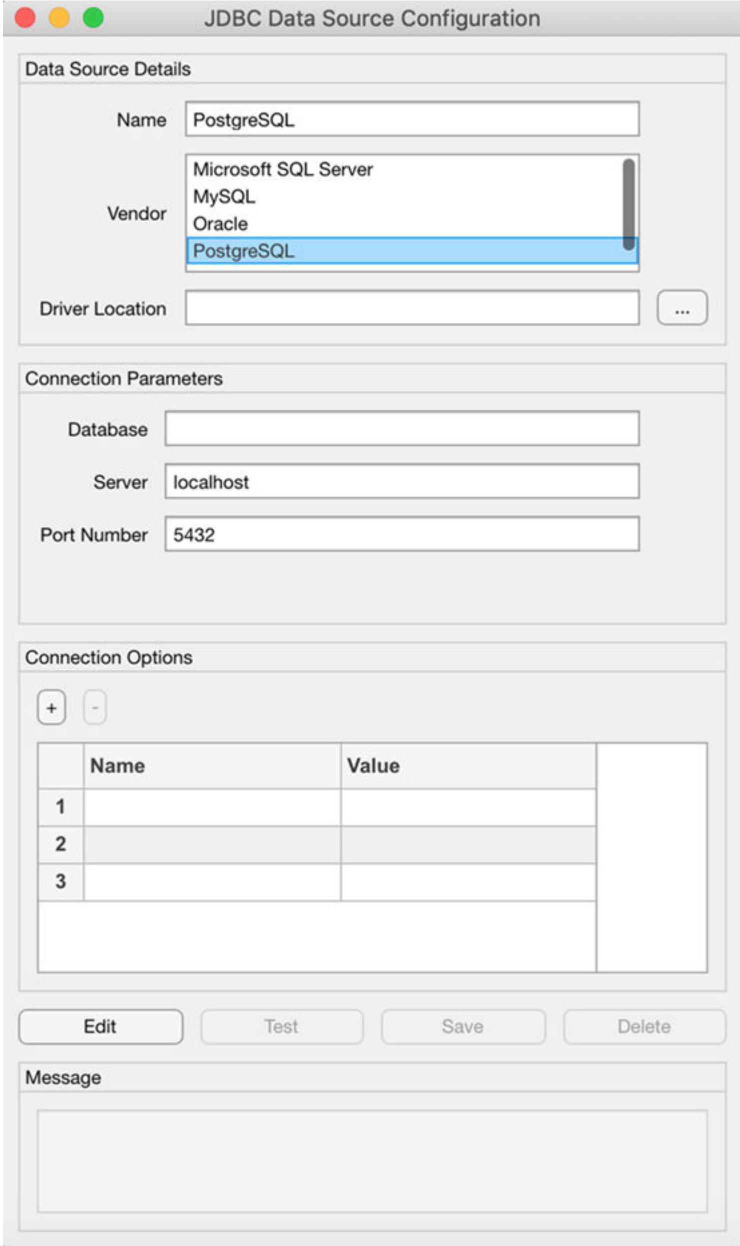
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `PostgreSQL`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `PostgreSQL`.



5 In the **Driver Location** box, enter the full path to the JDBC driver file.

6 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

7 Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.

8 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

9. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for a PostgreSQL database.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `PostgreSQL`, full path of the JDBC driver file `/home/user/DB_Drivers/postgresql-8.4-702.jdbc4.jar`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQL", ...
    'JDBCDriverLocation',"/home/user/DB_Drivers/postgresql-8.4-702.jdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432);
```

3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4. Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to PostgreSQL Using JDBC Driver and Command Line

1. Connect to a PostgreSQL database using the configured JDBC data source, user name `username`, and password `pwd`.

```
datasource = "PostgreSQL";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

PostgreSQL ODBC for Linux

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the command line. The tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database on the Linux platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

If you need to install an ODBC driver, contact your database administrator or see PostgreSQL Software Catalogue - Drivers and Interfaces.

Step 2. Set up the data source.

Follow the instructions in PostgreSQL Documentation Configuration Files to create a data source name (DSN).

Step 3. Connect using the command line.

1. Connect to the database using the configured DSN, user name `username`, and password `pwd` with the `odbc` function. For example, this code assumes that you are connecting to an ODBC data source `PostgreSQL`.

```
datasource = "PostgreSQL";
username = "username";
password = "pwd";
conn = odbc(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Functions
`odbc` | `close`

More About

- "Configure Driver and Data Source" on page 2-14
- "PostgreSQL ODBC for Windows" on page 2-56
- "PostgreSQL ODBC for Linux DSN-Less Connection" on page 2-113
- "Modify and Delete Data Sources" on page 4-17
- "Database Connection Error Messages" on page 3-7

PostgreSQL ODBC for Linux DSN-Less Connection

This tutorial shows how to verify your driver installation and connect to a PostgreSQL database using a DSN-less connection string at the command line. (DSN is a data source name.) The tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database on the Linux platform.

Step 1. Verify the driver installation.

The ODBC driver is typically preinstalled on your computer. For details about the driver installation or troubleshooting the installation, contact your database administrator or refer to your database documentation on ODBC drivers.

Step 2. Connect using the DSN-less connection string and command line.

1 Connect to the database using the DSN-less connection string with the `odbc` function. For example, this code assumes that you are connecting to the local database server, database name `toystore_doc`, user name `username`, and password `pwd`.

```
dsnless = strcat("Driver={PostgreSQL ANSI};Servername=localhost;", ...
   "Database=toystore_doc;UID=username;PWD=pwd");
conn = odbc(dsnless);
```

2 Close the database connection.

```
close(conn)
```

See Also

`odbc` | `close`

Related Examples

- “Configure Driver and Data Source” on page 2-14
- “PostgreSQL ODBC for Linux” on page 2-112
- “PostgreSQL ODBC for Windows” on page 2-56
- “Database Connection Error Messages” on page 3-7

PostgreSQL JDBC for Linux

This tutorial shows how to set up a data source and connect to a PostgreSQL database using the Database Explorer app or the command line. The tutorial uses the JDBC4 PostgreSQL Driver, Version 8.4 to connect to a PostgreSQL 9.2 database.

Step 1. Verify the driver installation.

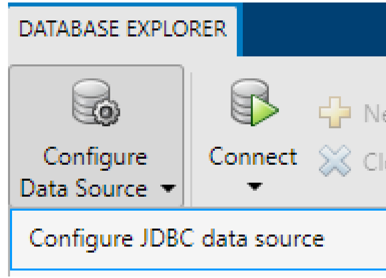
If the JDBC driver for PostgreSQL is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

Step 2. Set up the data source.

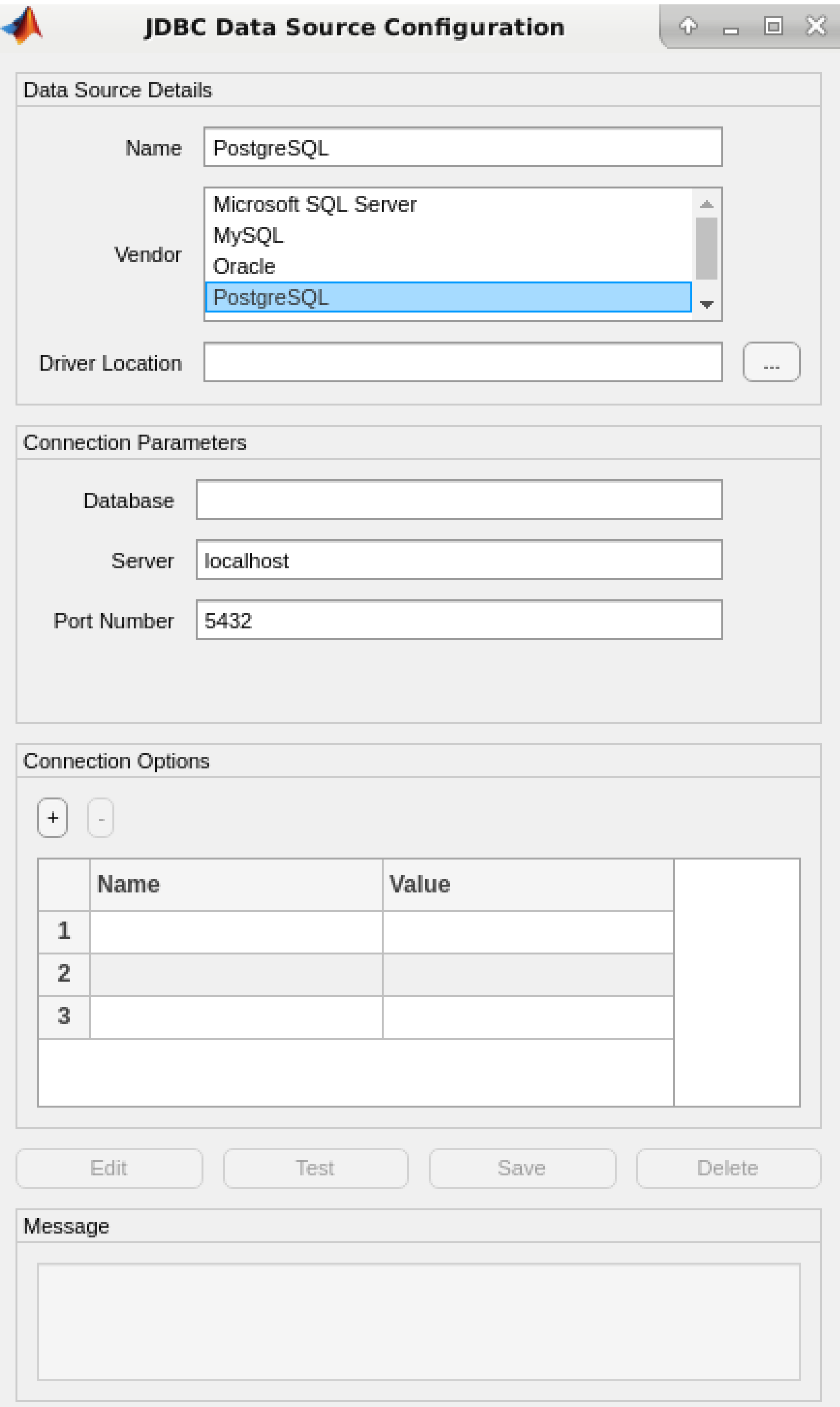
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `PostgreSQL`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `PostgreSQL`.



5 In the **Driver Location** box, enter the full path to the JDBC driver file.

6 In the **Database** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

7. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
8. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
9. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for a PostgreSQL database.

   ```
   vendor = "PostgreSQL";
   opts = databaseConnectionOptions("jdbc",vendor);
   ```
2. Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `PostgreSQL`, full path of the JDBC driver file `/home/user/DB_Drivers/postgresql-8.4-702.jdbc4.jar`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

   ```
   opts = setoptions(opts, ...
       'DataSourceName',"PostgreSQL", ...
       'JDBCDriverLocation',"/home/user/DB_Drivers/postgresql-8.4-702.jdbc4.jar", ...
       'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
       'PortNumber',5432);
   ```
3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

   ```
   username = "username";
   password = "pwd";
   status = testConnection(opts,username,password);
   ```
4. Save the JDBC data source.

   ```
   saveAsDataSource(opts)
   ```

After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to PostgreSQL Using JDBC Driver and Command Line

1. Connect to a PostgreSQL database using the configured JDBC data source, user name `username`, and password `pwd`.

```
datasource = "PostgreSQL";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

SQLite JDBC for macOS

This tutorial shows how to set up a data source and connect to an SQLite database using the Database Explorer app or the command line. The tutorial uses the SQLite JDBC 3.7.2 Driver to connect to an SQLite Version 3.7.17 database.

Step 1. Verify the driver installation.

If the JDBC driver for SQLite is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

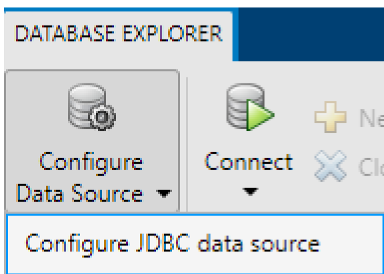
If you do not want to install a driver and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

Step 2. Set up the data source.

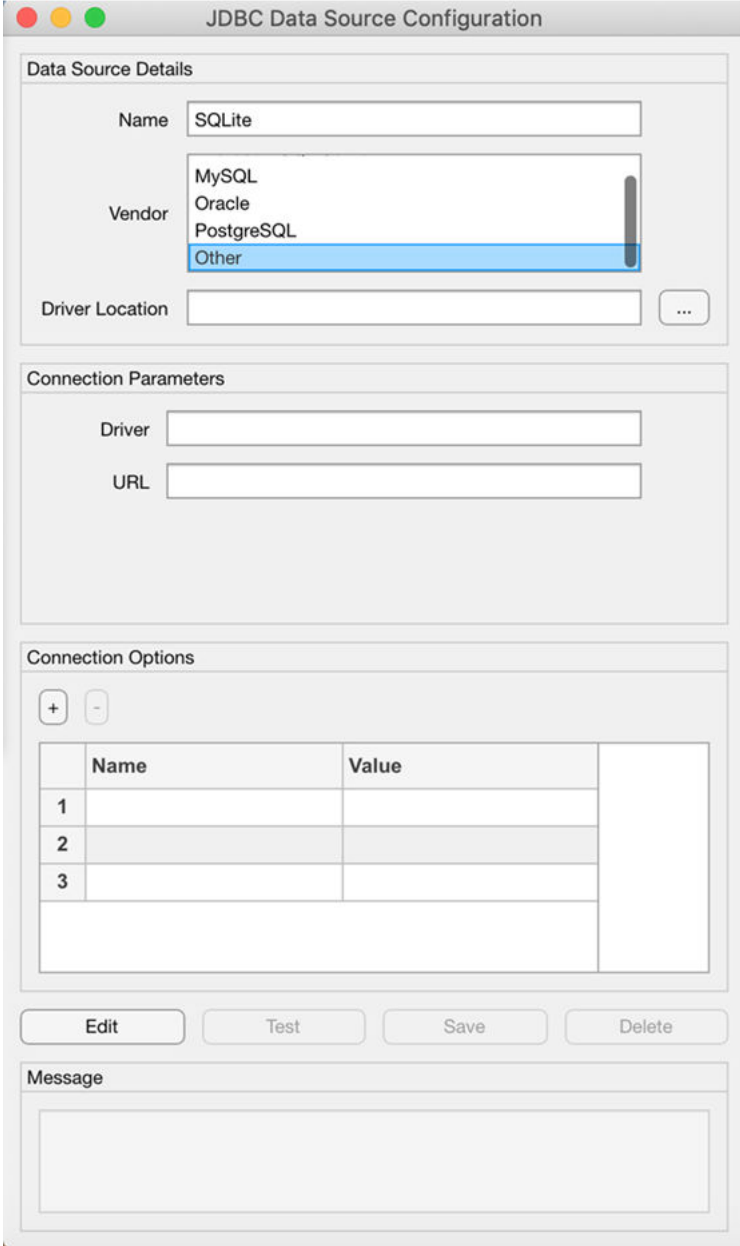
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `SQLite`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `Other`.



5. In the **Driver Location** box, enter the full path to the JDBC driver file.
6. In the **Driver** box, enter the SQLite driver Java class object. Here, use `org.sqlite.JDBC`.

Note Your entries for **Driver** and **URL** can vary depending on the type and version of the JDBC driver and your database. For details, see the JDBC driver documentation for your database.

---

7. Connect to the SQLite database by creating a URL string using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string remains constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. For SQLite, `subname` contains the location of the database. For example, your URL string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer. Enter your string in the **URL** box and press **Enter**.

8. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
9. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
10. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for an SQLite database.

```
vendor = "Other";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `SQLite`, full path of the SQLite driver location `/home/user/Drivers/sqlite-jdbc-3.8.11.2.jar`, SQLite driver Java class object `org.sqlite.JDBC`, and URL string `jdbc:sqlite:/home/user/Databases/sqlite.db`.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLite", ...
    'JDBCDriverLocation',"/home/user/Drivers/sqlite-jdbc-3.8.11.2.jar", ...
    'Driver',"org.sqlite.JDBC", ...
    'URL',"jdbc:sqlite:/home/user/Databases/sqlite.db");
```

3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4. Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the SQLite database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to SQLite Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source

name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.

3. Select tables in the **Data Browser** pane to query the database.
4. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to SQLite Using JDBC Driver and Command Line

1. Connect to an SQLite database using the configured JDBC data source, user name `username`, and password `pwd`.

```
datasource = "SQLite";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- "Create JDBC Data Source and Set Options Programmatically" on page 2-17
- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14
- "Modify and Delete Data Sources" on page 4-17
- "Database Explorer App Error Messages" on page 3-14
- "Database Connection Error Messages" on page 3-7

SQLite JDBC for Linux

This tutorial shows how to set up a data source and connect to an SQLite database using the Database Explorer app or the command line. The tutorial uses the SQLite JDBC 3.7.2 Driver to connect to an SQLite Version 3.7.17 database.

Step 1. Verify the driver installation.

If the JDBC driver for SQLite is not installed on your computer, find the link on the Driver Installation page to install the driver. Follow the instructions to download and install this driver on your computer.

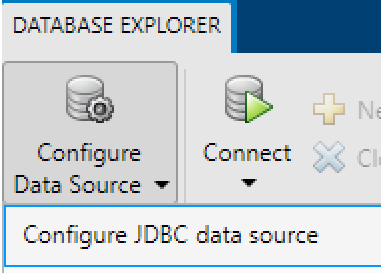
If you do not want to install a driver and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see "Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5.

Step 2. Set up the data source.

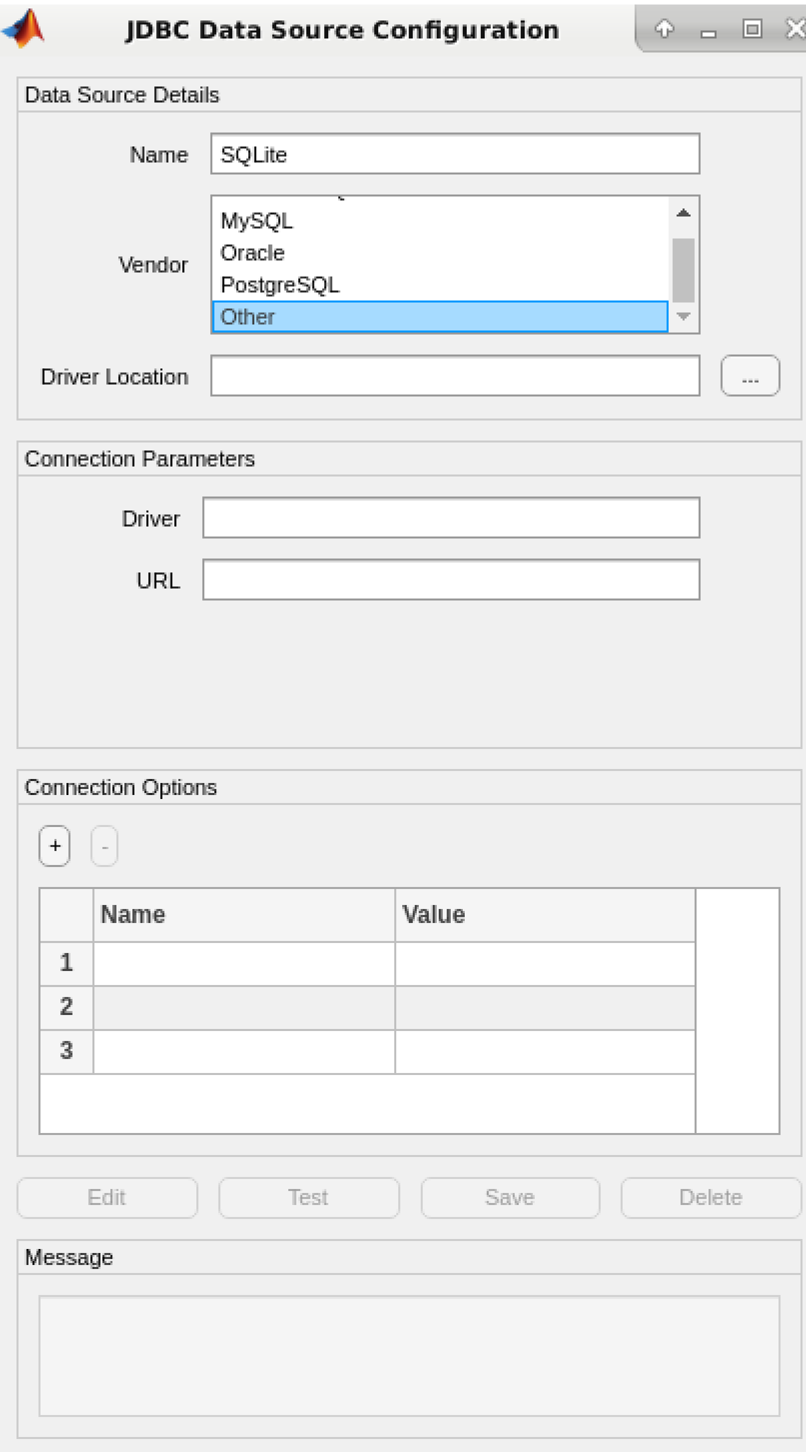
You set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure JDBC data source**.

   The JDBC Data Source Configuration dialog box opens.
3. In the **Name** box, enter a name for your data source. (This example uses a data source named `SQLite`.) You use this name to establish a connection to your database.
4. From the **Vendor** list, select `Other`.



5 In the **Driver Location** box, enter the full path to the JDBC driver file.

6 In the **Driver** box, enter the SQLite driver Java class object. Here, use `org.sqlite.JDBC`.

Note Your entries for **Driver** and **URL** can vary depending on the type and version of the JDBC driver and your database. For details, see the JDBC driver documentation for your database.

7. Connect to the SQLite database by creating a URL string using the format `jdbc:subprotocol:subname`. The `jdbc` part of this string remains constant for any JDBC driver. `subprotocol` is a database type, in this case, `sqlite`. For SQLite, `subname` contains the location of the database. For example, your URL string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer. Enter your string in the **URL** box and press **Enter**.
8. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
9. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database, or leave these boxes blank if your database does not require them. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.
10. Click **Save**. The JDBC Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a JDBC data source for an SQLite database.

```
vendor = "Other";
opts = databaseConnectionOptions("jdbc",vendor);
```

2. Set the JDBC connection options. For example, this code assumes that you are connecting to a JDBC data source named `SQLite`, full path of the SQLite driver location `/home/user/Drivers/sqlite-jdbc-3.8.11.2.jar`, SQLite driver Java class object `org.sqlite.JDBC`, and URL string `jdbc:sqlite:/home/user/Databases/sqlite.db`.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLite", ...
    'JDBCDriverLocation',"/home/user/Drivers/sqlite-jdbc-3.8.11.2.jar", ...
    'Driver',"org.sqlite.JDBC", ...
    'URL',"jdbc:sqlite:/home/user/Databases/sqlite.db");
```

3. Test the database connection by specifying the user name `username` and password `pwd`, or leave these arguments blank if your database does not require them.

```
username = "username";
password = "pwd";
status = testConnection(opts,username,password);
```

4. Save the JDBC data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the SQLite database using the Database Explorer app or the JDBC driver and command line.

Step 3. Connect using the Database Explorer app or the command line.

Connect to SQLite Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.

2. In the connection dialog box, enter a user name and password, or leave these boxes blank if your database does not require them. Click **Connect**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
3. Select tables in the **Data Browser** pane to query the database.
4. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

   Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to SQLite Using JDBC Driver and Command Line

1. Connect to an SQLite database using the configured JDBC data source, user name `username`, and password `pwd`.

```
datasource = "SQLite";
username = "username";
password = "pwd";
conn = database(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection`

More About

- “Create JDBC Data Source and Set Options Programmatically” on page 2-17
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14
- “Database Connection Error Messages” on page 3-7

Other ODBC-Compliant or JDBC-Compliant Databases

This tutorial provides steps for configuring data sources and connecting to other ODBC-compliant or JDBC-compliant databases that are not listed in “Configure Driver and Data Source” on page 2-14. After creating a data source, you can connect to your database using the Database Explorer app or the command line.

ODBC-Compliant Databases

These steps show how to configure a driver and connect to an ODBC-compliant database. Database Toolbox can connect to any ODBC-compliant database that is relational and uses ANSI® SQL. For example, if your database is Microsoft Excel® or IBM DB2®, follow these basic steps:

1. If your driver is not preinstalled on your computer, find a compatible driver and install it on your computer. You can view preinstalled drivers using the Microsoft ODBC Data Source Administrator dialog box. For details about this dialog box, see Driver Installation.
2. Create a data source by using the installed driver and the Microsoft ODBC Data Source Administrator dialog box. To open this dialog box, use the `configureODBCDataSource` function.
3. Use the Database Explorer app to test your connection and connect to your database. For an example, see “MySQL ODBC for Windows” on page 2-47.

   Or, you can connect to your database using the `database` function at the command line.
4. For detailed assistance, contact your database administrator or refer to your database documentation.

JDBC-Compliant Databases

You set up a data source to a JDBC-compliant database using the Database Explorer app or the command line.

These steps show how to configure a driver and connect to a JDBC-compliant database. Database Toolbox can connect to any JDBC-compliant database that is relational and uses ANSI SQL. For example, if your database is Apache Derby or Microsoft Windows Azure, follow these basic steps:

Note The details of these steps can vary depending on your database and database version. For detailed assistance, contact your database administrator or refer to your database documentation.

Set Up Data Source Using Database Explorer

1. If your driver is not installed on your computer, find a compatible driver and install it on your computer.
2. Create a data source by using the JDBC Data Source Configuration dialog box. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure JDBC data source** to open the dialog box.
3. In the **Name** box, enter a name for your data source. You use this name to establish a connection to your database.
4. From the **Vendor** list, select `Other`.

5. In the **Driver Location** box, specify the full path of the driver file.
6. To connect to a JDBC-compliant database, you must know your database driver Java class object. For example, the Java class object for an SQLite database driver is `org.sqlite.JDBC`. In the **Driver** box, specify the driver value.
7. To connect to a JDBC-compliant database, you must create a URL string. The URL string has the form `jdbc:subprotocol:subname`. The `jdbc` part of this string remains constant for any JDBC driver. `subprotocol` is the database type. The `subname` contains the location of the database and additional connection information, such as the port number. For example, if you are using SQLite, the URL string is `jdbc:sqlite:dbpath`, where `dbpath` is the full path to your SQLite database on your computer. In the **URL** box, specify the URL string.

   Note For JDBC-compliant databases, specify the driver and URL in the JDBC Data Source Configuration dialog box. The driver and the URL string can vary depending on the type and version of the JDBC driver and your database. For details about the driver and URL, see the JDBC driver documentation for your database.

8. Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.
9. Click **Test** to test your connection. If the connection is successful, then click **Save** to save the JDBC data source.
10. Connect to your database with the saved JDBC data source by using the Database Explorer app. For an example, see “SQLite JDBC for Windows” on page 2-65.

Set Up Data Source Using Command Line

1. If your driver is not installed on your computer, find a compatible driver and install it on your computer.
2. Create a data source using the `databaseConnectionOptions` function.
3. Set the JDBC connection options using the `setoptions` function.
4. Test the database connection using the `testConnection` function.
5. Save the JDBC data source using the `saveAsDataSource` function.
6. Connect to your database with the saved JDBC data source by using the `database` function. For an example, see “SQLite JDBC for Windows” on page 2-65.

See Also

Apps
Database Explorer

Functions
`database` | `close` | `databaseConnectionOptions` | `configureODBCDataSource` | `setoptions` | `testConnection` | `saveAsDataSource`

Related Examples

- “MySQL ODBC for Windows” on page 2-47
- “SQLite JDBC for Windows” on page 2-65

More About

- "Create JDBC Data Source and Set Options Programmatically" on page 2-17
- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14
- "Java Class Path"
- "Modify and Delete Data Sources" on page 4-17
- "Database Explorer App Error Messages" on page 3-14
- "Database Connection Error Messages" on page 3-7

Connect to Database

To connect to a database from MATLAB, install an ODBC or JDBC driver and create a data source. Or, you can connect to MySQL or PostgreSQL databases using the native interfaces. For details about driver installation and data source setup, see “Configure Driver and Data Source” on page 2-14. If you do not have an installed database and want to store relational data quickly, you can use the MATLAB interface to SQLite. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

You can connect to a database using the Database Explorer app or the command line. These two options enable you to perform different actions. For details about deciding which option to use, see “Connection Options” on page 2-8.

Database Explorer App Connection Workflow

Use these steps as a general workflow for creating a database connection using the app.

- In the **Data Source** section of the **Database Explorer** tab, click **Configure Data Source** and select the appropriate option for configuring an ODBC, JDBC, or native data source.
- In the **Connections** section, click **Connect** and select the configured data source to create a database connection.
- To close the database connection, in the **Connections** section, click **Close Connection**. If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Command Line Connection Workflow

Use these steps as a general workflow for creating a database connection at the command line.

- Configure an ODBC data source using the `configureODBCDataSource` function, or configure a JDBC data source using the `databaseConnectionOptions` function.
- Create a database connection by completing one of these steps:
  - Create an ODBC database connection using the `odbc` function.
  - Create an ODBC or JDBC database connection using the `database` function.
  - Create a MySQL database connection using the MySQL native interface with the `mysql` function.
  - Create a PostgreSQL database connection using the PostgreSQL native interface with the `postgresql` function.
- If you do not configure a data source using a data source name (DSN), you can create a DSN-less connection using a connection string with the `odbc` function.
- Close the database connection using the `close` function.

Database List

After choosing to use the Database Explorer app or the command line, connect to your database by following the steps for the corresponding database and driver type, as given in this table.

Database	Driver or Interface	Connection Topics
Microsoft Access	ODBC	"Connect to Access Using Database Explorer App" on page 2-21 "Connect to Access Using ODBC Driver and Command Line" on page 2-22
Microsoft SQL Server	ODBC	"Connect to SQL Server Using Database Explorer App" on page 2-26 "Connect to SQL Server Using ODBC Driver and Command Line" on page 2-27 Connect to SQL Server Using DSN-Less Connection String and Command Line on page 2-28
	JDBC	"Connect to SQL Server Using Database Explorer App" on page 2-34 "Connect to SQL Server Using JDBC Driver and Command Line" on page 2-34
Oracle	ODBC	"Connect to Oracle Using Database Explorer App" on page 2-39 "Connect to Oracle Using ODBC Driver and Command Line" on page 2-39
	JDBC	"Connect to Oracle Using Database Explorer App" on page 2-45 "Connect to Oracle Using JDBC Driver and Command Line" on page 2-45

Database	Driver or Interface	Connection Topics
MySQL	ODBC	“Connect to MySQL Using Database Explorer App” on page 2-49 “Connect to MySQL Using ODBC Driver and Command Line” on page 2-50 Connect to MySQL Using DSN-Less Connection String and Command Line on page 2-51
	MySQL native interface	“Connect to MySQL Using Database Explorer App” on page 6-4 “Connect to MySQL Using Command Line” on page 6-4
	JDBC	“Connect to MySQL Using Database Explorer App” on page 2-54 “Connect to MySQL Using JDBC Driver and Command Line” on page 2-55
PostgreSQL	ODBC	“Connect to PostgreSQL Using Database Explorer App” on page 2-58 “Connect to PostgreSQL Using ODBC Driver and Command Line” on page 2-58 Connect to PostgreSQL Using DSN-Less Connection String and Command Line on page 2-60
	PostgreSQL native interface	“Connect to PostgreSQL Using Database Explorer App” on page 7-4 “Connect to PostgreSQL Using Command Line” on page 7-5
	JDBC	“Connect to PostgreSQL Using Database Explorer App” on page 2-63 “Connect to PostgreSQL Using JDBC Driver and Command Line” on page 2-64

Database	Driver or Interface	Connection Topics
SQLite	JDBC	"Connect to SQLite Using Database Explorer App" on page 2-68 "Connect to SQLite Using JDBC Driver and Command Line" on page 2-68
	None	To create an SQLite connection when no driver or database installation is required, use the `sqlite` function to create a new SQLite database file or connect to an existing SQLite database file.
All other ODBC-compliant or JDBC-compliant databases	ODBC or JDBC	"Other ODBC-Compliant or JDBC-Compliant Databases" on page 2-126

See Also

`database` | `close` | `configureODBCDataSource` | `databaseConnectionOptions` | `odbc`

More About

- "Setup Requirements for Database Connection" on page 2-11
- "Access Relational Database Data in MATLAB" on page 2-2
- "Connection Options" on page 2-8
- "Choose Between ODBC and JDBC Drivers" on page 2-12
- "Configure Driver and Data Source" on page 2-14
- "Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5

Data Import Using Database Explorer App or Command Line

You can import data from a database into MATLAB using the Database Explorer app or the command line. To select data for import, you can build an SQL query visually by using the Database Explorer app. Or, you can use the command line to write SQL queries. To achieve maximum performance with large data sets, use the command line instead of the Database Explorer app.

After importing data, you can repeat the steps in the process, such as connecting to a database, executing an SQL query, and so on, by using a MATLAB script to automate them.

To open multiple connections to the same database simultaneously, you can create multiple SQL queries using the Database Explorer app. Or, you can connect to the database using the command line.

If you do not have access to a database and want to import your data quickly, you can use the MATLAB interface to SQLite. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

Data Import Using Database Explorer App

If you have minimal proficiency writing SQL queries or want to browse the data in a database quickly, use the Database Explorer app. To build queries, see “Create SQL Queries Using Database Explorer App” on page 4-2. After creating a query using the Database Explorer app, you can generate the SQL code for the query. For details, see “Generate SQL Query” on page 4-20. You can embed the generated SQL code into the SQL query that you specify in the `fetch` function. Or, you can create an SQL script file to use with the `executeSQLScript` function.

If you want to automate the current task after you create the SQL query, then generate a MATLAB script. For details, see “Generate MATLAB Script” on page 4-20.

Data Import Using Command Line

If you are not familiar with writing SQL queries, then use the Database Explorer app to select data to import from your database. Or, you can use the `sqlread` function at the command line. This function needs only a database connection and the database table name to import data. Furthermore, the `sqlread` function does not require you to set database preferences.

If you know how to write SQL queries, you can write basic SQL statements as character vectors or string scalars. For a simple example, see “Import Data from Database Table Using sqlread Function” on page 5-58.

When writing SQL queries, you can import data into MATLAB in one of two ways. Use the `select` function for maximum memory efficiency and quick access to imported data. Or, use the `fetch` function to import numeric data with double precision by default or define the import strategy for the SQL query.

For memory management, see “Data Import Memory Management” on page 5-20.

If you have a stored procedure that imports data, then use the `runstoredprocedure` or `fetch` functions.

Custom Data Types

When importing data from a database, Database Toolbox functions return custom data types, such as Oracle ref cursors, as Java objects. You can manually parse these objects to retrieve their data contents. Use the `methods` function to access all the methods of a Java object. Use the available methods to retrieve data from a Java object. The steps for your object are specific to your database. For details, refer to your JDBC driver or database documentation.

SQL Queries Saved in Scripts or Files

If you have a long SQL query or multiple SQL queries that you want to run sequentially to import data, create an SQL script file containing your SQL queries. To execute the SQL script file, use the `executeSQLScript` function. If you have SQL queries stored in `.sql` or text files that you want to run from MATLAB, you can also use this function.

See Also

`select` | `fetch` | `database` | `sqlread`

More About

- "Connection Options" on page 2-8
- "Data Import Memory Management" on page 5-20
- "Working with Large Data Sets" on page 2-135
- "Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5
- "Data Type Support" on page 1-3
- "Data Retrieval Restrictions" on page 1-5

Working with Large Data Sets

Connect to a Database with Maximum Performance

When you are using MATLAB with a database containing large volumes of data, you can experience out-of-memory issues or slow processing. To achieve the fastest performance, connect to your database using the native ODBC interface. If the native ODBC interface does not work, connect to your database using a JDBC driver. For details, see “Connect to Database” on page 2-129.

Import Large Data Sets into MATLAB

If you are selecting large volumes of data in a database to import into MATLAB, you can experience out-of-memory issues or slow processing. To achieve the fastest performance, you can import the data in batches.

When working with a native ODBC connection, the amount of memory available to MATLAB can restrict you from processing your whole set of data at once. To manage the MATLAB memory, process your data in parts. Use the `fetch` function to limit the number of rows your query returns by using the `'MaxRows'` input argument. Using a MATLAB script, you can import data in increments until all data is retrieved. For an example, see `fetch`.

If you do not have access to a database and want to import large data sets, you can use the MATLAB interface to SQLite. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

Export Large Data Sets from MATLAB

When inserting large volumes of data into a database, you can experience slow processing. To achieve the fastest performance, use the `sqlwrite` function to export your data from MATLAB.

If you do not have access to a database and want to export large data sets, you can use the `insert` function with the MATLAB interface to SQLite. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

Access Large Data Using a DatabaseDatastore

An alternative for importing large data sets stored in a database into MATLAB is using a `DatabaseDatastore`. A `DatabaseDatastore` is a datastore that contains a collection of data stored in a database.

You can analyze data in a `DatabaseDatastore` using tall arrays with common MATLAB functions, such as `mean` and `histogram`. For details, see “Analyze Large Data in Database Using Tall Arrays” on page 5-30. Or, for more control, you can also write your own algorithms using MapReduce. For details, see “Analyze Large Data in Database Using MapReduce” on page 5-27.

See Also

More About

- “Choose Between ODBC and JDBC Drivers” on page 2-12

- “Data Import Using Database Explorer App or Command Line” on page 2-133
- “Import Data from Database Table Using sqlread Function” on page 5-58
- “Insert Data into Database Table” on page 5-61

Databricks ODBC Driver for Database Toolbox Support Package Installation

The Databricks ODBC driver is used for accessing Databricks services and Apache Hadoop®/Spark™ distributions. You can install Databricks ODBC driver from a MATLAB support package.

Installation

Follow these steps to install the Databricks ODBC driver.

1. In the Environment section of the MATLAB toolstrip, select **Add-Ons** > **Get Add-Ons**.
2. In the Add-On Explorer, search for Databricks ODBC Driver for Database Toolbox.
3. Install the Databricks ODBC Driver.

The installer downloads and installs the Databricks ODBC driver. For more information about this driver, see Databricks ODBC driver.

MariaDB ODBC Driver for Database Toolbox Support Package Installation

The MariaDB ODBC driver is used for connecting to either a MySQL or a MariaDB server. On the Windows platform, the driver is installed as MariaDB ODBC 3.1 driver. You can install this driver from a MATLAB support package.

Installation

Follow these steps to install the MariaDB ODBC driver.

1. In the Environment section of the MATLAB toolstrip, select **Add-Ons** > **Get Add-Ons**.
2. In the Add-On Explorer, search for MariaDB ODBC Driver for Database Toolbox.
3. Install the MariaDB ODBC Driver.

PostgreSQL ODBC Driver for Database Toolbox Support Package Installation

The PostgreSQL ODBC driver is used for connecting to a PostgreSQL server and is installed as both a PostreSQL ANSI(x64) and a PostreSQL Unicode(x64) driver. On the Windows platform, the driver is installed as PostreSQL ODBC 15.0 driver. You can install this driver from a MATLAB support package.

Installation

Follow these steps to install the PostgreSQL ODBC driver.

1. In the Environment section of the MATLAB toolstrip, select **Add-Ons** > **Get Add-Ons**.
2. In the Add-On Explorer, search for PostgreSQL ODBC Driver for Database Toolbox.
3. Install the PostgreSQL ODBC Driver.

Working with Data Sources

- “Writing Data Common Errors” on page 3-2
- “Importing Data Common Errors” on page 3-3
- “Database Connection Error Messages” on page 3-7
- “Database Explorer App Error Messages” on page 3-14
- “SQL Prepared Statement Error Messages” on page 3-16

Writing Data Common Errors

This table describes how to address common errors you might encounter while working with the `sqlwrite` function. These errors apply to all database vendors.

Error Message	Probable Causes	Resolution
`*columnname*` `column value must be a numeric array or cell array of numeric scalars.`	The specified data type of the database column is invalid.	Specify a valid data type for the database column. For valid data types, see the `data` input argument description in the `sqlwrite` function.
`*columnname*` `column value must be a datetime array, cell array of character vectors, or string array.`		
`*columnname*` `column value must be a logical array.`		
`*columnname*` `column value must be a cell array of character vectors or string array.`		
`JDBC/ODBC Error:` `*errormessage*`	The JDBC or ODBC driver throws an error.	Consult your database driver documentation.
`Unable to create` `*tablename*` `without column types. Specify 'ColumnType' for each variable in the table data.`	You are creating an empty database table.	Specify the `'ColumnType'` name-value pair argument and provide the data type for all columns in the database table. For details, see the `sqlwrite` function.
`Specify 'ColumnType' for each variable in the table data.`	You did not specify the data type of at least one column in the database table.	Specify the `'ColumnType'` name-value pair argument and provide the data type for all columns in the database table. For details, see the `sqlwrite` function.

Importing Data Common Errors

Address common errors that you can encounter when importing data from databases and customizing import options.

Data Import Common Errors

The following table describes errors that can occur in either the Database Explorer app or the command line when you use the `fetch`, `sqlinnerjoin`, and `sqlouterjoin` functions.

Vendor	Error Message	Probable Causes	Resolution
All	`Must provide either the "Keys" value, or both the "LeftKeys" and "RightKeys" values.`	You specified only the `'LeftKeys'` or `'RightKeys'` name-value pair argument.	Specify the `'Keys'` name-value pair argument, or both the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.
	`Multiple table entry found for` *`tablename`*`. Must provide` *`LeftCatalog/ RightCatalog`* `and` *`LeftSchema/ RightSchema`* `values.`	The database contains multiple tables with the same name across catalogs and schemas.	Specify the `'LeftCatalog'` and `'LeftSchema'` or `'RightCatalog'` and `'RightSchema'` name-value pair arguments.
	`Unable to find information for table` *`tablename`*`. Must provide either the "Keys" value, or both the "LeftKeys" and "RightKeys" values.`	The function cannot find information about the specified database table.	Specify the `'Keys'` name-value pair argument, or both the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.
	`Unable to find columns for table` *`tablename`*`. Must provide either the "Keys" value, or both the "LeftKeys" and "RightKeys" values.`	The function cannot find information about the columns of the specified database table.	Specify the `'Keys'` name-value pair argument, or both the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.

Vendor	Error Message	Probable Causes	Resolution
	`Unable to find common keys for table` *`lefttable`* `and` *`righttable`*`. Must provide either the "Keys" value, or both the "LeftKeys" and "RightKeys" values.`	The function cannot find common keys between the specified left and right tables to join.	Specify the `'Keys'` name-value pair argument, or both the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.
	`The number of key variables on the left and right must be the same.`	The number of specified keys for the left and right tables do not match.	Specify the same number of keys for the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.
Microsoft SQL Server	`The statement did not return a result set.`	There are other SQL statements in the middle of the stored procedure. This error happens after you execute `exec` but before you execute `fetch`. This error happens only with the command line.	Add `'SET NOCOUNT ON'` at the beginning of your stored procedure. For details, see `exec`.
Microsoft SQL Server	`JDBC Driver 3.0 returns incorrect date values when used with JRE™ 1.7 by a Java application.`	There is an issue with the Microsoft SQL Server JDBC Driver 3.0. This error happens after you execute `fetch`. This error happens either with Database Explorer or the command line.	Install a hotfix from Microsoft for JDBC Driver 3.0. Alternatively, upgrade your Microsoft SQL Server JDBC driver to version 4.0.
Microsoft SQL Server	`Connection is busy with results for another command.`	You are connecting to Microsoft SQL Server using a driver that `preview` does not support.	Connect to Microsoft SQL Server using the JDBC driver.
Oracle	`Stored procedures and functions return result sets as cursor types.`	The JDBC driver returns stored procedure and function result sets as custom Java objects. This error happens after you execute `fetch`. This error happens only with the command line.	Write custom MATLAB code to process the Java objects into MATLAB variables.

Vendor	Error Message	Probable Causes	Resolution

PostgreSQL	`Java exception occurred: java.lang.OutOfMemoryError: Java heap space`	The JDBC driver caches results in the memory. There is not enough memory in the Java heap to store the large amount of data fetched from your database. This error happens after you execute `fetch`. This error happens either with Database Explorer or the command line.	Write custom code. Write the code for connecting to your database via the command line. Then write the following.
			
			`conn.AutoCommit = 'off';`
			
			`h = conn.Handle;`
			
			`stmt = h.createStatement();`
			
			`stmt.setFetchSize(50);`
			
			`rs = stmt.executeQuery(java.lang.String('SELECT * FROM largeData where productnumber <= 3000000'));`
			
			Modify the previous statement to include your SQL query instead.
			
			Then process the result set object `rs` in batches.

Custom Import Options Common Errors

The following table describes errors that can occur when you use the `SQLImportOptions` object to customize options for importing data from a database. These error messages apply across all database vendors.

Error Message	Probable Causes	Resolution
`Calling` *`function`* `without an output argument has no effect. Use the following instead: opts =` *`function`*`(opts,...)`	You did not specify an output argument when executing the `setoptions` function.	Use the `setoptions` function with an output argument.
`argument` `must be a character vector or cell array of character vectors.`	The specified input argument has an invalid data type.	The input argument must be a character vector or cell array of character vectors.

Error Message	Probable Causes	Resolution
`Unknown variable name: ''`*`argument`*`''.`	The specified variable name is invalid.	Specify a variable name that exists in the `VariableNames` property of the `SQLImportOptions` object.
`Variable selection out of range. Vector must contain integers between 1 and N, where N is the number of variables in the import options.`	The specified index value is out of bounds within the number of selected variables.	Specify an index that is in the range of the number of variables in the `SelectedVariableNames` property of the `SQLImportOptions` object.
`Expected a name or numeric index of a variable name.`	The data type of the specified input argument is invalid.	The input argument must be a numeric index or a variable name.
`Cell array of types must be a vector of length `*`n`*`.`	The length of the specified data types is invalid.	When you set the `VariableTypes` property of the `SQLImportOptions` object, the length of the cell array must be equal to the number of variables.
`Cell array of names must be a vector of length `*`n`*`.`	The length of the specified variable names is invalid.	When you set the `VariableNames` property of the `SQLImportOptions` object, the length of the cell array must be equal to the number of variables.

See Also

`fetch` | `setoptions` | `getoptions` | `sqlinnerjoin` | `sqlouterjoin`

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Data Import Using Database Explorer App or Command Line” on page 2-133
- “Call Stored Procedure That Returns Data” on page 5-17

Database Connection Error Messages

This table describes how to address common errors you might encounter while connecting to the Database Toolbox using Database Explorer or the command line.

Connection Error Messages and Probable Causes

Vendor	Error Message	Probable Causes	Resolution
All	`Undefined variable 'database' or class 'database.ODBCConnection'.`	• Database Toolbox software is not installed. • You are connecting using the native ODBC interface with MATLAB R2013a or earlier.	• Ensure that Database Toolbox software is installed. • If you want to use the native ODBC interface, ensure that MATLAB R2013b or later is installed.
	`Unable to access data source name. Use databaseConnectionOptions to create a JDBC data source. Use configureODBCDataSource to create an ODBC data source.`	The specified data source name does not exist. This error message occurs with Windows only.	Create a JDBC or ODBC data source using the corresponding `databaseConnectionOptions` or `configureODBCDataSource` function. For examples, see "Configure Driver and Data Source" on page 2-14.
	`Parameter name must be 'AutoCommit', 'ReadOnly', 'LoginTimeout', 'ErrorHandling'.`	The specified name-value arguments are invalid with the `database(datasource,username,password,Name,Value)` syntax.	Specify one or more of these valid name-value arguments with the `database` function: `'AutoCommit'`, `'ReadOnly'`, `'LoginTimeout'`, and `ErrorHandling`.
All ODBC-Compliant Databases	`[Microsoft][ODBC Driver Manager] Data source name not found and no default driver specified`	Data source name is not spelled correctly.	Verify your data source name.
	`[Microsoft][ODBC Driver Manager] The specified DSN contains an architecture mismatch between Driver and Application`	There is a difference in the bitness (32-bit or 64-bit) between the database, driver, and MATLAB.	Use a 64-bit driver. If you have issues working with the ODBC driver, use the JDBC driver instead. For details about driver installation, see "Configure Driver and Data Source" on page 2-14. To address differences in bitness for Microsoft Access, see "Microsoft Access ODBC for Windows" on page 2-19.

Vendor	Error Message	Probable Causes	Resolution
	`ODBC Driver Error: [unixODBC][Driver Manager]Can't open lib'/driver.dylib' : file not found`	• Driver does not exist. • Improper driver manager is used.	• Make sure that the libraryexists. • Make sure that unixODBC is installed with Homebrew • Make sure that iODBC is installed. • Try adding the `DriverManager` name-value argument with the `database` function.
	`ODBC Driver Error: [unixODBC][Driver Manager]Data source name not found and no default driver specified`	• Driver entry is not installed properly. • Data source is not installed properly.	• Make sure that the driver entry is installed at `/usr/local/etc/odbcinst.ini` • Make sure that the data source entry is installed at `~/.odbc.ini`
	`ODBC Driver Error: [iODBC][Driver Manager]dlopen(MariaDB ODBC Driver, 0x0006): tried: 'MariaDB ODBC Driver' (no such file)`	iODBC cannot find the driver.	Make sure that the driver entry is installed at `/Library/ODBC/odbcinst.ini`.
	`Error using` **`odbc`** `Unable to access data source name`	Data source name is not spelled correctly.	Make sure that the data source entry is installed at `~/.odbc.ini`.
All JDBC-Compliant Databases	`Unable to find JDBC driver file on MATLAB Java class path.`	You specify a path to the JDBC driver JAR file that is not on the static or dynamic class path. Or, you specify an incorrect driver name in the **Driver** box of the JDBC Data Source Configuration dialog box.	Specify the full path to the JDBC driver file in the **Driver Location** box and the correct driver name in the **Driver** box of the JDBC Data Source Configuration dialog box. For details, see the `databaseConnectionOptions` function.
	`Unable to access data source name. Use databaseConnectionOptions to create a JDBC data source.`	The specified data source name does not exist. This error message occurs with UNIX® only.	Create a JDBC data source using the `databaseConnectionOptions` function. For examples, see "Configure Driver and Data Source" on page 2-14.

Vendor	Error Message	Probable Causes	Resolution
	`JDBC data source does not contain driver location. Use databaseConnectionOptions to specify JDBC driver location.`	The specified driver location in the JDBC data source is invalid.	Modify the JDBC data source to specify a valid JDBC driver location using the `databaseConnectionOptions` function.
Microsoft Access	`[Microsoft][ODBC Microsoft Access Driver] '(unknown)' is not a valid path. make sure that the path name is spelled correctly and that you are connected to the server on which the file resides`	Error occurs in the Connection Failure dialog box after clicking **Connect** in the Connect to a Data Source dialog box. The file location of the Microsoft Access database is incorrect.	Verify the location of the database file. If the database file is on a network drive, map to the network drive. Modify the existing file location by selecting **New > ODBC** and selecting the existing database name from the ODBC Data Source Administrator dialog box. Then select **Configure** to change the database file location.
Microsoft SQL Server	`The TCP/IP connection to the host` *`hostname`*`, port` *`portnumber`* `has failed. Error: "null. Verify the connection properties, check that an instance of SQL Server is running on the host and accepting TCP/IP connections at the port, and that no firewall is blocking TCP connections to the port."`	Incorrect server name or port number.	Verify your database server name and your port number. Microsoft SQL Server uses a dynamic port for JDBC. Verify the value using Microsoft SQL Server Configuration Manager. For details, see "Step 2. Verify the port number." on page 2-29
Microsoft SQL Server	`This driver is not configured for integrated authentication.`	The Microsoft SQL Server Windows authentication library is not added to `javalibrarypath.txt`.	Add the Microsoft SQL Server Windows authentication library to `javalibrarypath.txt`. For details about configuring a Microsoft SQL Server Authenticated Database Connection, see "Microsoft SQL Server JDBC for Windows" on page 2-29.
Microsoft SQL Server	`Invalid string or buffer length.`	64-bit ODBC driver error.	Use a JDBC driver or the native ODBC interface instead.

Vendor	Error Message	Probable Causes	Resolution
Microsoft SQL Server	`JDBC Driver Error: com.microsoft.sqlserver.jdbc.SQLServerDriver.Driver Not Found/Loaded.`	The full path to the JAR file was not added to the `javaclasspath.txt` file, or it was added using the `javaaddpath` command. Alternatively, the path to the JAR file is incorrect.	Ensure that the path to the JAR file is not misspelled. Ensure that you add the path to the static class path.
Microsoft SQL Server	`com.microsoft.sqlserver.jdbc.AuthenticationJNI <clinit> WARNING: Failed to load the sqljdbc_auth.dll`	The path to the folder containing the file `sqljdbc_auth.dll` was not added to the `javalibrarypath.txt` file. Or, the full path to the file was added instead of the path to the folder. This error also occurs when you add the path to the 32-bit version of the DLL using a 64-bit version of MATLAB.	Add the path to the folder containing the file `sqljdbc_auth.dll` to the `javalibrarypath.txt` file. For details about configuring a Microsoft SQL Server Authenticated Database Connection, see “Microsoft SQL Server JDBC for Windows” on page 2-29.
Microsoft SQL Server	`Login failed for user 'DOMAIN\username'.`	Either the login credentials you are using are incorrect or your user account does not have enough rights to access the remote machine. This error also occurs when the database server is not configured to accept Integrated Windows Authentication login credentials.	Ensure that your user name and password are correct. Refer to your system administrator for appropriate access rights to your machines. Contact your database administrator to see if your database is set up with Windows Authentication.
Microsoft SQL Server	`MSSQLSERVER_`*`number`*	The Microsoft SQL Server driver returns a numbered error message.	Find more information about the specific error in System Error Messages.
MySQL	`Access denied for user 'user'@'machinename' (using password: YES)`	Incorrect user name and password combination.	Verify your user name and password.
MySQL	`Communications link failure.` `The last packet sent successfully to the server was 0 milliseconds ago. The driver has not received any packets from the server.`	Incorrect server name or port number.	Verify your database server name and port number.
MySQL	`Unknown database 'databasename'.`	Provided database name is incorrect.	Verify your database name.

Vendor	Error Message	Probable Causes	Resolution
MySQL	`ERROR` *`number`* `(`*`SQLSTATE`*`):` *`errormessage`*	The MySQL driver returns an error that contains an error number, a `SQLSTATE` value, and an error message.	Navigate to the latest database documentation in the MySQL Documentation, and search for the specific error.
Oracle	`Error when connecting to Oracle oci8 database using JDBC driver: Error using com.mathworks.toolbox.database.databaseConnect/makeDatabaseConnection Java exception occurred: java.lang.UnsatisfiedLinkError: no ocijdbc11 in java.library.pathat java.lang.ClassLoader.loadLibrary(Unknown Source)at java.lang.Runtime.loadLibrary0.......`	MATLAB cannot find the Oracle DLL that the `oci8` drivers need.	Add the path for the location of the Oracle DLLs to `javalibrarypath.txt`. For details, see “Oracle JDBC for Windows” on page 2-41.
Oracle	`Invalid Oracle URL specified: OracleDataSource.makeURL`	The `DriverType` parameter is not specified.	Specify the `DriverType` parameter as either `thin` for connecting without Windows authentication or `oci` for connecting with Windows authentication.
Oracle	`The Network Adapter could not establish the connection.`	Either `Server` or `Portnumber` is not specified or has an incorrect value.	Verify the server name and port number for your Oracle database.
Oracle	`TNS:listener does not currently know of SID given in connect descriptor: Incorrect database name or incorrect URL.`	The service name for your database is incorrect.	Verify the service name for your Oracle database.
Oracle	`ORA-`*`number`*	The Oracle driver returns a numbered error message.	Navigate to the latest database documentation in the Oracle Documentation, and search for the specific error.

See Also

`database`

More About

- “Configure Driver and Data Source” on page 2-14
- “Connect to Database” on page 2-129

Database Explorer App Error Messages

This table describes how to address common errors you can encounter while working with the Database Explorer app. For Database Toolbox connection errors, see “Database Connection Error Messages” on page 3-7.

Error Category	Error Message	Probable Causes	Resolution
Database connection	`No data sources found. Configure a data source before creating a new query.`	You clicked **New Query** before configuring any data sources.	Configure at least one ODBC or JDBC data source. For details, see “Configure Driver and Data Source” on page 2-14.
Configure JDBC data source	`Unable to find the JDBC driver file on the MATLAB Java class path.`	The JDBC Data Source Configuration dialog box displays this message at the bottom of the dialog box. This message is displayed when the JDBC driver for the database, or the driver specified for the **Driver** option when the **Vendor** option is set to `OTHER`, is not found on the MATLAB Java class path.	Specify the full path to the JDBC driver file in the **Driver Location** box of the JDBC Data Source Configuration dialog box. For details, see the `databaseConnectionOptions` function.
SQL statements	`Database Explorer supports one SELECT SQL statement only.`	You entered an incompatible SQL query. The Database Explorer app accepts a single `SELECT` statement only. Other SQL statements are not supported.	Create one valid SQL `SELECT` statement in the **SQL Query** pane.
Data preview	`Received the following message from the database:`	If an error occurs on the database server when it executes the SQL query, an error message appears in the **Data Preview** pane. This text precedes the exact error message from the database server.	Refer to the error message to determine the issue. Consult your database administrator for further details.
Data preview	`Error occurred while executing the query on the database.`	The Database Explorer app returned a MATLAB error while trying to execute the SQL query.	Click the button to view the stack trace. For questions, contact technical support.

Error Category	Error Message	Probable Causes	Resolution
Data preview	`No data was returned for this SQL Query.`	The SQL query executed successfully but did not return any data. The Database Explorer app displays this error message in the **Data Preview** pane when previewing data or in a dialog box when importing data.	Use the Database Explorer app to modify the SQL query. Ensure that the selected table contains data by clicking it in the **Data Browser** pane.
Data import	*`variable`* `not a valid MATLAB variable name.`	You entered an invalid MATLAB variable name.	Enter a valid MATLAB variable name, such as `data`.

See Also

Apps
Database Explorer

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14

SQL Prepared Statement Error Messages

This table describes how to address common errors you can encounter when working with SQL prepared statements. For details about SQL prepared statements, see the `SQLPreparedStatement` object.

Error Message	Probable Causes	Resolution
`Invalid SQL statement. SQL prepared statement must be SELECT, INSERT, UPDATE, DELETE, or CALL.`	The SQL prepared statement is invalid.	Specify a valid SQL prepared statement in the `SQLPreparedStatement` object by using the `databasePreparedStatement` function. You can specify these SQL statements: • `SELECT` • `INSERT` • `UPDATE` • `DELETE` • `CALL`
`Invalid SQL statement. SQL prepared statement must have at least one SQL parameter.`	The specified SQL prepared statement is invalid because it has no parameters.	Specify at least one parameter value to bind in the SQL prepared statement by using the `databasePreparedStatement` function.
`Parameter selection out of range. Vector must contain integers between 1 and n, where n is the number of parameters.`	The specified indices for the selected parameters in the `bindParamValues` function are invalid.	Specify indices for the selected parameters within the range of the parameter values in the `bindParamValues` function. The values must be between 1 and `n`, where `n` is the number of parameters.
`Parameter index must be a numeric scalar.`	The specified indices for the selected parameters in the `bindParamValues` function are not numeric.	Specify numeric index values for the selected parameters in the `bindParamValues` function. The values must be between 1 and `n`, where `n` is the number of parameters.
`Value must be a cell array with length between 1 and n, where n is the number of parameters.`	The parameter values in the `bindParamValues` function are invalid.	The values to bind must be a cell array that has a length between 1 and `n`, where `n` is the number of parameters.

See Also

`databasePreparedStatement` | `bindParamValues` | `close`

More About

- "Import Data Using SQL Prepared Statement with Multiple Parameter Values" on page 5-75

Using Database Explorer

Create SQL Queries Using Database Explorer App

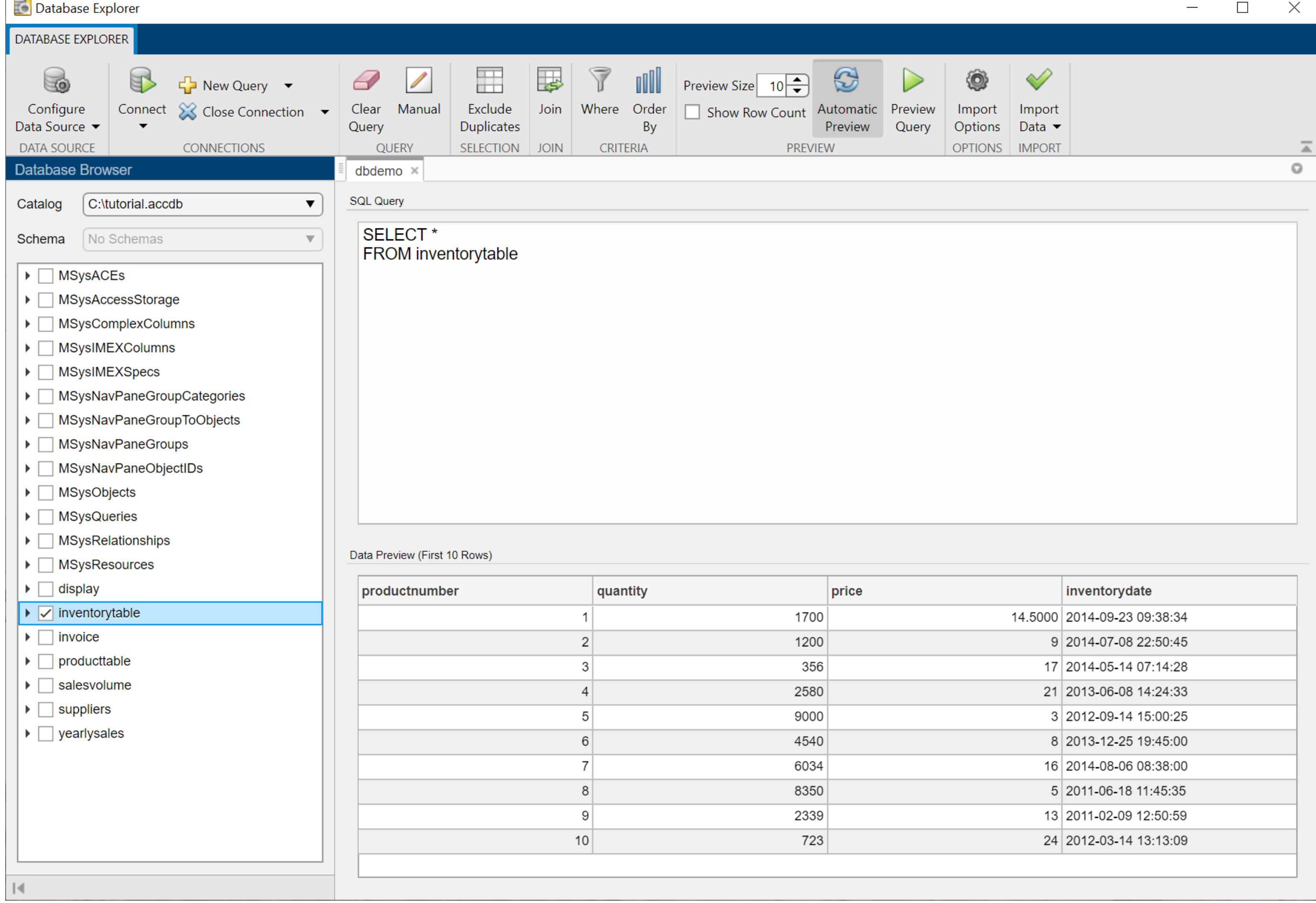
Using the Database Explorer app, you can open one or multiple database connections simultaneously by clicking **Connect** in the toolstrip. The Database Explorer app creates a data source tab for each SQL query.

On each data source tab, you can write an SQL query in one of two ways. If you are unfamiliar with the SQL query language or want to explore data in your database, then use the **Data Browser** pane along with the buttons in the toolstrip. Or, if you are already familiar with SQL, then enter an SQL query manually. When you enter a query, you can use more advanced SQL statements (for example, `AS`, `GROUP BY`, `HAVING`). You can also enter SQL code that is proprietary to the database and does not comply with the ANSI standard.

Create SQL Query Using Toolstrip Buttons

Use these steps as a general workflow for creating an SQL query by using buttons in the toolstrip.

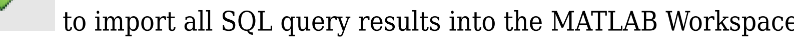
- Connect to a data source by using the Database Explorer app. For an example, see “MySQL ODBC for Windows” on page 2-47.
- Click a table in the **Data Browser** pane. The **SQL Query** pane in the data source tab displays an SQL query that selects all columns and rows of the table. The **Data Preview** pane shows a preview of the first 10 rows of data in the table. For example, connect to a Microsoft Access database and select the `inventorytable` database table.



- In the **Join** section of the **Database Explorer** tab, click **Join** to display the **Join** tab in the toolstrip. In the **Add** section of the **Join** tab, the name of the table selected in the **Data Browser** pane appears in the left **Table** list.

  - From the left **Column** list, select the name of the shared column.
  - From the right **Table** list, select the name of the table to join.
  - From the right **Column** list, select the name of the shared column.
  - Click **Add Join**. The app creates an inner join by default.
  - Close the **Join** tab.

  For details about joining tables, see “Join Tables Using Database Explorer App” on page 4-10.
- In the **Data Browser** pane, expand the table name node of the joined table and select specific check boxes to choose the table columns. The **SQL Query** and **Data Preview** panes display the specified columns.
- In the **Criteria** section, click **Where** to display the **Where** tab in the toolstrip. In the **Add** section, select an operator and value to enter an SQL `WHERE` condition. Click **Add Filter**. To represent strings in values, enclose text in single quotes. Close the **Where** tab.
- In the **Criteria** section, click **Order By** to display the **Order By** tab in the toolstrip. In the **Add** section, select the column to sort and click **Add Sort**. Close the **Order By** tab.

- In the **Import** section, click  to import all SQL query results into the MATLAB Workspace as a table.
- In the **Query** section, click **Clear Query** to clear the current SQL query and create a new one.
- In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

For detailed examples, see the Database Explorer app.

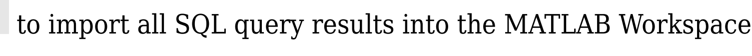
Enter SQL Query Manually

Use these steps as a general workflow for entering an SQL query manually.

- Connect to a data source in the Database Explorer app. For an example, see “MySQL ODBC for Windows” on page 2-47.
- In the **Query** section, click **Manual** to open a new data source tab. The tab has the same data source name as the prior active tab, but the Database Explorer app appends the suffix `_manual` to the tab name. The manual data source tab keeps the same database connection as the prior active tab.
- Enter or paste an SQL query into the **SQL Query** pane.

Note If you click **Manual** when the active data source tab contains an SQL query in the **SQL Query** pane, then you can modify the existing SQL query manually. Or, you can click **Clear Query** to clear the existing SQL query in the new tab and enter a new query.

For each subsequent time you click **Manual**, the new tab contains a numbered suffix.

- In the **Preview** section, click **Preview Query**. The Database Explorer app executes the SQL query and updates the **Data Preview** pane with the results. If the SQL query is valid, the **Data Preview** pane displays the first 10 rows of data by default. To see more rows, adjust the value in the **Preview Size** box.
- Modify the SQL query and click **Preview Query**. The **Data Preview** pane shows the updated results.
- In the **Import** section, click  to import all SQL query results into the MATLAB Workspace as a table.
- In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

For a detailed example of entering an SQL query manually, see the Database Explorer app.

Work with Multiple SQL Queries

To create different SQL queries using the same database, follow these steps:

- In the **Connections** section of the **Database Explorer** tab, click **Connect** and select the data source to create a database connection.
- In the connection dialog box, enter the user name and password for your database, and click **Connect**.
- In the Catalog and Schema dialog box, select the catalog and schema, and click **OK**. If only one catalog or schema is available in the database, the Catalog and Schema dialog box does not open.

  The Database Explorer app opens a new tab with the data source name as the tab name.
- To create a different SQL query using the same database connection, click **New Query** in the **Connections** section.

The app opens a new data source tab and appends a numbered suffix to the tab name. The number increases by one in each subsequent data source tab name.

You can also create SQL queries in different catalogs or schemas. Repeat these steps and select a different catalog or schema in the Catalog and Schema dialog box.

To connect to a different database, repeat these steps and select a different data source from the **Connect** list.

SQL Query Limitations

The Database Explorer app has these limitations, which you can avoid by using the command line instead.

- You can connect to relational databases only.
- You can enter a single SQL `SELECT` statement only. You cannot enter other SQL statements or multiple SQL statements in the **SQL Query** pane.
- You cannot modify the database structure or the database data.
- You cannot execute stored procedures.

See Also

Functions
`database`

Apps
Database Explorer

More About

- “Configure Driver and Data Source” on page 2-14
- “Connect to Database” on page 2-129
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14

- “Generate SQL Query and MATLAB Script” on page 4-20
- “Database Explorer App Error Messages” on page 3-14

External Websites

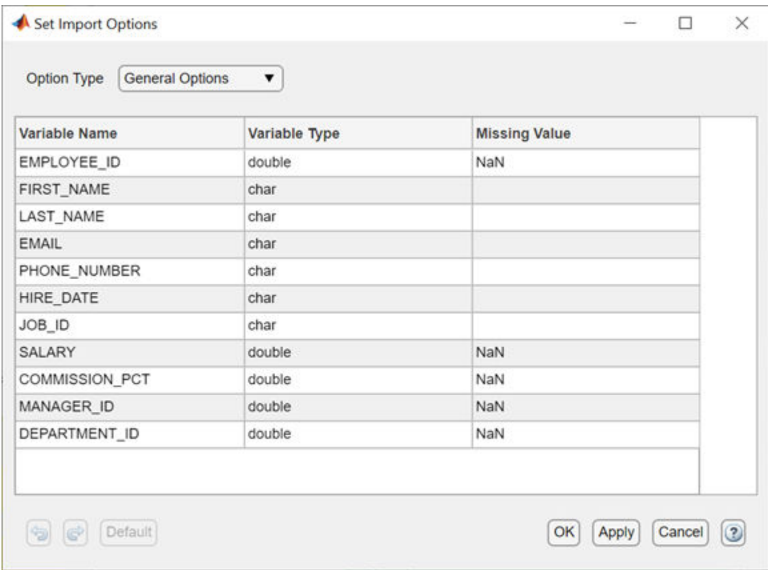
- SQL Tutorial

Customize Import Options Using Database Explorer App

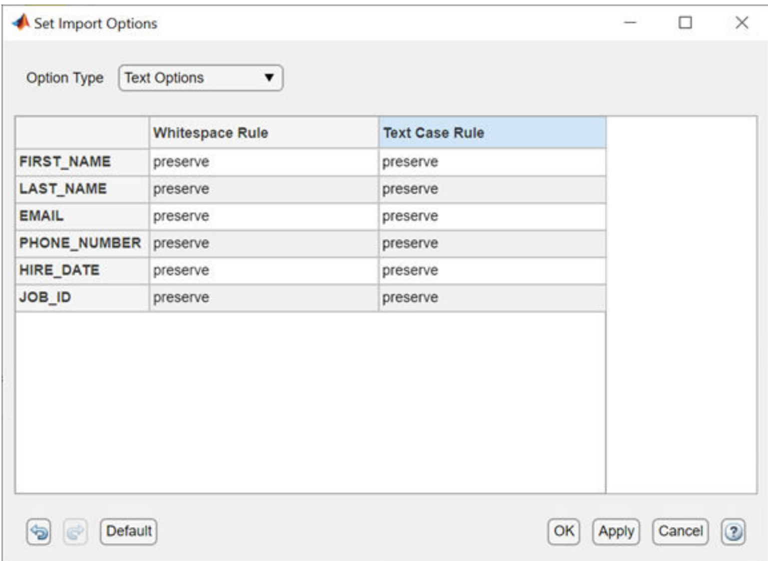
You can customize import options using the Database Explorer app after creating an SQL query and before importing data into the MATLAB Workspace. For details about creating SQL queries, see “Create SQL Queries Using Database Explorer App” on page 4-2.

Follow these steps as a general workflow to customize import options by using the Set Import Options dialog box. This workflow assumes that you create an SQL query that selects all data from a database table containing employee information.

- In the **Options** section, click **Import Options**. The Set Import Options dialog box opens and displays the default general options.

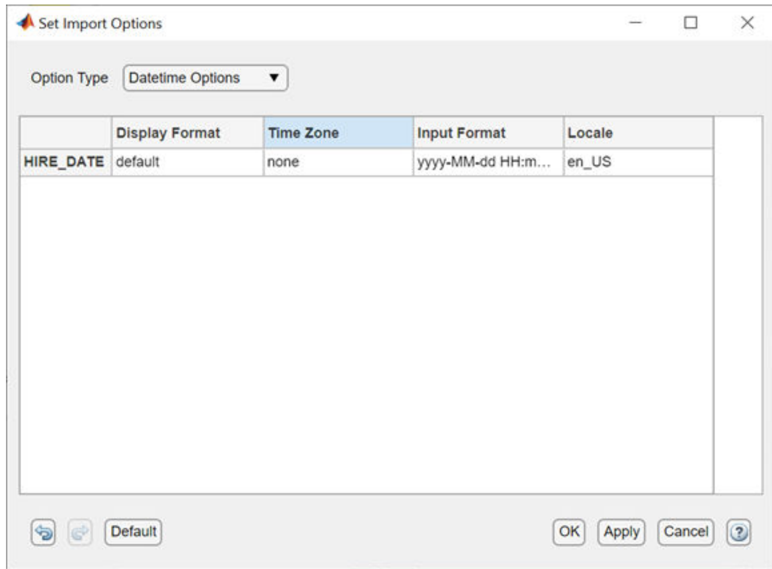


- Under **Variable Name**, enter a different name for a specific variable to change its name in the imported data.
- Under **Variable Type**, select a different variable type for a specific variable to change its type in the imported data. The selected variable type must be compatible with the database type. For valid data types, see the `Option1,OptionValue1,...,OptionN,OptionValueN` input argument of the `setoptions` function.
- Under **Missing Value**, enter a different value for a specific variable to change how missing data is represented in the imported data. The data type of the specified value must match the variable type.
- From the **Option Type** list, select `Text Options`. The Set Import Options dialog box displays the import options for variables with text data types.



For details about customizing text import options, see the `Option1,OptionValue1,...,OptionN,OptionValueN` input argument of the `setoptions` function.

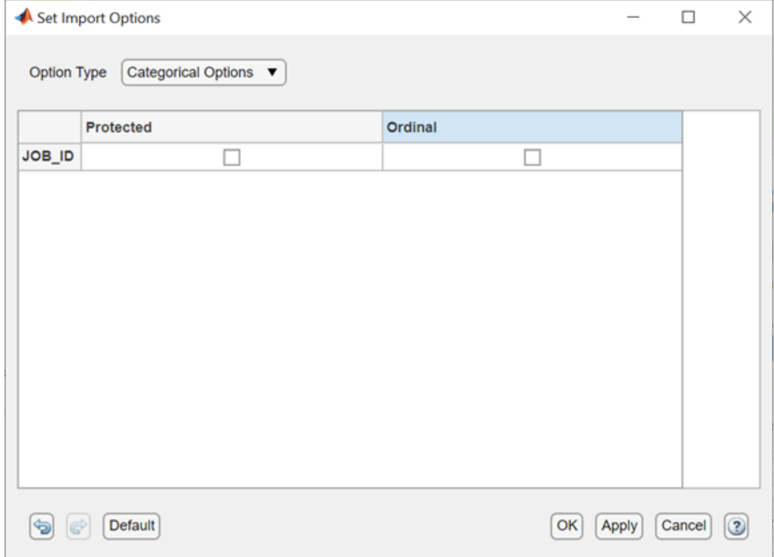
- After you select the `datetime` variable type for any variable in the general options, you can customize the datetime import options. For example, assume that you set the **HIRE_DATE** variable to the `datetime` variable type. From the **Option Type** list, select `Datetime Options`. The Set Import Options dialog box displays the import options for variables with `datetime` data types.



For details about customizing datetime import options, see the `Option1,OptionValue1,...,OptionN,OptionValueN` input argument of the `setoptions` function.

- After you select the `categorical` variable type for any variable in the general options, you can customize the categorical import options. For example, assume that you set the **JOB_ID** variable

to the `categorical` variable type. From the **Option Type** list, select `Categorical Options`. The Set Import Options dialog box displays the import options for variables with `categorical` data types.



For details about customizing categorical import options, see the `Option1,OptionValue1,...,OptionN,OptionValueN` input argument of the `setoptions` function.
- Click **OK**. The dialog box closes and the **Data Preview** pane shows a preview of the data using the import options.
- In the **Import** section, click to import all SQL query results as a table in the MATLAB Workspace, according to the specified import options.
- In the **Import** section, select **Import Data** > **Generate MATLAB Script** to display a MATLAB script in the MATLAB Editor. The script mimics the actions of customizing import options in the Set Import Options dialog box for each option you set by using the `setoptions` function. For details about generating MATLAB scripts, see "Generate SQL Query and MATLAB Script" on page 4-20.

See Also

Apps
Database Explorer

More About

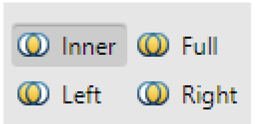
- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Generate SQL Query and MATLAB Script" on page 4-20

Join Tables Using Database Explorer App

You can select and import data from multiple tables using the Database Explorer app. First, you must join tables, and then select the data to import. You can join tables using different join types that depend on the database.

Different Join Types

The Database Explorer app creates an inner join by default. To use another join type, click the corresponding button in the **Edit** section of the **Join** tab.



There are four join types:

- Inner — An inner join retrieves records that have matching values in the selected column of both tables.
- Full — A full join retrieves records that have matching values in the selected column of both tables, and unmatched records from both the left and right tables.
- Left — A left join retrieves records that have matching values in the selected column of both tables, and unmatched records from the left table only.
- Right — A right join retrieves records that have matching values in the selected column of both tables, and unmatched records from the right table only.

Join Tables

The Database Explorer app performs joins in one of two ways. The app can join tables automatically when you select tables by using shared columns (for example, the primary keys), or you can select tables without shared columns and manually specify the names of columns to match.

Automatic Join

The Database Explorer app can join tables automatically when you select tables in the **Data Browser** pane. In this case, the app checks if the selected tables have any column names in common. If there is a match, the app performs these steps.

1. Opens the **Join** tab.
2. Adds a join for each matched column name, creates an SQL query with the added joins, and executes the SQL query.
3. Displays the SQL query in the **SQL Query** pane and the query results in the **Data Preview** pane.

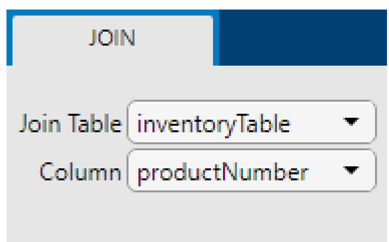
If the app does not find a match, the app displays an error dialog box that directs you to select a table in the **Join** tab. The app also removes the selections from the tables in the **Data Browser** pane.

Manual Join

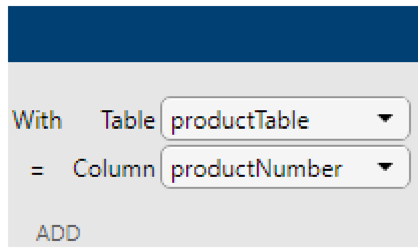
To join tables manually, you must know the names of each table and the names of the shared columns in the tables. Use these steps as a general workflow for joining tables.

1. After connecting to a database, select a table in the **Data Browser** pane. In the **Join** section, click **Join** to display the **Join** tab in the toolstrip. In the **Add** section, the name of the table selected in the **Data Browser** pane appears in the left **Table** list.

   From the left **Column** list, select the name of the shared column.

2. From the right **Table** list, select the name of the table to join. From the right **Column** list, select the name of the shared column for this table.

3. In the **Add** section, click **Add Join**. The **SQL Query** pane updates the SQL query with the new join. If the **Automatic Preview** button (located in the **Preview** section of the **Database Explorer** tab) is toggled on, the **Data Preview** pane displays the updated SQL query results automatically. The **Join Diagram** pane displays a pictorial representation of the join between the selected tables.

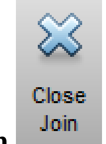
4 To add another join, select another table and column name combination in the left and right lists. Then, click **Add Join** again.

5 In the **Edit** section, click one of the join types (for example, Left) to specify a different join type, if necessary.

6 To remove a join, select it in the list of joins in the **Edit** section, and click **Remove Join**.

Note To change the order of joins, remove existing joins and create joins in another order.

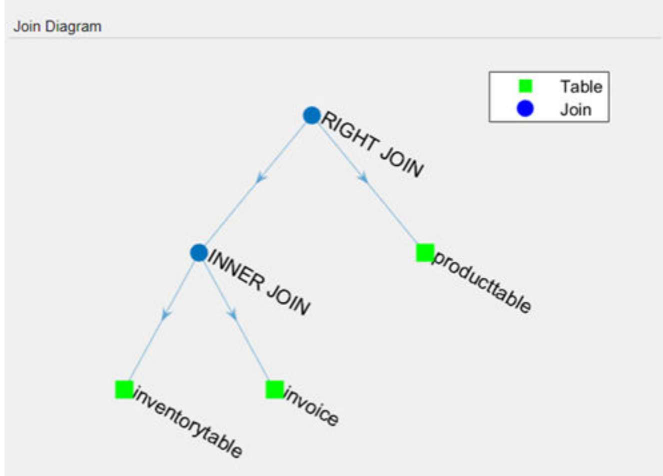
---

7 In the **Close** section, click **Close Join** 

to close the **Join** tab.

Join Diagram

After you join at least two tables, the **Join Diagram** pane displays a pictorial representation of the joins between tables. Each blue circle shows the join type. Each green square shows a table in the join.



When working with multiple joins, use this diagram to see the hierarchy of joins. Ensure that you are using the correct join types for your data. As you modify join types, the diagram updates to reflect the new join types.

Join Type Limitations

Some database vendors do not support all join types. The Database Explorer app enables the corresponding buttons in the **Join** tab for the supported join types in these databases:

- SQLite supports only inner and left join types.
- Microsoft Access and MySQL support only inner, left, and right join types.

See Also

Apps
Database Explorer

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Data Preview Using Database Explorer App" on page 4-14
- "Generate SQL Query and MATLAB Script" on page 4-20
- "Database Explorer App Error Messages" on page 3-14

External Websites

- SQL Tutorial

Data Preview Using Database Explorer App

Using the Database Explorer app, you can preview data in the **Data Preview** pane when you:

- Select tables and columns in the **Data Browser** pane.
- Create an SQL query using the buttons in the toolstrip.
- Enter an SQL query manually.

After previewing the data, you can modify the SQL query or import the data into the MATLAB Workspace.

Automatic Preview

The Database Explorer app previews data automatically, by default. With the **Automatic Preview** button toggled on in the **Preview** section and a valid SQL query in the **SQL Query** pane, the Database Explorer app executes the SQL query and previews the data in the **Data Preview** pane. You can control the number of rows displayed in this pane by entering a value in the **Preview Size** box in the toolstrip.

As you create an SQL query, the **Data Preview** pane updates the preview of the query results for each change you make to the query. When you change selections in the **Data Browser** pane, or add or remove a join, filter, or sort, the **SQL Query** pane updates along with the **Data Preview** pane.

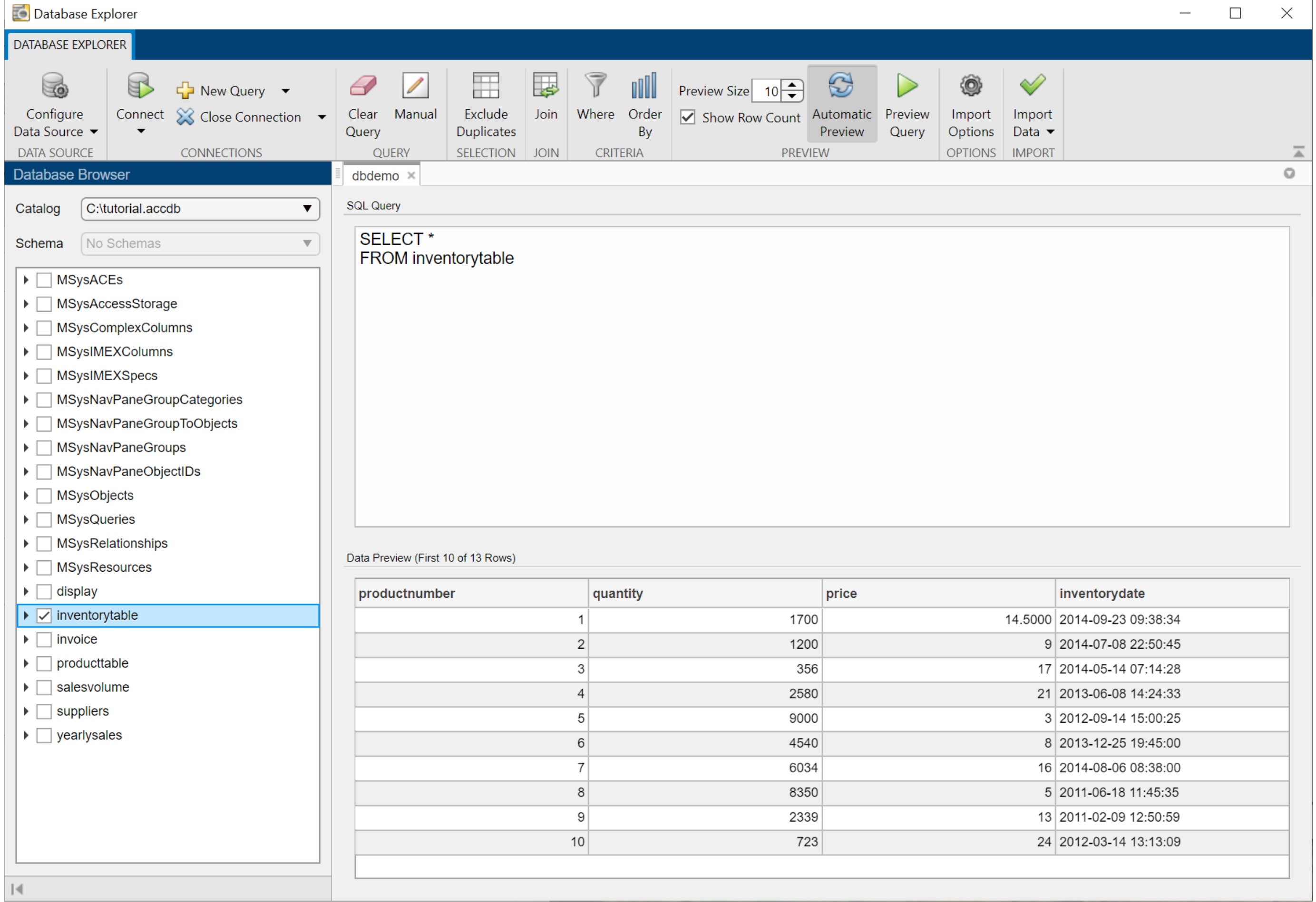
If your SQL query takes a long time to execute or you know that the query results contain a large amount of data, you can stop the automatic preview of data. Click the **Automatic Preview** button in the **Preview** section of the toolstrip. When this button is toggled off, you can modify the query in the **SQL Query** pane without updating the preview of data. After you finish modifying the query, click **Preview Query** in the **Preview** section to see the updated query results in the **Data Preview** pane.

Preview Size

To see more rows in the **Data Preview** pane, enter a larger value in the **Preview Size** box in the **Preview** section. The number of rows in the **Data Preview** pane matches the entered value. However, if the number of rows in the SQL query results is less than the entered value, then all rows are displayed in the **Data Preview** pane.

To see the count of the total number of rows in the SQL query results, select the **Show Row Count** check box in the **Preview** section. The **Data Preview** pane displays the row count of the SQL query results. For example, using the sample database connection:

1. In the **Data Browser** pane, select **inventorytable**. The **SQL Query** pane displays the SQL query that selects all data from the database table `inventorytable`.
2. In the **Preview** section, select the **Show Row Count** check box. The **Data Preview** pane displays the row count **13** in the note within parentheses.



Preview Data by Creating SQL Query

After you connect to a database, the tables in the database are displayed in the **Data Browser** pane. Use this pane along with buttons in the toolstrip to view the database structure and create an SQL query.

- Expand and collapse the tables to see the columns in each table.
- Click the box next to a table name to see a quick preview of the data in the table. If the **Automatic Preview** button is toggled on, the **Data Preview** pane displays the first 10 rows of data automatically.
- Click boxes next to column names to see a quick preview of data in those columns only.
- Use the buttons in the toolstrip to exclude duplicate rows, join tables, filter data, and sort data.

After you create a valid SQL query in the **SQL Query** pane, the Database Explorer app executes the query and previews the results as described earlier in Automatic Preview.

Preview Data by Entering SQL Query Manually

You can enter an SQL query manually or by pasting text into the **SQL Query** pane. Or, you can modify an existing SQL query in the **SQL Query** pane. To enter or modify an SQL query, click **Manual** in the **Edit** section.

Note When you enter or modify an SQL query manually, the Database Explorer app stops the automatic preview of data.

After you enter the SQL query, click **Preview Query** in the **Preview** section. The **Data Preview** pane displays the first 10 rows of data only after you click this button. If you modify the SQL query, then click **Preview Query** again to refresh the SQL query results.

See Also

Apps
Database Explorer

More About

- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Generate SQL Query and MATLAB Script” on page 4-20
- “Database Explorer App Error Messages” on page 3-14

Modify and Delete Data Sources

You can modify and delete ODBC and JDBC data sources using the Database Explorer app or the command line. For ODBC drivers, you can create, modify, and delete data sources using the ODBC Data Source Administrator dialog box. For JDBC drivers, you can create, modify, and delete data sources using the JDBC Data Source Configuration dialog box or the command line.

Modify Data Sources Interactively

Use the Database Explorer app to modify data sources by following these steps.

ODBC Data Sources

1. Open the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure ODBC data source**. The ODBC Data Source Administrator dialog box opens.

   Alternatively, run the `configureODBCDataSource` function.
2. In the ODBC Data Source Administrator dialog box, select the data source to modify. Click **Configure**.
3. Modify the settings as needed.

JDBC Data Sources

1. Opening the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure JDBC data source**. The JDBC Data Source Configuration dialog box opens.
2. Click **Edit**. In the list, select the data source to modify. Click **OK**.
3. Modify the settings in the JDBC Data Source Configuration dialog box. If you do not change the data source name, the Database Explorer app overwrites the existing data source with the new settings. To avoid overwriting the existing data source, enter a new data source name.
4. Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database. Click **Test**.

   If your connection succeeds, the app displays a message indicating a successful connection. Otherwise, it displays an error message.
5. Click **Save**.

Modify Data Sources Programmatically

Use the command line to modify data sources by following these steps.

ODBC Data Sources

Modify an ODBC data source using the ODBC Data Source Administrator dialog box. To access this dialog box, see the `configureODBCDataSource` function.

JDBC Data Sources

1. Edit an existing JDBC data source using the `databaseConnectionOptions` function.

2. Set JDBC connection options using the `setoptions` function. Or, you can set properties in the `SQLConnectionOptions` object using dot notation.
3. Add JDBC driver-specific connection options using the `setoptions` function. Or, remove existing JDBC driver-specific options using the `rmoptions` function.
4. Test the database connection using the `testConnection` function.
5. Save the JDBC data source using the `saveAsDataSource` function.

Delete Data Sources Interactively

Use the Database Explorer app to delete data sources by following these steps.

ODBC Data Sources

1. Open the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure ODBC data source**. The ODBC Data Source Administrator dialog box opens.
2. Select the data source to delete.
3. Click **Remove**.

JDBC Data Sources

1. Open the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure JDBC data source**. The JDBC Data Source Configuration dialog box opens.
2. Click **Edit**.
3. In the list, select the name of the data source to delete. Click **OK**.
4. Click **Delete** and click **Yes**.

Delete Data Sources Programmatically

Delete an ODBC data source using the ODBC Data Source Administrator dialog box. To access this dialog box, see the `configureODBCDataSource` function.

To delete a JDBC data source, specify the name of the data source in the `deleteDataSource` function.

See Also

Apps
Database Explorer

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `setoptions` | `rmoptions` | `testConnection` | `saveAsDataSource` | `deleteDataSource`

More About

- "Choose Between ODBC and JDBC Drivers" on page 2-12
- "Configure Driver and Data Source" on page 2-14
- "Create JDBC Data Source and Set Options Programmatically" on page 2-17
- "Connect to Database" on page 2-129

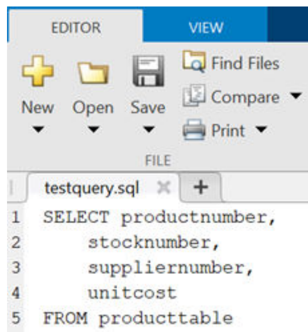
Generate SQL Query and MATLAB Script

You can generate SQL code from an SQL query or create a MATLAB script by using the Database Explorer app. After defining an SQL query in the **SQL Query** pane, you can generate the SQL code for running an SQL script. You can also generate a MATLAB script to automate connecting to a database, running an SQL query, and performing data analysis on the imported data.

Generate SQL Query

To generate SQL code from an SQL query, follow these steps:

1. Connect to a data source and create an SQL query. For details about creating SQL queries, see "Create SQL Queries Using Database Explorer App" on page 4-2.
2. In the **Import** section, select **Import Data** > **Generate SQL Query**.
3. Save the SQL code to a `.txt` or `.sql` file. The MATLAB Editor opens the saved SQL code file.



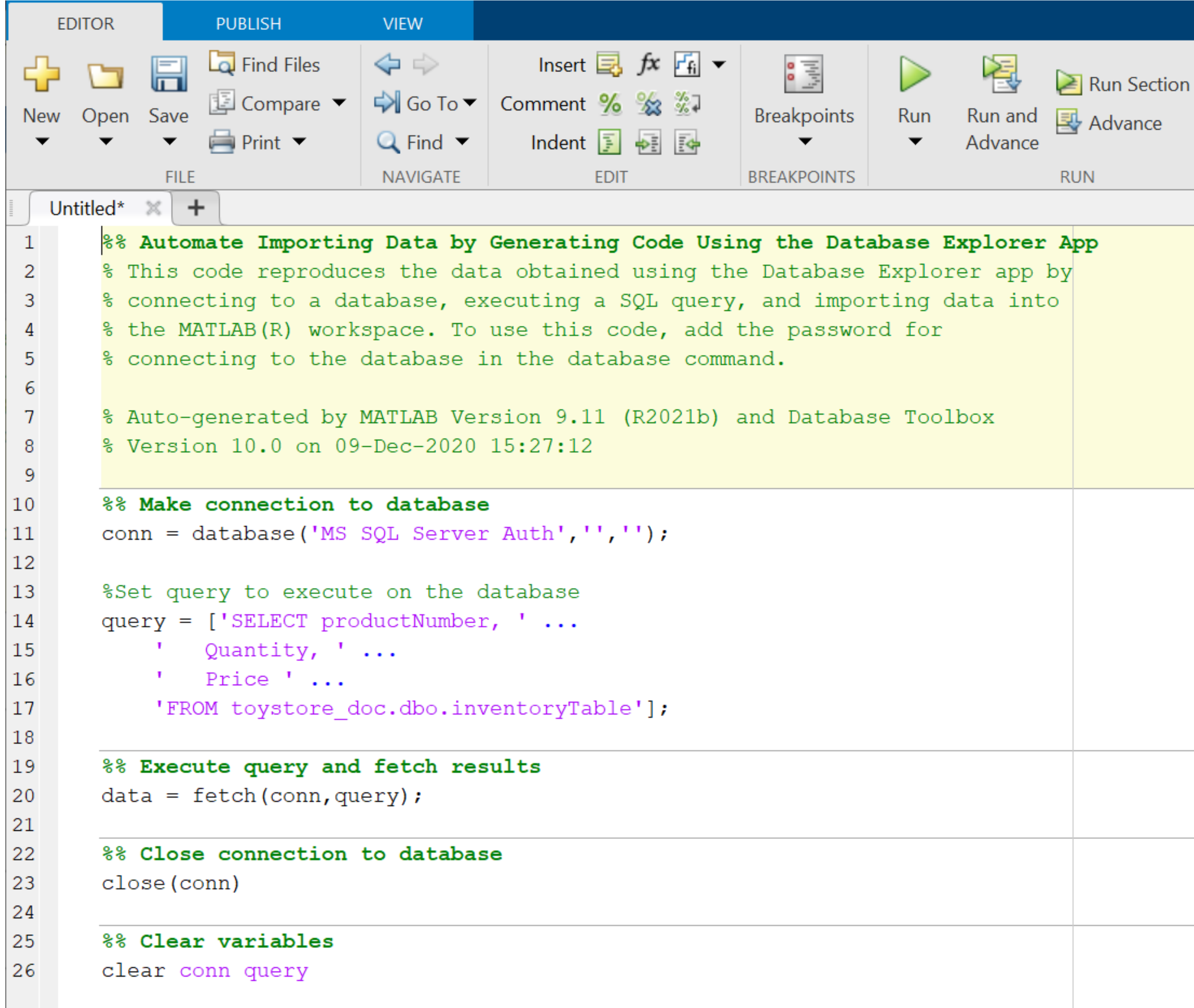
You can use the SQL code to rebuild a query by using the **SQL Query** pane by entering the SQL code manually.

Alternatively, you can use the `.sql` file to import data programmatically into MATLAB by using the `executeSQLScript` function.

Generate MATLAB Script

To generate a MATLAB script that automates connecting to a data source, running an SQL query, and importing the SQL query results, follow these steps:

1. Connect to a data source and create an SQL query. For details about creating SQL queries, see "Create SQL Queries Using Database Explorer App" on page 4-2.
2. In the **Import** section, select **Import Data** > **Generate MATLAB Script** to display a MATLAB script in the MATLAB Editor. To customize import options before importing data, see "Customize Import Options Using Database Explorer App" on page 4-7.



3 Save the MATLAB script. You can run this script at the command line.

Note To run the script, enter the database password as an input argument of the `database` function in the script.

For details about editing and running scripts, see “Scripts”.

See Also

Functions
`executeSQLScript`

Apps
Database Explorer

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14
- "Customize Import Options Using Database Explorer App" on page 4-7

Using Database Toolbox Functions

- "Roll Back Data in Database" on page 5-2
- "Change Database Connection Catalog" on page 5-4
- "Create Table and Add Column" on page 5-5
- "Delete Data from Databases" on page 5-6
- "Roll Back Data After Updating Record" on page 5-9
- "Replace Existing Data in Database" on page 5-12
- "Export Data Using Bulk Insert" on page 5-13
- "Call Stored Procedure That Returns Data" on page 5-17
- "Run Custom Database Function" on page 5-19
- "Data Import Memory Management" on page 5-20
- "Import Large Data Using DatabaseDatastore Object" on page 5-23
- "Analyze Large Data in Database Using MapReduce" on page 5-27
- "Analyze Large Data in Database Using Tall Arrays" on page 5-30
- "Import Data Using MATLAB Interface to SQLite" on page 5-32
- "Insert Data into SQLite Database Table" on page 5-36
- "Create Table and Add Column in SQLite Database" on page 5-38
- "Delete Data from SQLite Database" on page 5-39
- "Roll Back Data in SQLite Database" on page 5-41
- "Deploy MATLAB Interface to SQLite Database Application with MATLAB Compiler" on page 5-43
- "Retrieve Image Data Types" on page 5-48
- "Import Boolean Data from Database" on page 5-51
- "Append Data to Existing Database Table Using Insert Functionality" on page 5-53
- "Insert Data into New Database Table Using Insert Functionality" on page 5-55
- "Join Tables Using Command Line" on page 5-57
- "Import Data from Database Table Using sqlread Function" on page 5-58
- "Insert Data into Database Table" on page 5-61
- "Retrieve Database Metadata" on page 5-64
- "Customize Options for Importing Data from Database into MATLAB" on page 5-67
- "Deploy Relational Database Application with MATLAB Compiler" on page 5-70
- "Import Data Using SQL Prepared Statement with Multiple Parameter Values" on page 5-75

Roll Back Data in Database

This example shows how to connect to a database, update an existing row of data in the database, and roll back the update. Use the `execute` function to roll back the update after executing the `update` function.

Create a database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable` that contains these columns:

- `productnumber`
- `quantity`
- `price`
- `inventorydate`

Set the `AutoCommit` property of the `connection` object to `'off'`. Any updates you make after turning off this flag do not commit to the database automatically.

```
conn.AutoCommit = 'off';
```

Define a cell array containing the column names that you are updating in `inventorytable`.

```
colnames = {'price','inventorydate'};
```

Define a table that contains the data for insertion. Update the price to $15 and set the inventory timestamp to `'2014-12-01 08:50:15.000'`.

```
data = table(15,{'2014-12-01 08:50:15.000'}, ...
    'VariableNames',{'price','inventorydate'});
```

Update the columns `price` and `inventorydate` in the table `inventorytable` for the product number equal to `1`.

```
tablename = 'inventorytable';
whereclause = 'WHERE productnumber = 1';

update(conn,tablename,colnames,data,whereclause)
```

Roll back data for the update.

```
sqlquery = 'ROLLBACK';
execute(conn,sqlquery)
```

You can commit data to the database by replacing the `ROLLBACK` SQL statement with `COMMIT`. You can also roll back or commit data after executing an `INSERT` SQL statement using the `sqlwrite` function.

Close the database connection.

```
close(conn)
```

See Also

`execute` | `close` | `database`

Related Examples

- "Insert Data into Database Table" on page 5-61
- "Replace Existing Data in Database" on page 5-12

Change Database Connection Catalog

This example shows how to connect to a database and change the database catalog. You can work with data in a different catalog within the same database using the `execute` function.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Change the catalog for the database connection `conn` to `intlprice` by creating and executing an SQL query.

```
sqlquery = 'Use intlprice';
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`execute` | `close` | `database`

Related Examples

- “Retrieve Database Metadata” on page 5-64

External Websites

- SQL Tutorial

Create Table and Add Column

This example shows how to connect to a database and manage the database structure. You can manage the database structure using the `execute` function.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Use the SQL `CREATE` statement to create the table `Person`.

```
sqlquery = ['CREATE TABLE Person(LastName varchar, ' ...
    'FirstName varchar,Address varchar,Age int)'];
```

Create the table in the database using the database connection.

```
execute(conn,sqlquery)
```

Use the SQL `ALTER` statement to add the column `City` to the table `Person`.

```
sqlquery = 'ALTER TABLE Person ADD City varchar(30)';
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`execute` | `close` | `database`

Related Examples

- “Retrieve Database Metadata” on page 5-64

External Websites

- SQL Tutorial

Delete Data from Databases

This example shows how to delete data from your database using MATLAB.

Create the SQL statement with your deletion SQL syntax. Consult your database documentation for the correct SQL syntax. Execute the delete operation on your database using the `execute` function with your SQL statement. This example demonstrates deleting data records in a Microsoft Access database.

Connect to Database

Create the database connection `conn` to a Microsoft Access database using an ODBC driver and the data source name `dbdemo`. This database contains the table `inventorytable` with the column `productnumber`.

```
conn = database('dbdemo','','');
```

The SQL query `sqlquery` selects all rows of data in the table `inventorytable`. Execute this SQL query using `conn`. Import the data from the executed query using the `fetch` function and display the last few rows.

```
sqlquery = 'SELECT * FROM inventorytable';
data = fetch(conn,sqlquery);
tail(data)
```

```
ans =

  8×4 table

    productnumber    quantity    price         inventorydate
    _____________    ________    _____    _____________________

          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
          9            2339        13     '2011-02-09 12:50:59'
         10             723        24     '2012-03-14 13:13:09'
         11             567         0     '2012-09-11 00:30:24'
         12            1278         0     '2010-10-29 18:17:47'
         13            1700      14.5     '2009-05-24 10:58:59'
```

Delete Specific Record

Delete the data for the product number `13` from the table `inventorytable`. Specify the product number using the `WHERE` clause in the SQL statement `sqlquery`.

```
sqlquery = 'DELETE * FROM inventorytable WHERE productnumber = 13';
execute(conn,sqlquery)
```

Display the data in the table `inventorytable` after the deletion. The record with product number `13` is missing.

```
sqlquery = 'SELECT * FROM inventorytable';
data = fetch(conn,sqlquery);
tail(data)
```

```
ans =
```

```
  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          5            9000         3     '2012-09-14 15:00:25'
          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
          9            2339        13     '2011-02-09 12:50:59'
         10             723        24     '2012-03-14 13:13:09'
         11             567         0     '2012-09-11 00:30:24'
         12            1278         0     '2010-10-29 18:17:47'
```

Delete Record Using MATLAB Variable

Define a MATLAB variable `productID` by setting it to the product number `12`.

```
productID = 12;
```

Delete the data using the MATLAB variable `productID`. Build an SQL statement `sqlquery` that combines the SQL for the delete operation with the MATLAB variable. Since the variable is numeric and the SQL statement is a character vector, convert the number to a character vector. Use the `num2str` function for the conversion. Concatenate the delete SQL statement and the numeric conversion using the square brackets.

```
sqlquery = ['DELETE * FROM inventorytable WHERE ' ...
    'productnumber = ' num2str(productID)];
execute(conn,sqlquery)
```

Display the data in the table `inventorytable` after the deletion. The record with product number `12` is missing.

```
sqlquery = 'SELECT * FROM inventorytable';
data = fetch(conn,sqlquery);
tail(data)
```

```
ans =

  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          4            2580        21     '2013-06-08 14:24:33'
          5            9000         3     '2012-09-14 15:00:25'
          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
          9            2339        13     '2011-02-09 12:50:59'
         10             723        24     '2012-03-14 13:13:09'
         11             567         0     '2012-09-11 00:30:24'
```

Close Database Connection

```
close(conn)
```

See Also

`execute` | `fetch` | `num2str`

Related Examples

- “Import Data from Database Table Using sqlread Function” on page 5-58

External Websites

- SQL Tutorial

Roll Back Data After Updating Record

This example shows how to update data in a database and roll back the changes. Rolling back the changes reinstates the data as it appears before running the update.

Create a database connection `conn`. For example, the following code uses the database `toy_store`, user name `username`, password `pwd`, server name `sname`, and port number `123456` to connect to a Microsoft SQL Server database. This database contains the table `inventoryTable` that contains these columns: `productNumber`, `Quantity`, and `Price`.

```
conn = database('toy_store','username','pwd',...
                'Vendor','Microsoft SQL Server',...
                'Server','sname',...
                'PortNumber',123456);
```

Set the `AutoCommit` property of the `connection` object to `'off'`. Any updates you make after turning off this flag do not commit to the database automatically.

```
conn.AutoCommit = 'off';
```

Display the data in the `inventoryTable` table before making updates. Import the data from the executed query using the `fetch` function and display the first few rows of imported data.

```
d = fetch(conn,'SELECT * FROM inventoryTable');
head(d)
```

```
ans =

  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          1            1700      14.5     '2014-09-23 09:38:34'
          2            1200         9     '2014-07-08 22:50:45'
          3             356        17     '2014-05-14 07:14:28'
          4            2580        21     '2013-06-08 14:24:33'
          5            9000         3     '2012-09-14 15:00:25'
          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
```

Define a cell array for the new price of the first product.

```
data(1,1) = {30.00};
```

Define the `WHERE` clause for the first product.

```
whereclause = 'where productNumber = 1';
```

Update the `Price` column in the `inventoryTable` for the first product.

```
tablename = 'inventoryTable';
colname = {'Price'};

update(conn,tablename,colname,data,whereclause)
```

Display the data in the `inventoryTable` table after making the update.

```
d = fetch(conn,'SELECT * FROM inventoryTable');
head(d)
```

```
ans =

  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          1            1700        30     '2014-09-23 09:38:34'
          2            1200         9     '2014-07-08 22:50:45'
          3             356        17     '2014-05-14 07:14:28'
          4            2580        21     '2013-06-08 14:24:33'
          5            9000         3     '2012-09-14 15:00:25'
          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
```

The first product has an updated price of `30`. Though the data is updated, the change has not committed to the database.

Roll back the update.

```
rollback(conn)
```

Alternatively, you can roll back the update using an SQL `ROLLBACK` statement by using the `execute` function.

Display the data in the `inventoryTable` table after rolling back the update.

```
d = fetch(conn,'SELECT * FROM inventoryTable');
head(d)
```

```
ans =

  8×4 table

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          1            1700      14.5     '2014-09-23 09:38:34'
          2            1200         9     '2014-07-08 22:50:45'
          3             356        17     '2014-05-14 07:14:28'
          4            2580        21     '2013-06-08 14:24:33'
          5            9000         3     '2012-09-14 15:00:25'
          6            4540         8     '2013-12-25 19:45:00'
          7            6034        16     '2014-08-06 08:38:00'
          8            8350         5     '2011-06-18 11:45:35'
```

The first product has the old price of `14.50`.

Close the database connection.

```
close(conn)
```

See Also

`execute` | `database` | `fetch` | `rollback` | `close`

Related Examples

- "Insert Data into Database Table" on page 5-61
- "Replace Existing Data in Database" on page 5-12

External Websites

- SQL Tutorial

Replace Existing Data in Database

This example shows how to update a value of the `month` column in the table `yearlysales` using the data source named `dbdemo`. To access the example where you import the values of the `month` column, see "Insert Data into Database Table" on page 5-61.

Create a database connection `conn` to the Microsoft Access database using the ODBC driver. Here, this code assumes that you are connecting to a data source named `dbdemo` with blank user name and password.

```
conn = database('dbdemo','','');
```

To update the month, specify the `month` column that contains the months in the cell array `colnames`.

```
colnames = {'month'};
```

Assign the month value `March2010` to the MATLAB variable `data` for the update. The data type of `data` is a table.

```
data = table({'March2010'},'VariableNames',{'month'});
```

Specify the record to update in the database by defining an SQL `WHERE` statement `whereclause`. The record to update is the record whose `month` is `March`. Embed `March` in two single quotation marks so that MATLAB interprets `March` as a character vector in the SQL `WHERE` statement.

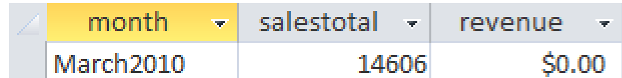
```
whereclause = 'WHERE month = ''March'''
```

```
whereclause =

    'WHERE month = 'March''
```

Update the data for the record whose `month` is `March` in the database table `yearlysales`.

```
update(conn,'yearlysales',colnames,data,whereclause)
```

In Microsoft Access, view the `yearlysales` table to verify the results.



month	salestotal	revenue
March2010	14606	$0.00

Close the database connection.

```
close(conn)
```

See Also

`update` | `database` | `close`

Related Examples

- "Insert Data into Database Table" on page 5-61

External Websites

- SQL Tutorial

Export Data Using Bulk Insert

Bulk Insert Functionality

One way to export data from MATLAB and insert it into your database is to use the `sqlwrite` function at the command line. However, if you experience performance issues with this process, you can instead create a data file containing every record in your data set. Then, you can use this data file as input into the bulk insert functionality of your database to process the large data set. Also, with this file, you can insert data with special characters such as double quotes. A bulk insert provides performance gains by using the bulk insert utilities that are native to different database systems. For details, see "Working with Large Data Sets" on page 2-135.

The following examples use preconfigured JDBC data sources. For more information about configuring a JDBC data source, see the `databaseConnectionOptions` function.

Bulk Insert into Oracle

This example uses a data file containing sports data on a local machine with Oracle installed and exports data in the file to the Oracle server using bulk insert functionality.

1. Connect to a configured JDBC data source for the Oracle database.

   ```
   datasource = "ORA_JDBC";
   username = "user";
   password = "password";
   conn = database(datasource,username,password);
   ```

2. Create a table named `BULKTEST` using the `execute` function.

   ```
   execute(conn,['CREATE TABLE BULKTEST (salary number, ' ...
       'player varchar2(25), signed varchar2(25), ' ...
       'team varchar2(25))'])
   ```

3. Create a data record.

   ```
   A = {100000.00,'KGreen','06/22/2011','Challengers'};
   ```

4. Expand `A` to a data set containing 10,000 records.

   ```
   A = A(ones(10000,1),:);
   ```

5. Write data to a file for bulk insert functionality.

   Tip When connecting to a database on a remote machine, you must write this file to the remote machine. Oracle has difficulty reading files that are not on the same machine as the database.

   ```
   fid = fopen('c:\temp\tmp.txt','wt');
   for i = 1:size(A,1)
       fprintf(fid,'%10.2f \t %s \t %s \t %s \n',A{i,1}, ...
       A{i,2},A{i,3},A{i,4});
   end
   fclose(fid);
   ```

6. Set the folder location using the `execute` function.

```
execute(conn, ...
    'CREATE OR REPLACE DIRECTORY ext AS ''C:\\Temp''')
```

7 Delete the temporary table, if it exists, using the `execute` function.

```
execute(conn,'DROP TABLE testinsert')
```

8 Create a temporary table and use bulk insert functionality to insert it into the table BULKTEST.

```
execute(conn,['CREATE TABLE testinsert (salary number, ' ...
    'player varchar2(25), signed varchar2(25), ' ...
    'team varchar2(25)) ORGANIZATION EXTERNAL ' ...
    '( TYPE ORACLE_LOADER DEFAULT DIRECTORY ext ACCESS ' ...
    'PARAMETERS ( RECORDS DELIMITED BY NEWLINE FIELDS ' ...
    'TERMINATED BY ''\t'') LOCATION (''tmp.txt'')) ' ...
    'REJECT LIMIT 10000'])

execute(conn,'INSERT INTO BULKTEST SELECT * FROM testinsert')
```

9 Confirm the number of variables in BULKTEST.

```
results = fetch(conn,'SELECT * FROM BULKTEST');
results.Properties.VariableNames

ans =

  1×4 cell array

    {'SALARY'}    {'PLAYER'}    {'SIGNED'}    {'TEAM'}
```

10 Close the database connection.

```
close(conn)
```

Bulk Insert into Microsoft SQL Server 2005

This example uses a data file containing sports data on a local machine with Microsoft SQL Server installed and exports data in the file to the Microsoft SQL Server using bulk insert functionality.

1 Connect to a configured JDBC data source for the Microsoft SQL Server database.

```
datasource = "MSSQLServer_JDBC";
username = "user";
password = "password";
conn = database(datasource,username,password);
```

2 Create a table named BULKTEST using the `execute` function.

```
execute(conn,['CREATE TABLE BULKTEST (salary ' ...
    'decimal(10,2), player varchar(25), signed_date ' ...
    'datetime, team varchar(25))'])
```

3 Create a data record.

```
A = {100000.00,'KGreen','06/22/2011','Challengers'};
```

4 Expand A to a data set containing 10,000 records.

```
A = A(ones(10000,1),:);
```

5 Write data to a file for bulk insert functionality.

Tip When connecting to a database on a remote machine, you must write this file to the remote machine. Microsoft SQL Server has difficulty reading files that are not on the same machine as the database.

```
fid = fopen('c:\temp\tmp.txt','wt');
for i = 1:size(A,1)
   fprintf(fid,'%10.2f \t %s \t %s \t %s \n',A{i,1}, ...
   A{i,2},A{i,3},A{i,4});
end
fclose(fid);
```

6 Run the bulk insert functionality using the `execute` function.

```
execute(conn,['BULK INSERT BULKTEST FROM ' ...
    '''c:\temp\tmp.txt'' WITH (FIELDTERMINATOR = ''\t'', ' ...
    'ROWTERMINATOR = ''\n'')'])
```

7 Confirm the number of variables in `BULKTEST`.

```
results = fetch(conn,'SELECT * FROM BULKTEST');
results.Properties.VariableNames
```

```
ans =

  1×4 cell array

    {'SALARY'}    {'PLAYER'}    {'SIGNED_DATE'}    {'TEAM'}
```

8 Close the database connection.

```
close(conn)
```

Bulk Insert into MySQL

This example uses a data file containing sports data on a local machine with MySQL installed and exports data in the file to a MySQL database using bulk insert functionality.

1 Connect to a configured JDBC data source for the MySQL database.

```
datasource = "MySQL_JDBC";
username = "user";
password = "password";
conn = database(datasource,username,password);
```

2 Create a table named `BULKTEST` using the `execute` function.

```
execute(conn,['CREATE TABLE BULKTEST (salary decimal, ' ...
    'player varchar(25), signed_date varchar(25), ' ...
    'team varchar(25))'])
```

3 Create a data record.

```
A = {100000.00,'KGreen','06/22/2011','Challengers'};
```

4 Expand `A` to a data set containing 10,000 records.

```
A = A(ones(10000,1),:);
```

5 Write data to a file for bulk insert functionality.

Note MySQL reads files saved locally, even if you are connecting to a remote machine. Therefore, you can write the file to either your local or remote machine.

```
fid = fopen('c:\temp\tmp.txt','wt');
for i = 1:size(A,1)
```

```
    fprintf(fid,'%10.2f \t %s \t %s \t %s \n', ...
    A{i,1},A{i,2},A{i,3},A{i,4});
end
fclose(fid);
```

6 Run the bulk insert functionality. The SQL statement uses the statement `LOCAL INFILE` for error handling. For details about this statement, consult the MySQL database documentation.

```
execute(conn,['LOAD DATA LOCAL INFILE ' ...
    ' ''C:\\temp\\tmp.txt'' INTO TABLE BULKTEST ' ...
    'FIELDS TERMINATED BY ''\t'' LINES TERMINATED ' ...
    'BY ''\n'''])
```

7 Confirm the number of variables in `BULKTEST`.

```
results = fetch(conn,'SELECT * FROM BULKTEST');
results.Properties.VariableNames

ans =

  1×4 cell array

    {'SALARY'}    {'PLAYER'}    {'SIGNED_DATE'}    {'TEAM'}
```

8 Close the database connection.

```
close(conn)
```

See Also

`execute` | `fetch` | `database` | `close`

Related Examples

- “Insert Data into Database Table” on page 5-61

External Websites

- SQL Tutorial

Call Stored Procedure That Returns Data

This example shows how to call a stored procedure that returns data using the `fetch` function. Use the JDBC interface to connect to a Microsoft SQL Server database, call a stored procedure, and return data. For this example, the Microsoft SQL Server database contains the stored procedure `getSupplierInfo`. This stored procedure returns the supplier information for suppliers of a given city. This code defines the procedure.

```
CREATE PROCEDURE dbo.getSupplierInfo
    (@cityName varchar(20))
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON

    SELECT * FROM dbo.suppliers WHERE City = @cityName
END
```

For Microsoft SQL Server, the statement `'SET NOCOUNT ON'` suppresses the results of `INSERT`, `UPDATE`, or any non-`SELECT` statements that might be before the final `SELECT` query, so you can import the results of the `SELECT` query.

Use the `fetch` function when the stored procedure returns one or more result sets. For procedures that return output parameters, use `runstoredprocedure`.

Create Database Connection

Using the JDBC interface, connect to the Microsoft SQL Server database called `'test_db'` with a user name and password using port number `1234`. This example assumes that your database server is on the machine `servername`.

```
conn = database('test_db','username','pwd', ...
    'Vendor','Microsoft SQL Server', ...
    'Server','servername','PortNumber',1234);
```

Call Stored Procedure

Call the stored procedure, `getSupplierInfo`, and display the supplier information for `New York` city using the `fetch` function and the database connection. `results` contains the supplier information.

```
sqlquery = '{call getSupplierInfo(''New York'')}';
results = fetch(conn,sqlquery)
```

```
ans =

  3×5 table

    SupplierNumber      SupplierName          City          Country           FaxNumber
    ______________    __________________    __________    _______________    ______________

    1001              'Wonder Products'     'New York'    'United States'    '212 435 1617'
    1006              'ACME Toy Company'    'New York'    'United States'    '212 435 1618'
    1012              'Aunt Jemimas'        'New York'    'USA'              '14678923104'
```

Close Database Connection

```
close(conn)
```

See Also

`fetch` | `runstoredprocedure` | `database`

External Websites

- SQL Tutorial

Run Custom Database Function

This example shows how to run a custom database function on Microsoft SQL Server.

Consider a database function `get_prodCount` that retrieves row counts in the table `productTable`. The table `productTable` contains 30 rows where each row represents a product. This code defines this database function and assumes a schema name `dbo`.

```
CREATE FUNCTION dbo.get_prodCount()
RETURNS int
AS
BEGIN
     DECLARE @PROD_COUNT int
     SELECT @PROD_COUNT = count(*) FROM productTable
     RETURN(@PROD_COUNT)
END
GO
```

Create Database Connection

Connect to Microsoft SQL Server using an ODBC driver. For example, this code assumes that you are connecting to a data source named `MS SQL Server` with user name `username` and password `pwd`.

```
conn = database('MS SQL Server','username','pwd');
```

Execute Custom Function

Construct an SQL query `sqlquery` that executes the custom function code. Execute the custom function and import the results by using the `fetch` function.

```
sqlquery = 'SELECT dbo.get_prodCount() as num_products';
results = fetch(conn,sqlquery);
```

Display the results. The custom function `get_prodCount` returns the product count `30`.

```
results
```

```
results =

  table

    num_products
    ____________

         30
```

Close Database Connection

```
close(conn)
```

See Also

`fetch` | `database` | `close`

External Websites

- SQL Tutorial

Data Import Memory Management

To import data with simple queries, you can use the Database Explorer app. For more complex queries and managing memory issues, use the command line to import data into the MATLAB workspace. To understand the differences between these two approaches, see “Data Import Using Database Explorer App or Command Line” on page 2-133.

Database Toolbox provides various ways to import data into the MATLAB workspace from a database.

sqlread Function

If you are not familiar with writing SQL queries, you can import data using the `sqlread` function. This function needs only a database connection and the database table name to import data. Furthermore, the `sqlread` function does not require you to set database preferences.

select Function

For memory savings, you can import and access data using the `select` function. With this function, you save memory by importing data using data types specified in a database. The table definitions in a database specify the data type for each column. The `select` function maps the data type in the database to a corresponding MATLAB data type for each variable during data import. Instead of importing every numeric value as a `double` in MATLAB, the `select` function allows the import of different integer data types. You no longer need to convert the data type of a numeric value to a specific numeric type after data import. The MATLAB memory size used by integer or unsigned integer data types is less than double precision. Therefore, the `select` function saves memory.

This table shows the numeric data types in a database and their MATLAB equivalents when using the `select` function.

Database Data Type	MATLAB Data Type
`SIGNED TINYINT`	`int8`
`UNSIGNED TINYINT`	`uint8`
`SIGNED SMALLINT`	`int16`
`UNSIGNED SMALLINT`	`uint16`
`SIGNED INT`	`int32`
`UNSIGNED INT`	`uint32`
`SIGNED BIGINT`	`int64`
`UNSIGNED BIGINT`	`uint64`
`REAL`	`single`
`FLOAT`	`single`
`DOUBLE`	`double`
`DECIMAL`	`double`
`NUMERIC`	`double`
Boolean	`logical`
Date, time, or text	`char`

For example, create a table Patients with this database table definition:

```
CREATE TABLE Patients(
    LastName VARCHAR(50),
    Gender VARCHAR(10),
    Age TINYINT,
    Location VARCHAR(300),
    Height SMALLINT,
    Weight SMALLINT,
    Smoker BIT,
    Systolic FLOAT,
    Diastolic NUMERIC,
    SelfAssessedHealthStatus VARCHAR(20))
```

These table columns have numeric data types in the database:

- Age
- Height
- Weight
- Systolic
- Diastolic

The fetch function imports the columns of numeric data with double precision by default. However, the select function imports the columns into their matching integer data type. When you import using the select function, the corresponding MATLAB data types for these columns are:

- uint8
- uint16
- uint16
- single
- double

The fetch function imports the Smoker column as a double in MATLAB. However, the select function imports the Smoker column as a logical variable.

To see data types after data import, use the select function with the metadata output argument.

Define Import Strategy Using SQLImportOptions Object

You can customize the import options for importing data from a database into the MATLAB workspace by using the SQLImportOptions object with the fetch function. The select function specifies the MATLAB data type by default. However, with the SQLImportOptions object, you can define the import strategy for specific database columns and specify the MATLAB data type for the corresponding imported data.

Also, you can specify categorical, datetime, and integer data types for imported data using the SQLImportOptions object. The MATLAB memory size used to store these data types is less than the memory size used for alternative data types, such as string or double.

See Also

fetch | executeSQLScript | select | sqlread

More About

- “Data Import Using Database Explorer App or Command Line” on page 2-133
- “Import Data from Database Table Using sqlread Function” on page 5-58
- “Working with Large Data Sets” on page 2-135

Import Large Data Using DatabaseDatastore Object

This example shows how to create a `databaseDatastore` object for accessing collections of data stored in a relational database. After creating a `DatabaseDatastore` object, you can preview data, read data in chunks, and read every record in the data set.

To analyze large data, you can run algorithms on large data sets using a tall array.

Alternatively, you can write a MapReduce algorithm that defines the chunking and reduction of the data.

This example uses a preconfigured JDBC data source to create the database connection. For more information, see the `configureJDBCDataSource` function.

Create DatabaseDatastore Object

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query retrieves all data from the `airlinesmall` table.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Preview Data in DatabaseDatastore Object

Preview the first eight records in the data set returned by executing the SQL query.

```
preview(dbds)
```

```
ans =

  8×29 table

    Year     Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____     _____    __________    _________    _______    __________    _______    __________

    1990       9          11            2         1810         1812        1939         1930
    1990      10          27            6         1353         1355        1634         1640
    1990      10          23            2         1057         1055        1205         1155
    1990      10           8            1         1515         1440        1609         1535
    1990      10          19            5         1130         1120        1203         1154
    1990      10          12            5         1755         1733        1858         1820
    2001      11          22            4         1345         1355        1530         1549
    2001      11          26            1         2105         2110        2209         2237
```

Read Data in DatabaseDatastore Object

Read the first 10 records.

```
dbds.ReadSize = 10;

read(dbds)
```

```
ans =

  10×29 table

    Year     Month     DayofMonth     DayOfWeek     DepTime     CRSDepTime     ArrTime     CRSArrTime
    ____     _____     __________     _________     _______     __________     _______     __________

    1987      10           30             5          1329          1329         1434          1436
    1987      11            7             6          1316          1315         1713          1647
    1987      11           28             6           815           815         1015          1015
    1987      11            2             1           700           700          800           800
    1987      11           14             6           840           840         1127          1120
    1987      11            1             7          1625          1625         1823          1758
    1987      11           26             4          1314          1315         1538          1542
    1987      10           28             3          1140          1140         1212          1215
    1987      10            9             5          1155          1155         1250          1300
    1987      10           22             4           715           715          807           803
```

Read the DatabaseDatastore object two more times by using counter n. Read 10 records at a time.

```
n = 0;

while(hasdata(dbds) && n~=2)
     read(dbds)
     n = n+1;
end
```

```
ans =

  10×29 table

    Year     Month     DayofMonth     DayOfWeek     DepTime     CRSDepTime     ArrTime     CRSArrTime
    ____     _____     __________     _________     _______     __________     _______     __________

    1987      10           16             5          1553          1555         1641          1640
    1987      10           30             5          1821          1815         1956          1955
    1987      10           12             1          1300          1300         1529          1528
    1987      10            7             3           810           810          904           900
    1987      10           19             1           733           735          827           831
    1987      10           15             4           828           830          916           921
    1987      10            4             7          1750          1735         1837          1816
    1987      10           16             5           959          1000         1212          1215
    1987      10           17             6          2020          2020         2100          2057
    1987      10            6             2          1132          1135         1426          1419


ans =
```

```
  10×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1987     10          24            6           944         945        1211         1213
    1987     10          18            7           833         835        1003         1011
    1987     10          26            1          2356        2355         730          721
    1987     10          29            4          1056        1055        1208         1215
    1987     10           1            4          2304        2255        2340         2329
    1987     10           3            6          1040        1040        1125         1120
    1987     10          23            5          1855        1855        2158         2205
    1987     10          30            5          1055        1055        1302         1315
    1987     10          28            3           NaN        1850         NaN         2050
    1987     10          26            1          1600        1600        1649         1640
```

Reset DatabaseDatastore Object

Reset the DatabaseDatastore object to its original state, where no data has been read from it. Resetting allows you to reread from the same DatabaseDatastore object.

```
reset(dbds)
```

Read Every Record in DatabaseDatastore Object

Read every record in the DatabaseDatastore object in increments of 50,000 records at a time.

```
dbds.ReadSize = 50000;
data = readall(dbds);
```

Display the first three records of the full data set.

```
data(1:3,:)
```

```
ans =

  3×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1987     10          28            3          1140        1140        1212         1215
    1987     10           9            5          1155        1155        1250         1300
    1987     10          22            4           715         715         807          803
```

Close DatabaseDatastore Object and Database Connection

```
close(dbds)
```

See Also

database | databaseDatastore | close | hasdata | preview | read | readall | reset

Related Examples

- "Analyze Large Data in Database Using Tall Arrays" on page 5-30
- "Analyze Large Data in Database Using MapReduce" on page 5-27

External Websites

- SQL Tutorial

Analyze Large Data in Database Using MapReduce

This example determines the mean arrival delay of a large set of flight data that is stored in a database. You can access large data sets using a `databaseDatastore` object with Database Toolbox™. After creating a `DatabaseDatastore` object, you can write a MapReduce algorithm that defines the chunking and reduction of the data. Alternatively, you can use a tall array to run algorithms on large data sets.

The `DatabaseDatastore` object does not support using a parallel pool with Parallel Computing Toolbox™ installed. To analyze data using tall arrays or run MapReduce algorithms, set the global execution environment to be the local MATLAB® session.

This example uses a preconfigured JDBC data source to create the database connection. For more information, see the `configureJDBCDataSource` function.

Create DatabaseDatastore Object

Set the global execution environment to be the local MATLAB® session.

```
mapreducer(0);
```

The file `airlinesmall.csv` contains a large set of flight data. Load this file into the Microsoft® SQL Server® database table `airlinesmall`. This table contains 123,523 records.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query retrieves arrival-delay data from the `airlinesmall` table.

```
sqlquery = 'select ArrDelay from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Define Mapper and Reducer Functions

To process large data sets in chunks, you can write your own mapper function. For each chunk in this example, use `meanArrivalDelayMapper.m` to:

- Read arrival-delay data from the `DatabaseDatastore` object.
- Determine the number of delays and the total delay in the chunk.
- Store both values in `KeyValueDatastore`.

The `meanArrivalDelayMapper.m` file contains this code.

```
function meanArrivalDelayMapper (data, info, intermKVStore)
% Mapper function for the MeanMapReduceExample.
```

```
% Copyright 2014 The MathWorks, Inc.

% Data is an n-by-1 table of the ArrDelay. Remove missing value first:
data(isnan(data.ArrDelay),:) = [];

% Record the partial counts and sums and the reducer will accumulate them.
partCountSum = [length(data.ArrDelay), sum(data.ArrDelay)];
add(intermKVStore, 'PartialCountSumDelay',partCountSum);
```

You also can write your own reducer function. In this example, use `meanArrivalDelayReducer.m` to read intermediate values for the number of delays and the total arrival delay. Then, determine the overall mean arrival delay. `mapreduce` calls this reducer function only once because the mapper function adds just one key to `KeyValueStore`. The `meanArrivalDelayReducer.m` file contains this code.

```
function meanArrivalDelayReducer(intermKey, intermValIter, outKVStore)
% Reducer function for the MeanMapReduceExample.

% Copyright 2014 The MathWorks, Inc.

% intermKey is 'PartialCountSumDelay'
count = 0;
sum = 0;
while hasnext(intermValIter)
   countSum = getnext(intermValIter);
   count = count + countSum(1);
   sum = sum + countSum(2);
end

meanDelay = sum/count;

% The key-value pair added to outKVStore will become the output of mapreduce
add(outKVStore,'MeanArrivalDelay',meanDelay);
```

Run MapReduce Using Mapper and Reducer Functions

To determine the mean arrival delay in the flight data, run MapReduce with the `DatabaseDatastore` object, mapper function, and reducer function.

```
outds = mapreduce(dbds,@meanArrivalDelayMapper,@meanArrivalDelayReducer);
```

```
********************************
*      MAPREDUCE PROGRESS      *
********************************
Map   0% Reduce   0%
Map  15% Reduce   0%
Map  30% Reduce   0%
Map  46% Reduce   0%
Map  61% Reduce   0%
Map  76% Reduce   0%
Map  92% Reduce   0%
Map 100% Reduce   0%
Map 100% Reduce 100%
```

Display Output from MapReduce

Read the table from the output datastore using `readall`.

```
outtab = readall(outds)
```

```
outtab =

  1×2 table

          Key               Value
    __________________    ________

    'MeanArrivalDelay'    [7.1201]
```

The table has only one row containing one key-value pair.

Display the mean arrival delay from the table.

```
meanArrDelay = outtab.Value{1}
```

```
meanArrDelay =

    7.1201
```

Close `DatabaseDatastore` Object and Database Connection

```
close(dbds)
```

See Also

`setdbprefs` | `database` | `databaseDatastore` | `readall` | `close` | `mapreduce` | `TabularTextDatastore`

Related Examples

- “Analyze Large Data in Database Using Tall Arrays” on page 5-30
- “Compute Mean Value with MapReduce”
- “Import Large Data Using DatabaseDatastore Object” on page 5-23
- “Getting Started with MapReduce”

External Websites

- SQL Tutorial

Analyze Large Data in Database Using Tall Arrays

This example determines the minimum arrival delay of a large set of flight data that is stored in a database. You can access large data sets and create a tall array using a `DatabaseDatastore` object with Database Toolbox™. Once a tall array exists, you can visualize data in the tall array. Alternatively, you can write a MapReduce algorithm that defines the chunking and reduction of the data.

The `DatabaseDatastore` object does not support using a parallel pool with Parallel Computing Toolbox™ installed. To analyze data using tall arrays or run MapReduce algorithms, set the global execution environment to be the local MATLAB® session.

This example uses a preconfigured JDBC data source to create the database connection. For more information, see the `configureJDBCDataSource` function.

Create DatabaseDatastore Object

Set the global execution environment to be the local MATLAB® session.

```
mapreducer(0);
```

The file `airlinesmall.csv` contains the large set of flight data. Load this file into the Microsoft® SQL Server® database table `airlinesmall`. This table contains 123,523 records.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query retrieves arrival-delay data from the `airlinesmall` table. `databaseDatastore` executes the SQL query.

```
sqlquery = 'select ArrDelay from airlinesmall';

dbds = databaseDatastore(conn,sqlquery,'ReadSize',50000);
```

Find Minimum Arrival Delay Using Tall Array

Because the `DatabaseDatastore` object returns a table, create a tall table.

```
tt = tall(dbds);
```

Find the minimum arrival delay.

```
minArrDelay = min(tt.ArrDelay);
```

`minArrDelay` contains the unevaluated minimum arrival delay. To return the output value, use `gather`. For details, see “Lazy Evaluation of Tall Arrays”.

```
minArrDelayValue = gather(minArrDelay)
```

```
Evaluating tall expression using the Local MATLAB Session:
- Pass 1 of 1: Completed in 1.6 sec
Evaluation completed in 1.9 sec

minArrDelayValue =

   -64
```

In addition to determining a minimum, tall arrays support many other functions. For details, see “Supporting Functions”.

Close `DatabaseDatastore` Object and Database Connection

```
close(dbds)
```

See Also

`databaseDatastore` | `database` | `gather` | `min` | `histogram` | `mapreducer` | `tall`

Related Examples

- “Visualization of Tall Arrays”
- “Analyze Large Data in Database Using MapReduce” on page 5-27

More About

- “Tall Arrays for Out-of-Memory Data”

External Websites

- SQL Tutorial

Import Data Using MATLAB Interface to SQLite

This example shows how to move data between MATLAB® and the MATLAB interface to SQLite. Suppose that you have product data that you want to import into MATLAB. You can load this data quickly into an SQLite database file. You do not need to install a database or driver. For details about the MATLAB interface to SQLite, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

Create SQLite Connection

Create an SQLite connection `conn` to a new SQLite database file `tutorial.db`. Specify the file name in the current working folder.

```
dbfile = fullfile(pwd,"tutorial.db");
conn = sqlite(dbfile,"create");
```

Create Tables in SQLite Database File

Create the tables `inventoryTable`, `suppliers`, `salesVolume`, and `productTable` using `execute`. Clear the MATLAB workspace variables.

```
createInventoryTable = strcat("CREATE TABLE inventoryTable ", ...
    "(productNumber NUMERIC, Quantity NUMERIC, ", ...
    "Price NUMERIC, inventoryDate VARCHAR)");
execute(conn,createInventoryTable)

createSuppliers = strcat("CREATE TABLE suppliers ", ...
    "(SupplierNumber NUMERIC, SupplierName VARCHAR(50), ", ...
    "City VARCHAR(20), Country VARCHAR(20), ", ...
    "FaxNumber VARCHAR(20))");
execute(conn,createSuppliers)

createSalesVolume = strcat("CREATE TABLE salesVolume ", ...
    "(StockNumber NUMERIC, January NUMERIC, ", ...
    "February NUMERIC, March NUMERIC, April NUMERIC, ", ...
    "May NUMERIC, June NUMERIC, July NUMERIC, ", ...
    "August NUMERIC, September NUMERIC, October NUMERIC, ", ...
    "November NUMERIC, December NUMERIC)");
execute(conn,createSalesVolume)

createProductTable = strcat("CREATE TABLE productTable ", ...
    "(productNumber NUMERIC, stockNumber NUMERIC, ", ...
    "supplierNumber NUMERIC, unitCost NUMERIC, ", ...
    "productDescription VARCHAR(20))");
execute(conn,createProductTable)

clear createInventoryTable createSuppliers createSalesVolume ...
    createProductTable
```

`tutorial.db` contains four empty tables.

Load Data into SQLite Database File

Load the MAT-file named `sqliteworkflowdata.mat`. The variables `CinvTable`, `Csuppliers`, `CsalesVol`, and `CprodTable` contain data for export. Export data into the tables in `tutorial.db` using `sqlwrite`. Clear the MATLAB workspace variables.

```
load('sqliteworkflowdata.mat')

tablename = "inventoryTable";
varnames = ["productNumber" "Quantity" "Price" "inventoryDate"];
data = cell2table(CinvTable); % convert data from cell array to table
data.Properties.VariableNames = varnames; % set variable names
sqlwrite(conn,tablename,data)

tablename = "suppliers";
varnames = ["SupplierNumber" "SupplierName" "City" "Country" "FaxNumber"];
data = cell2table(Csuppliers); % convert data from cell array to table
data.Properties.VariableNames = varnames; % set variable names
sqlwrite(conn,tablename,data)

tablename = "salesVolume";
varnames = ["StockNumber" "January" "February" "March" "April" "May" "June" ...
    "July" "August" "September" "October" "November" "December"];
data = cell2table(CsalesVol); % convert data from cell array to table
data.Properties.VariableNames = varnames; % set variable names
sqlwrite(conn,tablename,data)

tablename = "productTable";
varnames = ["productNumber" "stockNumber" "supplierNumber" "unitCost" ...
    "productDescription"];
data = cell2table(CprodTable); % convert data from cell array to table
data.Properties.VariableNames = varnames; % set variable names
sqlwrite(conn,tablename,data)

clear CinvTable Csuppliers CsalesVol CprodTable
```

Close the SQLite connection. Clear the MATLAB workspace variable.

```
close(conn)

clear conn
```

Create a read-only SQLite connection to `tutorial.db`.

```
conn = sqlite("tutorial.db","readonly");
```

Import Data into MATLAB

Import the product data into the MATLAB workspace using `fetch`. Variables `inventoryTable_data`, `suppliers_data`, `salesVolume_data`, and `productTable_data` contain data from the tables `inventoryTable`, `suppliers`, `salesVolume`, and `productTable`.

```
inventoryTable_data = fetch(conn,"SELECT * FROM inventoryTable");

suppliers_data = fetch(conn,"SELECT * FROM suppliers");

salesVolume_data = fetch(conn,"SELECT * FROM salesVolume");

productTable_data = fetch(conn,"SELECT * FROM productTable");
```

Display the first three rows of data in each table.

```
head(inventoryTable_data,3)
```

```
    productNumber    Quantity    Price        inventoryDate
    _____________    ________    _____    ______________________
```

```
         1            1700      14.5     "9/23/2014 9:38:34 AM"
         2            1200       9.3     "7/8/2014 10:50:45 PM"
         3             356      17.2     "5/14/2014 7:14:28 AM"
```

```
head(suppliers_data,3)
```

```
    SupplierNumber      SupplierName          City           Country             FaxNumber
    ______________    _________________    __________    ________________    _______________

         1001         "Wonder Products"    "New York"    "United States"     "212 435 1617"
         1002         "Terrific Toys"      "London"      "United Kingdom"    "44 456 9345"
         1003         "Wacky Widgets"      "Adelaide"    "Australia"         "618 8490 2211"
```

```
head(salesVolume_data,3)
```

```
    StockNumber    January    February    March    April    May    June    July    August    Sep
    ___________    _______    ________    _____    _____    ___    ____    ____    ______    ___

      125970        1400        1100       981      882     794    752     654      773        8
      212569        2400        1721      1414     1191     983    825     731      653        7
      389123        1800        1200       890      670     550    450     400      410        4
```

```
head(productTable_data,3)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9            125970            1003            13        "Victorian Doll"
          8            212569            1001             5        "Train Set"
          7            389123            1007            16        "Engine Kit"
```

Close SQLite Connection

```
close(conn)
```

Clear the MATLAB workspace variable.

```
clear conn
```

See Also

Objects
`sqlite`

Functions
`execute` | `fetch` | `sqlwrite` | `close`

Related Examples

- “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5
- “Insert Data into SQLite Database Table” on page 5-36
- “Create Table and Add Column in SQLite Database” on page 5-38

- “Delete Data from SQLite Database” on page 5-39
- “Deploy MATLAB Interface to SQLite Database Application with MATLAB Compiler” on page 5-43

External Websites

- SQL Tutorial

Insert Data into SQLite Database Table

This example shows how to import data from an SQLite database into MATLAB® using the MATLAB interface to SQLite, perform calculations on the data, and export the results to a database table.

The example assumes that you connect to an SQLite database that contains tables named `salesVolume` and `yearlySales`. The `salesVolume` table contains the column names for each month. The `yearlySales` table contains the column names `Month` and `SalesTotal`.

Create SQLite Connection

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Calculate Sum of Sales Volume for One Month

Import sales volume data for the month of March using the database connection. The `salesVolume` database table contains sales volume data.

```
tablename = "salesVolume";
data = sqlread(conn,tablename);
```

Display the first three rows of sales volume data. The fourth variable contains the data for the month of March.

```
head(data(:,4),3)
```

```
    March
    _____

     981
    1414
     890
```

Calculate the sum of the March sales. Assign the result to the MATLAB workspace variable `total` and display the result.

```
total = sum(data.March)
```

```
total = 27609
```

Insert Total Sales for One Month into Database

Retrieve the name of the month from the sales volume data.

```
month = data.Properties.VariableNames(4);
```

Define the names of the columns for the data to insert as a string array.

```
colnames = ["Month" "SalesTotal"];
```

Create a MATLAB table that stores the data to export.

```
results = table(month,total,'VariableNames',colnames);
```

Determine the status of the `AutoCommit` database flag. This status shows whether or not the insert action can be undone.

```
conn.AutoCommit
```

```
ans = 
'on'
```

The `AutoCommit` flag is set to `on`. The database commits the exported data automatically to the database, and this action cannot be undone.

Insert the sum of sales for the month of March into the `yearlySales` table.

```
tablename = "yearlySales";
sqlwrite(conn,tablename,results)
```

Import the data from the `yearlySales` table. This data contains the calculated result.

```
data = sqlread(conn,tablename)
```

```
data=1×2 table
     Month      SalesTotal
    _______     __________

    "March"       27609
```

Close Database Connection

```
close(conn)
```

See Also

Objects
`sqlite`

Functions
`sqlread` | `sqlwrite` | `close`

Related Examples

- “Import Data Using MATLAB Interface to SQLite” on page 5-32
- “Create Table and Add Column in SQLite Database” on page 5-38
- “Delete Data from SQLite Database” on page 5-39
- “Roll Back Data in SQLite Database” on page 5-41

Create Table and Add Column in SQLite Database

This example shows how to connect to an SQLite database and manage the database structure using the MATLAB® interface to SQLite. You can manage the database structure using the `execute` function.

Create SQLite Connection

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Create Database Table

Use the SQL CREATE statement to create the database table `Person`.

```
sqlquery = strcat("CREATE TABLE Person(lastname VARCHAR(250), ", ...
    "firstname VARCHAR(250), address VARCHAR(300), age INT)");
```

Create the table in the database using the database connection.

```
execute(conn,sqlquery)
```

Add Database Column

Use the SQL ALTER statement to add the database column `city` to the table `Person`.

```
sqlquery = "ALTER TABLE Person ADD city VARCHAR(30)";
execute(conn,sqlquery)
```

Close Database Connection

```
close(conn)
```

See Also

Objects
`sqlite`

Functions
`execute` | `close`

Related Examples

- “Import Data Using MATLAB Interface to SQLite” on page 5-32
- “Delete Data from SQLite Database” on page 5-39
- “Roll Back Data in SQLite Database” on page 5-41

External Websites

- SQL Tutorial

Delete Data from SQLite Database

This example shows how to delete data from an SQLite database using the MATLAB® interface to SQLite. Create the SQL statement using deletion SQL syntax. Execute the delete operation on your database using the `execute` function with the SQL statement.

Create SQLite Connection

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

The SQL query `sqlquery` selects all rows of data in the table `inventoryTable`. Execute this SQL query using the database connection. Import the data from the executed query using the `fetch` function, and display the last few rows.

```
sqlquery = "SELECT * FROM inventoryTable";
data = fetch(conn,sqlquery);
tail(data,3)
```

```
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

         11             567      11.2     "9/11/2012 12:30:24 AM"
         12            1278      22.3     "10/29/2010 6:17:47 PM"
         13            1700      16.8     "5/24/2009 10:58:59 AM"
```

Delete Specific Record

Delete the record for the product number `13` from the table `inventoryTable`. Specify the product number using the `WHERE` clause in the SQL statement `sqlquery`.

```
sqlquery = "DELETE FROM inventoryTable WHERE productnumber = 13";
execute(conn,sqlquery)
```

Display the data in the table `inventorytable` after the deletion. The record with product number `13` is missing.

```
sqlquery = "SELECT * FROM inventoryTable";
data = fetch(conn,sqlquery);
tail(data,3)
```

```
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

         10             723      24.3     "3/14/2012 1:13:09 PM"
         11             567      11.2     "9/11/2012 12:30:24 AM"
         12            1278      22.3     "10/29/2010 6:17:47 PM"
```

Insert the record back in to maintain the dataset.

```
data = table(13,1700,16.8,"5/24/2009 10:58:59 AM", ...
    'VariableNames',["productNumber" ...
    "Quantity" "Price" "inventoryDate"]);
sqlwrite(conn,"inventoryTable",data)
```

Close Database Connection

```
close(conn)
```

See Also

Objects
`sqlite`

Functions
`execute` | `fetch` | `close`

Related Examples

- "Import Data Using MATLAB Interface to SQLite" on page 5-32
- "Create Table and Add Column in SQLite Database" on page 5-38
- "Roll Back Data in SQLite Database" on page 5-41

External Websites

- SQL Tutorial

Roll Back Data in SQLite Database

This example shows how to connect to an SQLite database, insert a row into an existing database table, and then roll back the insertion using the MATLAB® interface to SQLite. The database contains the table `productTable`.

Create SQLite Connection

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Append Data to Existing Database Table

Set the `AutoCommit` property of the `connection` object to `off`. Any updates you make after turning off this flag do not commit to the database automatically.

```
conn.AutoCommit = "off";
```

To view the existing database table `productTable` before appending data, import its contents into MATLAB and display the last few rows.

```
tablename = "productTable";
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13            470816            1012            16           "Pancakes"
         14            510099            1011            19           "Shawl"
         15            899752            1011            20           "Snacks"
```

Create a MATLAB table that contains the data for one product.

```
data = table(30,500000,1000,25,"Rubik's Cube", ...
    'VariableNames',["productnumber" "stocknumber" ...
    "suppliernumber" "unitcost" "productdescription"]);
```

Append the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13            470816            1012            16          "Pancakes"
         14            510099            1011            19          "Shawl"
```

```
        15            899752            1011            20          "Snacks"
        30            500000            1000            25          "Rubik's Cube"
```

Roll Back Data

Roll back the inserted row.

```
rollback(conn)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results no longer contain the inserted row.

```
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13            470816            1012            16           "Pancakes"
         14            510099            1011            19           "Shawl"
         15            899752            1011            20           "Snacks"
```

Close Database Connection

```
close(conn)
```

See Also

Objects
`sqlite`

Functions
`sqlread` | `sqlwrite` | `rollback` | `close`

Related Examples

- “Import Data Using MATLAB Interface to SQLite” on page 5-32
- “Create Table and Add Column in SQLite Database” on page 5-38
- “Delete Data from SQLite Database” on page 5-39

Deploy MATLAB Interface to SQLite Database Application with MATLAB Compiler

This example shows how to write a script to analyze data stored in an SQLite database using the MATLAB® interface to SQLite, and then deploy the script as a standalone application. For this example, you write code that connects to a database, imports data from the database into MATLAB, analyzes the data, and closes the database connection. Then, you deploy the code by compiling it as a standalone application using the Application Compiler (MATLAB Compiler) app, and by running the application on other machines.

The example uses the MATLAB interface to SQLite to create the database connection. Overall, the example follows the steps described in “Create Standalone Application from MATLAB Function” (MATLAB Compiler) and updates the steps for a standalone database application.

Create Function in MATLAB

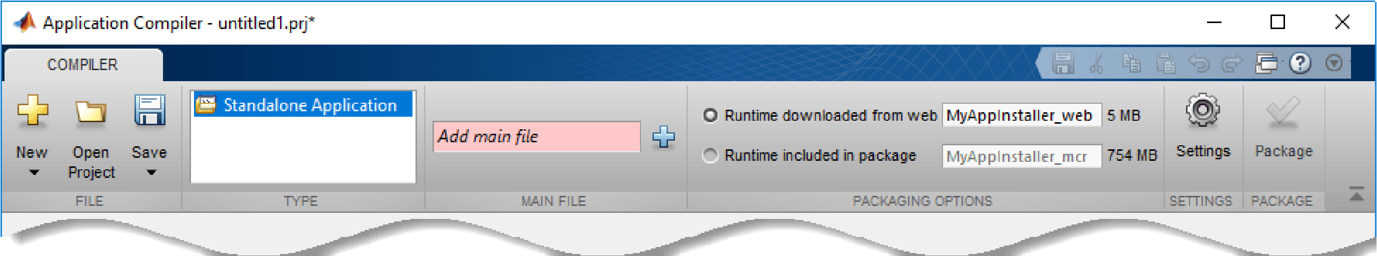
Create a MATLAB script named `importSQLiteInterface.m` and save it in a file location of your choice. The script contains the `importSQLiteInterface` function, which returns the maximum product number from the data in the `productTable` database table. The function connects to the SQLite database and imports all data from `productTable`. Then, the function calculates the maximum product number.

```
type importSQLiteInterface.m
```

```
function maxProdNum = importSQLiteInterface
% IMPORTSQLITEINTERFACE The importSQLiteInterface function connects to an
% SQLite database using the MATLAB(R) interface to SQLite, imports data
% from the database into MATLAB, performs a simple data analysis, and
% closes the database connection. The database contains a table named
% |productTable|.

%%
% Create the SQLite connection |conn| to the existing SQLite database file
% |tutorial.db|. The SQLite connection is an |sqlite| object.
dbfile = "tutorial.db";
conn = sqlite(dbfile);
%%
% Import data from the |productTable| database table.
tablename = "productTable";
data = sqlread(conn,tablename);
%%
% Determine the highest product number among products.
prodNums = data.productNumber;
maxProdNum = max(prodNums);
%%
% Close the database connection.
close(conn)
end
```

Create Standalone Application Using Application Compiler App

On the **MATLAB Apps** tab, on the far right of the **Apps** section, click the arrow to open the apps gallery. Under **Application Deployment**, click **Application Compiler**.



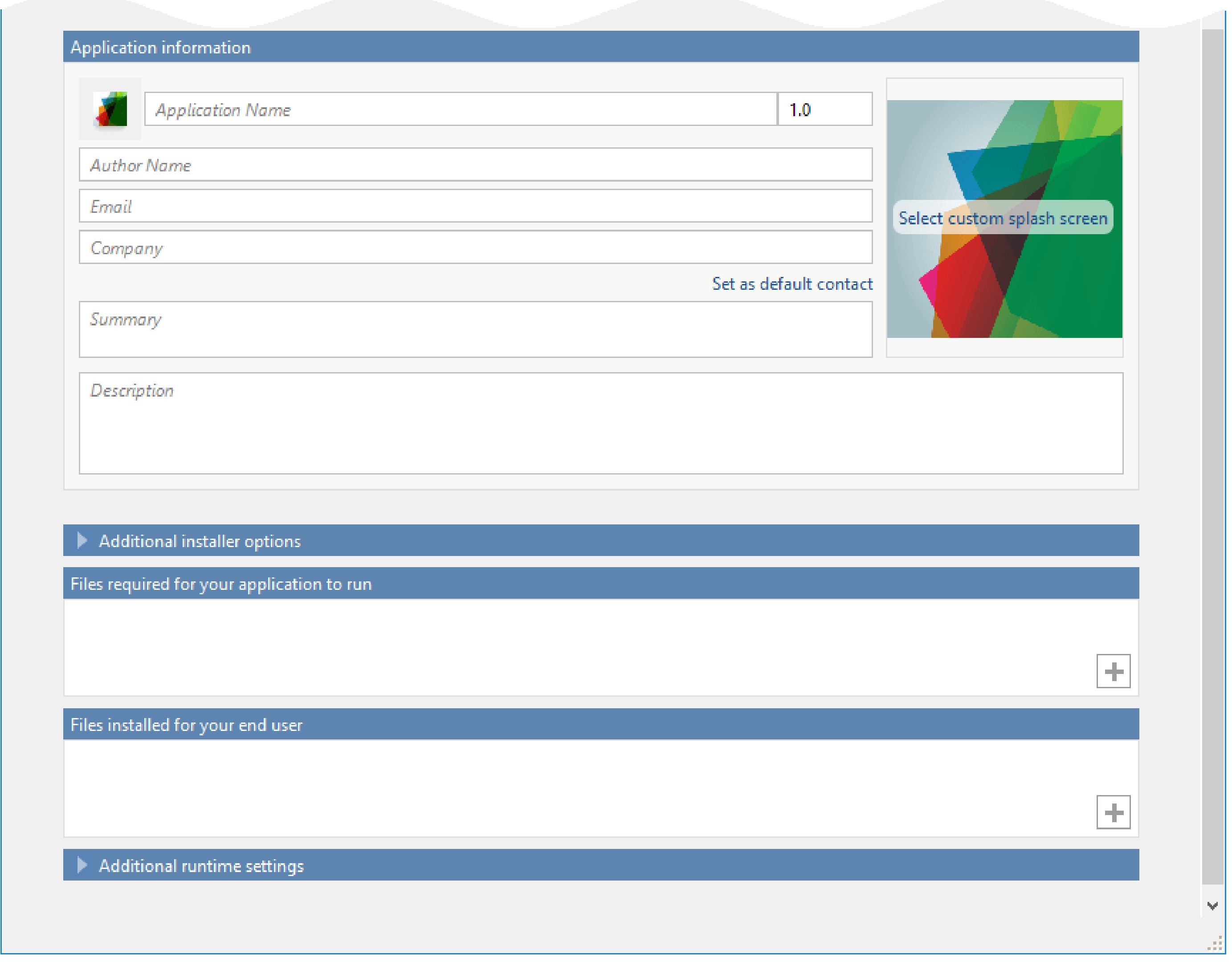
In the **MATLAB Compiler** project window, specify the main file of the MATLAB application that you want to deploy.

1. In the **Main File** section of the toolstrip, click the plus sign button to add a main file.
2. In the **Add Files** dialog box, browse to the file location that contains your saved script. Select `importSQLiteInterface.m` and click **Open**. The Application Compiler app adds the `importSQLiteInterface` function to the list of main files.

Decide whether to include the MATLAB Runtime installer in the generated application by selecting one of the two options in the **Packaging Options** section:

- **Runtime downloaded from web** — Generates an installer that downloads MATLAB Runtime and installs it along with the deployed MATLAB application.
- **Runtime included in package** — Generates an installer that includes the MATLAB Runtime installer.

Customize the packaged application and its appearance by specifying the following options:



- **Application information** — Editable information about the deployed application. You can also customize the appearance of the standalone application by changing the application icon and splash screen. The generated installer uses this information to populate the installed application metadata.
- **Additional installer options** — Options for editing the default installation path for the generated installer and selecting a custom logo.
- **Files required for your application to run** — Additional files required by the generated application to run. The software includes these files in the generated application installer.
- **Files installed for your end user** — Files that are installed with your application. These files include the generated `readme.txt` file and the generated executable for the target platform.
- **Additional runtime settings** — Platform-specific options for controlling the generated executable.

For details about these options, see “Customize an Application” (MATLAB Compiler).

To generate the packaged application, click **Package** in the **Package** section on the toolstrip. In the Save Project dialog box, specify the location in which to save the project.

In the **Package** dialog box, verify that the option **Open output folder when process completes** is selected.

When the deployment process is complete, examine the generated output:

- `for_redistribution` — Folder containing the file that installs the application and MATLAB Runtime.
- `for_testing` — Folder containing all the artifacts created by `mcc` (such as binary, JAR, header, and source files for a specific target). Use these files to test the installation.
- `for_redistribution_files_only` — Folder containing the files required for redistributing the application. Distribute these files to users who have MATLAB or MATLAB Runtime installed on their machines.
- `PackagingLog.txt` — Log file generated by MATLAB Compiler.

Install and Run Standalone Application

To install the standalone application, double-click the `MyAppInstaller_web` executable in the `for_redistribution` folder.

If you want to connect to the Internet using a proxy server, click **Connection Settings**. Enter the proxy server settings in the provided dialog box. Click **OK**.

To complete the installation, follow the instructions in the installation wizard.

To run your standalone application:

1. Open a terminal window.
2. Navigate to the folder in which you installed the application.
3. Run the application.

Test Standalone Application on Target Machine

Choose one target machine to test the MATLAB generated standalone application.

Copy the files in the `for_testing` folder to the target machine.

To test your standalone application:

1. Open a terminal window.
2. Navigate to the `for_testing` folder.
3. Run the application.

Deploy Standalone Application on Target Machines

Copy the `for_redistribution_files_only` folder to a file location on all target machines where MATLAB or MATLAB Runtime is installed.

Run the MATLAB generated standalone application on all target machines by using the executable in the `for_redistribution_files_only` folder.

See Also

Objects
`sqlite`

Functions
`sqlread` | `close`

Related Examples

- "Create Functions in Files"
- "Create Standalone Application from MATLAB Function" (MATLAB Compiler)
- "Customize an Application" (MATLAB Compiler)
- "Import Data Using MATLAB Interface to SQLite" on page 5-32

External Websites

- SQL Tutorial

Retrieve Image Data Types

This example shows how to retrieve images from a Microsoft Access database. To run this example, define the function `parsebinary` using this code.

```
function [x,map] = parsebinary(o,f)
%PARSEBINARY Write binary object to disk and display if image.
%   [X,MAP] = PARSEBINARY(O,F) writes the binary object in O to disk
%   in the format specified by F. If the object is an image,
%   display the image. This file was released for demonstration
%   purposes only. A Microsoft(R) Access(TM) database contains image data.
%   Use an ODBC driver to read the data. This function writes
%   any temporary files to the current working directory.
%
%   Valid file formats are:
%
%   BMP     Bitmap
%   DOC     Microsoft(R) Word document
%   GIF     GIF file
%   PPT     Microsoft(R) Powerpoint(R) file
%   TIF     TIF file
%   XLS     Microsoft(R) Excel(R) spreadsheet
%   PNG     Portable Network Graphics

% Transform object into vector of data
v = java.util.Vector;
v.addElement(o);
bdata = v.elementAt(0);

% Open file to write data to disk
fid = fopen(['testfile.' lower(f)],'wb');

% n specifies the end point of data written to disk
n = length(bdata);

% File type determines how many bytes of header data that
% the ODBC driver prepended to the data.

switch lower(f)

    case 'bmp'
      m = 79;

    case 'doc'
      m = 86;

    case 'gif'
      m = 5722;

    case 'png'

      m = 182;
      n = length(bdata)-285;

    case 'ppt'
      m = 94;

    case 'tif'
      m = 6472;

    case 'xls'
      m = 83;

    otherwise
      error(message('database:parsebinary:unknownFormat'))

end

% Write data to disk
fwrite(fid,bdata(m:n),'int8');
fclose(fid);

% Display if image
switch lower(f)

  case {'bmp','tif','gif','png'}

    [x,map] = imread(['testfile.' lower(f)]);
    imagesc(x)
```

```
    colormap(map)

  case {'doc','xls','ppt'}

    % Microsoft(R) Office formats
    % Insert path to Microsoft(R) Word or Microsoft(R) Excel(R)
    % executable here to run from MATLAB(R) prompt.
    % For example:
    % !d:\msoffice\winword testfile.doc
end
```

1 Connect to the Microsoft Access data source using the ODBC driver. The database contains the table `Invoice`.

```
conn = database('datasource','','');
```

2 Import the `InvoiceNumber` and `Receipt` columns of data from `Invoice`.

```
sqlquery = 'SELECT InvoiceNumber,Receipt FROM Invoice';
results = fetch(conn,sqlquery);
```

3 View the imported data.

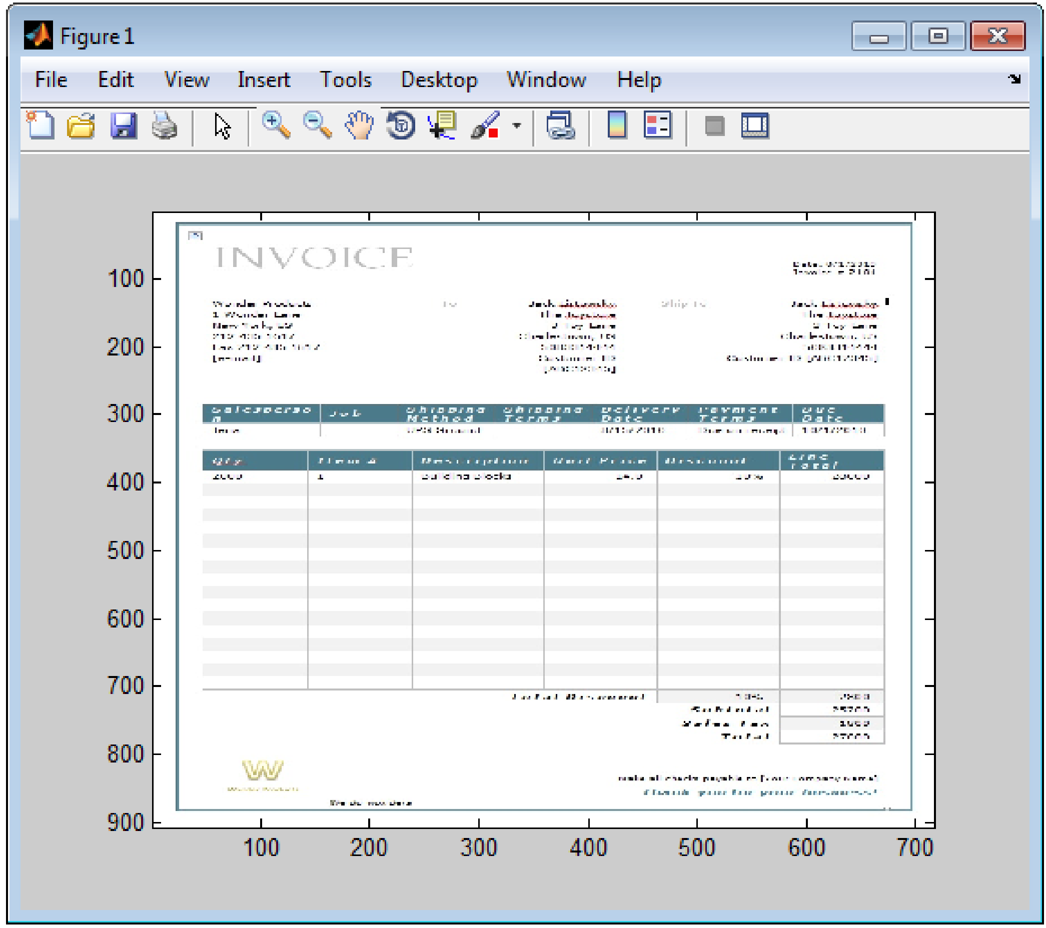
```
results

ans =

  10×2 table

    InvoiceNumber         Receipt
    _____________    _________________

         2101        [1948410×1 uint8]
         3546        [2059994×1 uint8]
        33116        [ 487034×1 uint8]
        34155        [2059994×1 uint8]
        34267        [2454554×1 uint8]
        37197        [1926362×1 uint8]
        37281        [2403674×1 uint8]
        41011        [1920474×1 uint8]
        61178        [2378330×1 uint8]
        62145        [ 492314×1 uint8]
```

4 Assign the image element you want to the variable `receipt`.

```
receipt = results.Receipt{1};
```

5 Run the `parsebinary` function. The function writes retrieved data to a file, strips ODBC header information from it, and displays `receipt` as a bitmap image in a figure window. Ensure that your current folder is writable so that the `parsebinary` function can write the output data.

```
cd 'I:\MATLABFiles\myfiles'
parsebinary(receipt,'BMP');
```



See Also

`database` | `fetch`

Related Examples

- "Import Data from Database Table Using sqlread Function" on page 5-58

External Websites

- SQL Tutorial

Import Boolean Data from Database

Import Boolean data from a database table into the MATLAB® workspace. MATLAB® imports Boolean data from databases into the MATLAB® workspace as data type `logical`. This data has values of `true` or `false`. You can store Boolean data in a table, structure, or cell array. Perform a simple data analysis on the imported data.

The code assumes that you have a database table `Invoice` stored in a Microsoft® SQL Server® database. Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create Database Connection

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import Boolean Data

Select the paid data from the `Invoice` table using an SQL `SELECT` statement. The database stores paid data as a Boolean to specify whether or not an invoice has been paid. Import and display the data using the `select` function.

```
selectquery = 'SELECT Paid FROM Invoice';
data = select(conn,selectquery)
```

```
data =

  10×1 table

    Paid 
    _____

    false
    true 
    true 
    false
    true 
    true 
    false
    true 
    false
    true 
```

Database Toolbox™ imports the data into the workspace variable `data`. The MATLAB® table `data` contains `Paid` as a `logical` variable.

Perform Data Analysis

Count the number of unpaid invoices.

```
unpaid = data.Paid == false;
sum(unpaid)

ans =

     4
```

Close Database Connection

```
close(conn)
```

See Also

`database` | `select` | `close`

Related Examples

- “Import Data from Database Table Using sqlread Function” on page 5-58
- “Insert Data into Database Table” on page 5-61

External Websites

- SQL Tutorial

Append Data to Existing Database Table Using Insert Functionality

To append data to an existing database table, you can use the `sqlwrite` function. The `datainsert` and `fastinsert` functions will be removed in a future release. When using the `sqlwrite` function, you no longer have to preprocess or convert the data, as required by the `datainsert` function. The following short examples show how to append the same data using both the `sqlwrite` and `datainsert` functions. Use these examples for migrating to the `sqlwrite` function for data insertion.

Append data to an existing database table by using the `sqlwrite` function.

```
% Read from 'airlinesmall.csv'
impObj = detectImportOptions('airlinesmall.csv');
impObj = setvartype(impObj, ...
    {'DepTime','ArrTime','ActualElapsedTime','CRSElapsedTime', ...
    'ArrDelay','DepDelay','Distance'},'double');

airlines_data = readtable('airlinesmall.csv',impObj);

% Insert using sqlwrite function
sqlwrite(conn,'airlinesmall',airlines_data);
```

Append the same data to the database table by using the `datainsert` function.

```
% Read from 'airlinesmall.csv'
impObj = detectImportOptions('airlinesmall.csv');
impObj = setvartype(impObj, ...
    {'DepTime','ArrTime','ActualElapsedTime','CRSElapsedTime', ...
    'ArrDelay','DepDelay','Distance'},'double');

airlines_data = readtable('airlinesmall.csv',impObj);
variablenames = airlines_data.Properties.VariableNames;
airlines_data = table2cell(airlines_data);

% Convert to compatible data
columns = size(airlines_data,2);
for i = 1:columns
    a = airlines_data(:,i);
    if all(cellfun(@(x)isnumeric(x),a)) == true
        a(cellfun(@isnan,a)) = {Inf};
        airlines_data(:,i) = a;
    end
end

airlines_data = cell2table(airlines_data,'VariableNames',variablenames);

% Insert using datainsert function
datainsert(conn,'airlinesmall',variablenames,airlines_data);
```

When using the `datainsert` function, you must complete additional steps to preprocess the data to insert. Use the `sqlwrite` function instead to avoid these extra steps.

See Also

`sqlwrite` | `detectImportOptions` | `setvartype` | `readtable` | `table2cell` | `cell2table`

More About

- “Insert Data into New Database Table Using Insert Functionality” on page 5-55
- “Insert Data into Database Table” on page 5-61
- “Writing Data Common Errors” on page 3-2

Insert Data into New Database Table Using Insert Functionality

To insert data into a new database table, you can use the `sqlwrite` function. The `datainsert` and `fastinsert` functions will be removed in a future release. When using the `sqlwrite` function, you no longer have to preprocess or convert the data, as required by the `datainsert` function. The following short examples show how to insert the same data using both the `sqlwrite` and `datainsert` functions. Use these examples for migrating to the `sqlwrite` function for data insertion.

Insert data in a new database table by using the `sqlwrite` function.

```
% Read from patient.xls file
patient_data = readtable('patient.xls');

% Insert using sqlwrite function
sqlwrite(conn,'patient',patient_data);
```

Insert the same data by using the `datainsert` function.

```
% Create a database table equivalent to data stored in patients.xls file
sqlquery = ['CREATE TABLE patients(LastName varchar, Gender varchar, ' ...
    'Age numeric, Location varchar, Height numeric, Weight numeric, ' ...
    'Smoker Boolean, Systolic numeric, Diastolic numeric, ' ...
    'SelfAssessedHealthStatus varchar)'];
execute(conn,sqlquery)

% Read from patients.csv file
patient_data = readtable('patients.csv');
variablenames = patient_data.Properties.VariableNames;
patient_data = table2cell(patient_data);

% Convert to compatible data
columns = size(patient_data,2);
for i = 1:columns
    a = patient_data(:,i);
    if all(cellfun(@(x)isnumeric(x),a)) == true
        a(cellfun(@isnan,a)) = {Inf};
        patient_data(:,i) = a;
    end
end

patient_data = cell2table(patient_data,'VariableNames',variablenames);

% Insert using datainsert function
datainsert(conn,'patient',variablenames,patient_data)
```

When using the `datainsert` function, you must complete additional steps to preprocess the data to insert. Use the `sqlwrite` function instead to avoid these extra steps.

See Also

`sqlwrite` | `readtable` | `table2cell` | `cell2table` | `exec`

More About

- “Append Data to Existing Database Table Using Insert Functionality” on page 5-53

- “Insert Data into Database Table” on page 5-61
- “Writing Data Common Errors” on page 3-2

Join Tables Using Command Line

You can join data in database tables and import the results interactively by using the Database Explorer app. Or, you can join two database tables by using the `sqlinnerjoin` and `sqlouterjoin` command line functions. The following short examples show how to join tables using the command line.

Enter this code to create an inner join between two database tables (the left table and right table of the join). An inner join retrieves records that have matching values in the shared column of both tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable);
```

To create an outer join, enter this code at the command line. An outer join retrieves the matched and unmatched rows between the two tables. This code shows a right outer join that uses different left and right keys in the corresponding database tables.

```
lefttable = 'employees';
righttable = 'departments';
data = sqlouterjoin(conn,lefttable,righttable, ...
    'LeftKey','MANAGER_ID','RightKey','DEPT_MANAGER_ID', ...
    'Type','right');
```

To join more than two database tables at a time, use the Database Explorer app. For details, see "Join Tables Using Database Explorer App" on page 4-10. Or, you can create and run an SQL script using the `executeSQLScript` function.

See Also

`sqlouterjoin` | `sqlinnerjoin`

More About

- "Join Tables Using Database Explorer App" on page 4-10
- "Importing Data Common Errors" on page 3-3

Import Data from Database Table Using sqlread Function

This example shows how to import data from a table in a Microsoft® Access™ database into the MATLAB® workspace using the `sqlread` function. The example then shows how to use an SQL script to import data from an SQL query that contains multiple joins.

Connect to Database

Create a Microsoft Access database connection with the data source name `dbdemo` using an ODBC driver and a blank user name and password. This database contains the table `producttable`.

```
conn = database('dbdemo','','');
```

If you are connecting to a database using a JDBC connection, then specify a different syntax for the database function.

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import Data from Database Table

Import product data from the database table `producttable` by using the `sqlread` function and the database connection. This function imports data as a MATLAB table.

```
tablename = 'producttable';
data = sqlread(conn,tablename);
```

Display the product number and description in the imported data.

```
data(:,[1 5])
```

```
ans =

  10×2 table

    productnumber    productdescription
    _____________    __________________

          9          'Victorian Doll'
          8          'Train Set'
          7          'Engine Kit'
          2          'Painting Set'
          4          'Space Cruiser'
          1          'Building Blocks'
          5          'Tin Soldier'
          6          'Sail Boat'
          3          'Slinky'
         10          'Teddy Bear'
```

Import Data Using Multiple Joins in SQL Query

Create an SQL script file named `salesvolume.sql` with the following SQL query. This SQL query uses multiple joins to join these tables in the `dbdemo` database:

- `producttable`
- `salesvolume`
- `suppliers`

The purpose of the query is to import sales volume data for suppliers located in the United States.

```
SELECT  salesvolume.january
,   salesvolume.february
,   salesvolume.march
,   salesvolume.april
,   salesvolume.may
,   salesvolume.june
,   salesvolume.july
,   salesvolume.august
,   salesvolume.september
,   salesvolume.october
,   salesvolume.november
,   salesvolume.december
,   suppliers.country
FROM     ((producttable
INNER JOIN salesvolume
ON  producttable.stocknumber = salesvolume.stocknumber)
INNER JOIN suppliers
ON  producttable.suppliernumber = suppliers.suppliernumber)
WHERE suppliers.country LIKE 'United States%'
```

Run the `salesvolume.sql` file by using the `executeSQLScript` function. `results` is a structure array with the data returned from running the SQL query in the SQL script file.

```
results = executeSQLScript(conn,'salesvolume.sql');
```

Display the first three rows in the `Data` table. Access this table as a field of the structure array by using dot notation.

```
head(results(1).Data,3)
```

```
ans =

  3×13 table

    january    february    march    april    may     june    july    august    september    octob
    _______    ________    _____    _____    ____    ____    ____    ______    _________    _____

     5000        3500      2800     2300     1700    1400    1000     900         1600       3300
     2400        1721      1414     1191      983     825     731     653          723        790
     1200         900       800      500      399     345     300     175          760       1500
```

Close Database Connection

```
close(conn)
```

See Also

`executeSQLScript` | `sqlread` | `database` | `close`

More About

- "Data Import Memory Management" on page 5-20

Insert Data into Database Table

This example shows how to import data from a database into MATLAB®, perform calculations on the data, and export the results to a database table.

The example assumes that you are connecting to a Microsoft® Access™ database that contains tables named `salesvolume` and `yearlysales`. Also, the example assumes that you start MATLAB as an administrator. The `salesvolume` table contains the column names for each month. The `yearlysales` table contains the column names `month` and `salestotal`.

Connect to Database

Create a database connection to the Microsoft Access database. For example, this code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Calculate Sum of Sales Volume for One Month

Import sales volume data for the month of March using the database connection. The `salesvolume` database table contains sales volume data.

```
tablename = 'salesvolume';
data = sqlread(conn,tablename);
```

Display the first three rows of sales volume data. The fourth variable contains the data for the month of March.

```
head(data(:,4),3)
```

```
ans =

  3×1 table

    march
    _____

     981
    1414
     890
```

Calculate the sum of the March sales. Assign the result to the MATLAB workspace variable `total` and display the result.

```
total = sum(data.march)
```

```
total =

       14606
```

Insert Total Sales for One Month into Database

Retrieve the name of the month from the sales volume data.

```
month = data.Properties.VariableNames(4);
```

Define the names of the columns for the data to insert as a cell array of character vectors.

```
colnames = {'month' 'salestotal'};
```

Create a MATLAB table that stores the data to export.

```
results = table(month,total,'VariableNames',colnames);
```

Determine the status of the `AutoCommit` database flag. This status determines whether or not the insert action can be undone.

```
conn.AutoCommit
```

```
ans =

    'on'
```

The `AutoCommit` flag is set to `on`. The database commits the exported data automatically to the database, and this action cannot be undone.

Insert the sum of sales for the month of March into the `yearlysales` table.

```
tablename = 'yearlysales';
sqlwrite(conn,tablename,results)
```

Import the data from the `yearlysales` table. This data contains the calculated result.

```
data = sqlread(conn,tablename)
```

```
data =

  1×3 table

     month      salestotal     revenue
    _______    __________    _______

    'march'      14606          0
```

Close Database Connection

```
close(conn)
```

See Also

`sqlwrite` | `sqlread` | `database` | `close`

More About

- "Export Data Using Bulk Insert" on page 5-13

Retrieve Database Metadata

This example shows how to retrieve database information using the `connection` object and the `sqlfind` function.

The example assumes that you are connecting to a MySQL® database that contains a table named `productTable`.

Connect to Database

Create an ODBC database connection to a MySQL database with a user name and password.

```
datasource = "MySQL ODBC";
username = "username";
password = "password";
conn = database(datasource,username,password);
```

Find Catalogs and Schemas

Display the catalogs in the database by using the `Catalogs` property of the `connection` object.

```
conn.Catalogs
```

```
ans =

  1×7 cell array

  Columns 1 through 4

    {'information_sch…'}    {'detsdb'}    {'mysql'}    {'performance_sch…'}

  Columns 5 through 7

    {'sys'}    {'toy_store'}    {'toystore_doc'}
```

Display the schemas in the database by using the `Schemas` property of the `connection` object.

```
conn.Schemas
```

```
ans =

  0×0 empty cell array
```

Find Table Types

Find all table types in the database by using the `sqlfind` function with the `connection` object.

```
tables = sqlfind(conn,'');
```

Display the first three table types.

```
tables(1:3,:)
```

```
ans =

  3×5 table

       Catalog           Schema            Table             Columns        Type
    ________________    __________    ____________________    ___________    _________

    {'toystore_doc'}    {0×0 char}    {'Person'         }    {1×5  cell}    {'TABLE'}
    {'toystore_doc'}    {0×0 char}    {'airlinesmall'   }    {1×29 cell}    {'TABLE'}
    {'toystore_doc'}    {0×0 char}    {'inventoryTable'}    {1×4  cell}    {'TABLE'}
```

Find the table type of the table `productTable`.

```
tablename = 'productTable';
data = sqlfind(conn,tablename);
data.Type
```

```
ans =

  1×1 cell array

    {'TABLE'}
```

Find Table Columns

Find all columns in the database table `productTable` and display them.

```
data = sqlfind(conn,tablename);
data.Columns{:}
```

```
ans =

  1×5 cell array

  Columns 1 through 4

    {'productNumber'}    {'stockNumber'}    {'supplierNumber'}    {'unitCost'}

  Column 5

    {'productDescript…'}
```

Close Database Connection

```
close(conn)
```

See Also

`sqlread` | `sqlfind` | `database` | `close`

More About

- “Import Data from Database Table Using sqlread Function” on page 5-58

Customize Options for Importing Data from Database into MATLAB

This example shows how to customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for multiple database columns. Import data using the `sqlread` function.

The example uses the `patients.xls` spreadsheet, which contains patient information. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create Database Connection

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load Example Data

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create `SQLImportOptions` Object

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Display the default data types of the variables by accessing the `VariableNames` and `VariableTypes` properties of the `SQLImportOptions` object using dot notation.

```
disp([opts.VariableNames' opts.VariableTypes'])
```

```
    'LastName'                    'char'
    'Gender'                      'char'
    'Age'                         'double'
    'Location'                    'char'
    'Height'                      'double'
    'Weight'                      'double'
    'Smoker'                      'double'
    'Systolic'                    'double'
    'Diastolic'                   'double'
    'SelfAssessedHealthStatus'    'char'
```

Customize Import Options

Change the data types of multiple variables. Convert the data type for all text variables to `string`. Also, convert the data type for all numeric variables to `single`.

```
textvars = {'LastName','Gender','Location','SelfAssessedHealthStatus'};
opts = setoptions(opts,textvars,'Type','string');

numvars = {'Age','Height','Weight','Systolic','Smoker','Diastolic'};
opts = setoptions(opts,numvars,'Type','single');
```

Display the updated data types of the variables.

```
disp([opts.VariableNames' opts.VariableTypes'])
```

```
    'LastName'                    'string'
    'Gender'                      'string'
    'Age'                         'single'
    'Location'                    'string'
    'Height'                      'single'
    'Weight'                      'single'
    'Smoker'                      'single'
    'Systolic'                    'single'
    'Diastolic'                   'single'
    'SelfAssessedHealthStatus'    'string'
```

Set the import options to replace missing data in the specified variables with the fill value `unknown`.

```
varnames = {'LastName','Location'};
opts = setoptions(opts,varnames,'FillValue',"unknown");
```

Set the import options to change the text of the `SelfAssessedHealthStatus` variable to lowercase.

```
varname = {'SelfAssessedHealthStatus'};
opts = setoptions(opts,varname,'TextCaseRule',"lower");
```

Set the import options to omit rows with missing data in the `LastName` variable.

```
varname = {'LastName'};
opts = setoptions(opts,varname,'MissingRule',"omitrow");
```

Preview Data Before Importing

Before importing the data, preview it by using the customized import options.

```
T = preview(opts)
```

```
T=8×10 table
     LastName      Gender     Age             Location              Height    Weight    Smoker
    __________    ________    ___    ___________________________    ______    ______    ______

    "Smith"       "Male"      38     "County General Hospital"        71       176        1
    "Johnson"     "Male"      43     "VA Hospital"                    69       163        0
    "Williams"    "Female"    38     "St. Mary's Medical Center"      64       131        0
    "Jones"       "Female"    40     "VA Hospital"                    67       133        0
    "Brown"       "Female"    49     "County General Hospital"        64       119        0
    "Davis"       "Female"    46     "St. Mary's Medical Center"      68       142        0
    "Miller"      "Female"    33     "VA Hospital"                    64       142        1
```

```
    "Wilson"      "Male"      40     "VA Hospital"                    68       180        0
```

Import Data Using Import Options

Import the variables with the customized data types by using the `sqlread` function, and display the first eight rows of imported data.

```
T = sqlread(conn,tablename,opts);
head(T)
```

```
ans=8×10 table
     LastName      Gender     Age              Location              Height    Weight    Smoker
    __________    ________    ___    ___________________________    ______    ______    ______

    "Smith"       "Male"      38     "County General Hospital"        71       176        1
    "Johnson"     "Male"      43     "VA Hospital"                    69       163        0
    "Williams"    "Female"    38     "St. Mary's Medical Center"      64       131        0
    "Jones"       "Female"    40     "VA Hospital"                    67       133        0
    "Brown"       "Female"    49     "County General Hospital"        64       119        0
    "Davis"       "Female"    46     "St. Mary's Medical Center"      68       142        0
    "Miller"      "Female"    33     "VA Hospital"                    64       142        1
    "Wilson"      "Male"      40     "VA Hospital"                    68       180        0
```

Delete Example Data and Close Database Connection

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`databaseImportOptions` | `setoptions` | `getoptions` | `preview` | `sqlread` | `database` | `close` | `sqlwrite` | `execute`

More About

- "Importing Data Common Errors" on page 3-3

External Websites

- SQL Tutorial

Deploy Relational Database Application with MATLAB Compiler

This example shows how to write a script to analyze data stored in a relational database, and deploy the script as a standalone application. Write code that connects to a database, imports data from the database into MATLAB®, analyzes the data, and closes the database connection. Then, you can deploy the code by compiling it as a standalone application by using the Application Compiler (MATLAB Compiler) app and running the application on other machines.

The example uses a JDBC driver to create the database connection. For a JDBC driver, include the JDBC driver JAR file among the files installed with your application. For an ODBC driver, install the ODBC driver and configure an ODBC data source on each machine where you run the application. For details about configuring ODBC and JDBC drivers, see "Configure Driver and Data Source" on page 2-14.

Overall, the example follows the steps described in "Create Standalone Application from MATLAB Function" (MATLAB Compiler) and updates the steps for a standalone database application.

Ensure that you have administrator privileges on the other machines to run the standalone application.

Create Function in MATLAB

Write a MATLAB script named `importAndAnalyzeDataFromDatabase.m` and save it in a file location of your choice. The script contains the `importAndAnalyzeDataFromDatabase` function, which returns the maximum product number from the data in the `productTable` database table. The function connects to a Microsoft® SQL Server® database and imports all data from `productTable`. Then, the function calculates the maximum product number.

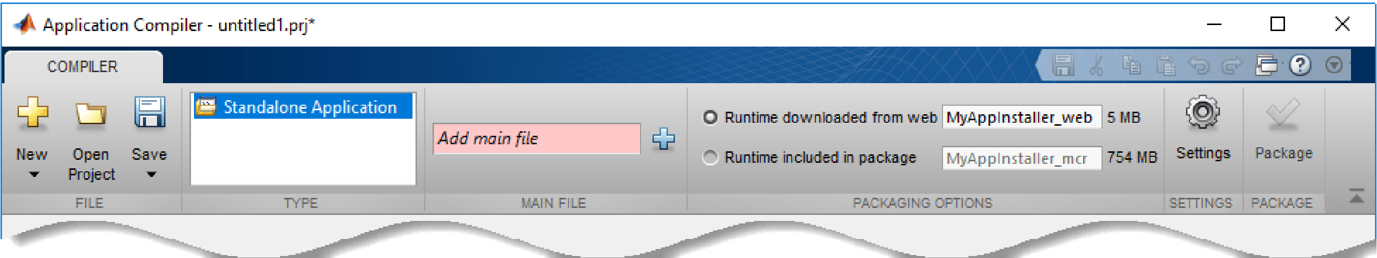
```
type importAndAnalyzeDataFromDatabase.m
```

```
function maxProdNum = importAndAnalyzeDataFromDatabase
%  IMPORTANDANALYZEDATAFROMDATABASE The importAndAnalyzeDataFromDatabase
%  function connects to a Microsoft® SQL Server® database using a JDBC
%  driver, imports data from the database into MATLAB®, performs a simple
%  data analysis, and closes the database connection.

%%
% Connect to the database by using the |Vendor| name-value pair argument of
% the database function to specify a connection to an |SQLServer| database.
% Set the |AuthType| name-value pair argument to |Server|. For example,
% this code assumes that you are connecting to a database named |dbname|,
% on a database server named |sname|, with the user name |username|, the
% password |pwd|, and the port number |123456|.
conn = database('dbname','username','pwd', ...
    'Vendor','Microsoft SQL Server','Server','sname', ...
    'AuthType','Server','PortNumber',123456);
%%
% Import data from the |productTable| database table.
tablename = 'productTable';
```

```
data = sqlread(conn,tablename);
%%
% Determine the highest product number among products.
prodNums = data.productnumber;
maxProdNum = max(prodNums);
%%
% Close the database connection.
close(conn)
end
```

Create Standalone Application Using Application Compiler App

On the **MATLAB Apps** tab, on the far right of the **Apps** section, click the arrow to open the apps gallery. Under **Application Deployment**, click **Application Compiler**.



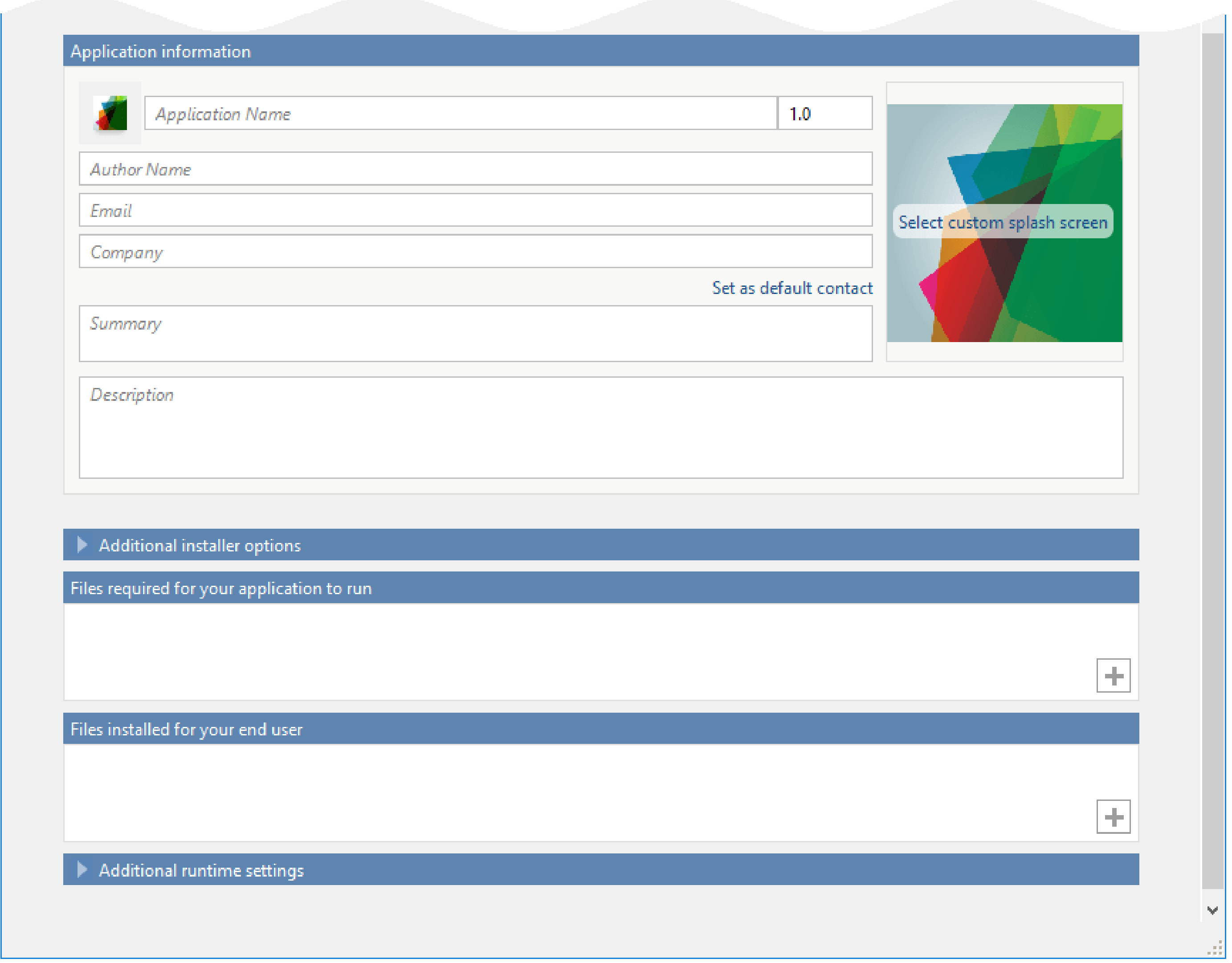
In the **MATLAB Compiler** project window, specify the main file of the MATLAB application that you want to deploy.

1. In the **Main File** section of the toolstrip, click .
2. In the **Add Files** dialog box, browse to the file location that contains your saved script. Select `importAndAnalyzeDataFromDatabase.m` and click **Open**. The Application Compiler app adds the `importAndAnalyzeDataFromDatabase` function to the list of main files.

Decide whether to include the MATLAB Runtime installer in the generated application by selecting one of the two options in the **Packaging Options** section:

- **Runtime downloaded from web** — Generates an installer that downloads the MATLAB Runtime and installs it along with the deployed MATLAB application
- **Runtime included in package** — Generates an installer that includes the MATLAB Runtime installer

Customize the packaged application and its appearance by entering the following options:



- **Application information** — Editable information about the deployed application. You can also customize the appearance of the standalone application by changing the application icon and splash screen. The generated installer uses this information to populate the installed application metadata.
- **Additional installer options** — Options for editing the default installation path for the generated installer and selecting a custom logo.
- **Files required for your application to run** — Additional files required by the generated application to run. The software includes these files in the generated application installer.
- **Files installed for your end user** — Files that are installed with your application. These files include the generated `readme.txt` file and the generated executable for the target platform. *To create a database connection using the standalone application, add the driver JAR file.* In this case, add `sqljdbc4.jar`.
- **Additional runtime settings** — Platform-specific options for controlling the generated executable.

For details about these options, see "Customize an Application" (MATLAB Compiler).

To generate the packaged application, click **Package** in the **Package** section on the toolstrip. In the Save Project dialog box, specify the location in which to save the project.

In the **Package** dialog box, verify that **Open output folder when process completes** is selected.

When the deployment process is complete, examine the generated output.

- `for_redistribution` — Folder containing the file that installs the application and the MATLAB Runtime.
- `for_testing` — Folder containing all the artifacts created by `mcc` (such as binary, JAR, header, and source files for a specific target). Use these files to test the installation.
- `for_redistribution_files_only` — Folder containing the files required for redistributing the application. Distribute these files to users who have MATLAB or MATLAB Runtime installed on their machines.
- `PackagingLog.txt` — Log file generated by MATLAB Compiler™.

Install and Run Standalone Application

To install the standalone application, in the `for_redistribution` folder, double-click the `MyAppInstaller_web` executable.

If you want to connect to the Internet using a proxy server, click **Connection Settings**. Enter the proxy server settings in the provided dialog box. Click **OK**.

To complete the installation, follow the instructions in the installation wizard.

To run your standalone application:

1. Open a terminal window.
2. Navigate to the folder in which you installed the application.
3. Run the application.

Test Standalone Application on Target Machine

Choose one target machine to test the MATLAB generated standalone application.

Copy the files in the `for_testing` folder to the target machine.

To test your standalone application:

1. Open a terminal window.
2. Navigate to the `for_testing` folder.
3. Run the application.

Deploy Standalone Application on Target Machines

Copy the `for_redistribution_files_only` folder to a file location on all target machines where MATLAB or MATLAB Runtime is installed.

Run the MATLAB generated standalone application on all target machines by using the executable in the `for_redistribution_files_only` folder.

See Also

`database` | `close` | `sqlread`

More About

- "Create Functions in Files"
- "Create Standalone Application from MATLAB Function" (MATLAB Compiler)
- "Customize an Application" (MATLAB Compiler)
- "Import Data from Database Table Using sqlread Function" on page 5-58

Import Data Using SQL Prepared Statement with Multiple Parameter Values

This example shows how to import data from a Microsoft® SQL Server® database using an SQL prepared statement with a JDBC database connection. Use the SELECT SQL statement in a loop to execute the same SQL query for multiple values. Import the data from the database and display the results.

The SQL prepared statement is a database feature that enables you to execute the same SQL statement repeatedly with high efficiency. As you define the SQL prepared statement and bind values to parameters, the database completes these actions:

- Create an SQL statement template with parameters.
- Parse, compile, and perform query optimization on the SQL statement template, and store the results without execution.
- Bind values to the parameters and execute the SQL statement. (An application can execute the statement as many times as specified with different values.)

The advantages of using SQL prepared statements include improved performance and security.

You can execute SQL prepared statements by using a JDBC database connection only.

Connect to Database

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
conn = database(datasource,'','');
```

Create SQL Prepared Statement

Create an SQL prepared statement for importing data from the SQL Server database using the JDBC database connection. The question marks in the SELECT SQL statement indicate it is an SQL prepared statement. This statement selects all data from the database table productTable for specified product descriptions.

```
query = strcat("SELECT * FROM productTable ", ...
    "WHERE productDescription = ?");
pstmt = databasePreparedStatement(conn,query);
```

Bind Multiple Values and Execute SQL Prepared Statement

Select the single parameter in the SQL prepared statement using its numeric index. Specify the values to bind as a string array containing three product descriptions: train set, engine kit, and slinky.

```
selection = [1];
values = ["Train Set" "Engine Kit" "Slinky"];
```

Bind parameter values in the SQL prepared statement. Using a for loop, bind the values for each product description and import data from the database using the bound parameter values. The results contain a table with three rows of data for the products with the specified product descriptions.

```
for i = 1:3
    pstmt = bindParamValues(pstmt,selection,values(i));
    results(i,:) = fetch(conn,pstmt);
end
results
```

```
results=3×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          8          2.1257e+05          1001             5         {'Train Set' }
          7          3.8912e+05          1007            16         {'Engine Kit'}
          3            4.01e+05          1009            17         {'Slinky'    }
```

Close SQL Prepared Statement and Database Connection

```
close(pstmt)
close(conn)
```

See Also

database | close | databasePreparedStatement | bindParamValues | close | fetch

More About

- “SQL Prepared Statement Error Messages” on page 3-16

6

MySQL Native Interface Topics

Configure MySQL Native Interface Data Source

This tutorial shows how to set up a MySQL native interface data source and connect to a MySQL database using the Database Explorer app or the command line. This tutorial uses the MariaDB C Connector driver to connect to a MySQL database.

The configuration steps show configuring the MySQL native data source on the Windows platform. The same steps work on Linux and macOS platforms.

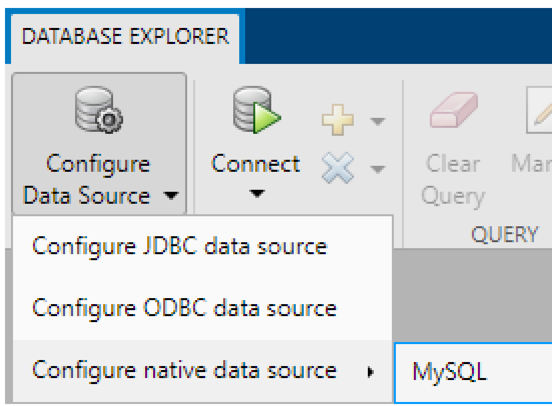
Database Toolbox provides MariaDB C Connector driver for connecting to MySQL server. Therefore, you do not have to install and configure the driver.

Step 1. Set up the data source.

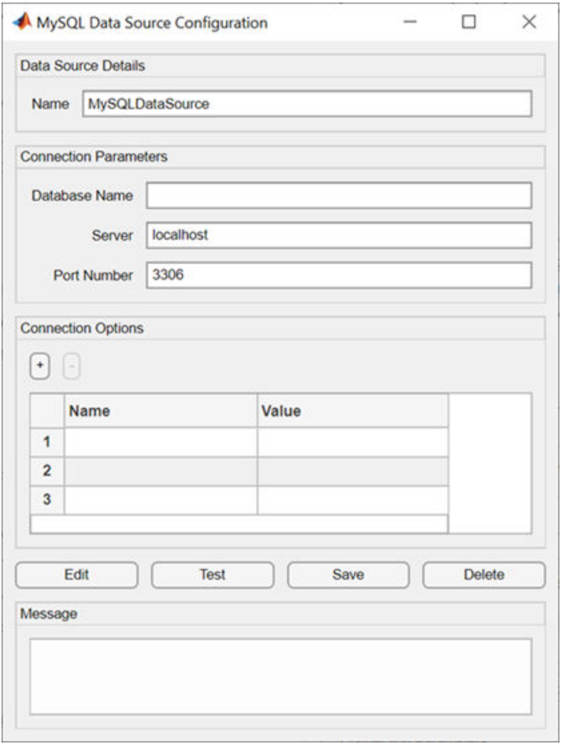
You can set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure native data source** > **MySQL**.

   The MySQL Data Source Configuration dialog box opens.
3. In the **Name** box, enter the name of your data source. (This example uses a data source named `MySQLDataSource`.) You use this name to establish a connection to your database.



4 In the **Database Name** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

5 Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The MySQL Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1 Create a MySQL native interface data source for a MySQL database.

```
vendor = "MySQL";
opts = databaseConnectionOptions("native",vendor);
```

2 Set the database connection options. For example, this code assumes that you are connecting to a data source named `MySQLDataSource`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306);
```

3. Test the database connection by specifying the user name and password.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password);
```

4. Save the data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the MySQL database using the Database Explorer app or the command line.

Step 2. Connect using the Database Explorer app or the command line.

Connect to MySQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. In the **Catalog** list, select the catalog. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to MySQL Using Command Line

1. Connect to a MySQL database using the configured MySQL native interface data source, user name, and password.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

2. Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

Functions
`mysql` | `close` | `databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection` | `setenv`

More About

- “Import Data from MySQL Database Table” on page 6-6
- “Create SQL Queries Using Database Explorer App” on page 4-2
- “Join Tables Using Database Explorer App” on page 4-10
- “Data Preview Using Database Explorer App” on page 4-14
- “Modify and Delete Data Sources” on page 4-17
- “Database Explorer App Error Messages” on page 3-14

Import Data from MySQL Database Table

This example shows how to import data from a table in a MySQL® database into the MATLAB® workspace using the `sqlread` and `fetch` functions with the MySQL native interface.

Connect to Database

Create a MySQL native interface database connection using the data source name `MySQLDataSource` and a user name and password. The MySQL database contains the table `productTable`.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Import Data from Database Table Using `sqlread` Function

Import product data from the database table `productTable` by using the `sqlread` function and the database connection. This function imports data as a MATLAB table.

```
tablename = "productTable";
data = sqlread(conn,tablename);
```

Display the product number and description in the imported data.

```
data(:,[1 5])
```

```
ans=10×2 table
    productNumber    productDescription
    _____________    __________________

          9          "Victorian Doll"
          8          "Train Set"
          7          "Engine Kit"
          2          "Painting Set"
          4          "Space Cruiser"
          1          "Building Blocks"
          5          "Tin Soldier"
          6          "Sail Boat"
          3          "Slinky"
         10          "Teddy Bear"
```

Import Data from Database Table Using `fetch` Function

Import product data from the database table `productTable` by using the `fetch` function and the database connection. Create an SQL query to import data that is sorted by product description alphabetically. The `fetch` function imports data as a MATLAB table.

```
sqlquery = "SELECT * FROM productTable ORDER BY productDescription ASC";
data = fetch(conn,sqlquery);
```

Display the product number and description in the imported data.

```
data(:,[1 5])
```

```
ans=10×2 table
    productNumber    productDescription
    _____________    __________________

          1          "Building Blocks"
          7          "Engine Kit"
          2          "Painting Set"
          6          "Sail Boat"
          3          "Slinky"
          4          "Space Cruiser"
         10          "Teddy Bear"
          5          "Tin Soldier"
          8          "Train Set"
          9          "Victorian Doll"
```

Close Database Connection

```
close(conn)
```

See Also

mysql | close | sqlread | executeSQLScript

More About

- "Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface" on page 6-8

External Websites

- MySQL Documentation

Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface

This example shows how to customize import options when importing data from a database table using the MySQL® native interface. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for multiple database columns. Import data using the `sqlread` function.

The example uses the `patients.xls` spreadsheet, which contains patient information. Also, the example uses a MySQL database with the MariaDB® C Connector driver.

Create Database Connection

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Load Example Data

Load patient information into the MATLAB® workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Create `SQLImportOptions` Object

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Display the default data types of the variables by accessing the `VariableNames` and `VariableTypes` properties of the `SQLImportOptions` object using dot notation.

```
disp([opts.VariableNames' opts.VariableTypes'])
```

```
    {'LastName'                }    {'string' }
    {'Gender'                  }    {'string' }
    {'Age'                     }    {'double' }
    {'Location'                }    {'string' }
    {'Height'                  }    {'double' }
    {'Weight'                  }    {'double' }
    {'Smoker'                  }    {'logical'}
    {'Systolic'                }    {'double' }
    {'Diastolic'               }    {'double' }
    {'SelfAssessedHealthStatus'}    {'string' }
```

Customize Import Options

Change the data types of multiple variables. Convert the data type for all text variables to `string`. Also, convert the data type for all numeric variables to `single`.

```
textvars = ["LastName" "Gender" "Location" "SelfAssessedHealthStatus"];
opts = setoptions(opts,textvars,'Type',"string");

numvars = ["Age" "Height" "Weight" "Systolic" "Smoker" "Diastolic"];
opts = setoptions(opts,numvars,'Type',"single");
```

Display the updated data types of the variables.

```
disp([opts.VariableNames' opts.VariableTypes'])
```

```
    {'LastName'                }    {'string'}
    {'Gender'                  }    {'string'}
    {'Age'                     }    {'single'}
    {'Location'                }    {'string'}
    {'Height'                  }    {'single'}
    {'Weight'                  }    {'single'}
    {'Smoker'                  }    {'single'}
    {'Systolic'                }    {'single'}
    {'Diastolic'               }    {'single'}
    {'SelfAssessedHealthStatus'}    {'string'}
```

Set the import options to replace missing data in the specified variables with the fill value `unknown`.

```
varnames = ["LastName" "Location"];
opts = setoptions(opts,varnames,'FillValue',"unknown");
```

Set the import options to omit rows with missing data in the `LastName` variable.

```
varname = "LastName";
opts = setoptions(opts,varname,'MissingRule',"omitrow");
```

Preview Data Before Importing

Before importing the data, preview it by using the customized import options.

```
T = preview(opts)
```

```
T=8×10 table
     LastName       Gender      Age             Location              Height    Weight    Smoker
    __________    ________    ___    ___________________________    ______    ______    ______

    "Smith"       "Male"      38     "County General Hospital"        71        176        1
    "Johnson"     "Male"      43     "VA Hospital"                    69        163        0
    "Williams"    "Female"    38     "St. Mary's Medical Center"      64        131        0
    "Jones"       "Female"    40     "VA Hospital"                    67        133        0
    "Brown"       "Female"    49     "County General Hospital"        64        119        0
    "Davis"       "Female"    46     "St. Mary's Medical Center"      68        142        0
    "Miller"      "Female"    33     "VA Hospital"                    64        142        1
    "Wilson"      "Male"      40     "VA Hospital"                    68        180        0
```

Import Data Using Import Options

Import the variables with the customized data types by using the `sqlread` function, and display the first eight rows of imported data.

```
T = sqlread(conn,tablename,opts);
head(T)
```

```
     LastName       Gender      Age              Location              Height    Weight    Smoker
    __________    _________    ___    ______________________________    ______    ______    ______

    "Smith"       "Male"       38     "County General Hospital"           71        176        1
    "Johnson"     "Male"       43     "VA Hospital"                       69        163        0
    "Williams"    "Female"     38     "St. Mary's Medical Center"         64        131        0
    "Jones"       "Female"     40     "VA Hospital"                       67        133        0
    "Brown"       "Female"     49     "County General Hospital"           64        119        0
    "Davis"       "Female"     46     "St. Mary's Medical Center"         68        142        0
    "Miller"      "Female"     33     "VA Hospital"                       64        142        1
    "Wilson"      "Male"       40     "VA Hospital"                       68        180        0
```

Delete Example Data and Close Database Connection

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

`databaseImportOptions` | `mysql` | `close` | `sqlwrite` | `setoptions` | `preview` | `sqlread` | `execute`

More About

- “Import Data from MySQL Database Table” on page 6-6

External Websites

- MySQL Documentation

Import Large Data Using DatabaseDatastore Object and MySQL Native Interface

This example shows how to use the `databaseDatastore` function to create a `DatabaseDatastore` object for accessing collections of data stored in a MySQL® database using the MySQL native interface. After creating a `DatabaseDatastore` object, you can preview data, read data in chunks, and read every record in the data set.

To analyze large data, you can run algorithms on large data sets using a tall array. Alternatively, you can write a MapReduce algorithm that defines the chunking and reduction of the data.

This example uses a preconfigured MySQL data source to create the database connection. For more information, see the `databaseConnectionOptions` function.

Create `DatabaseDatastore` Object

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This query retrieves all data from the `airlinesmall` table.

```
sqlquery = "select * from airlinesmall";
dbds = databaseDatastore(conn,sqlquery);
```

Preview Data in `DatabaseDatastore` Object

Preview the first eight records in the data set returned by executing the SQL query.

```
preview(dbds)
```

```
ans=8×29 table
    Year     Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____     _____    __________    _________    _______    __________    _______    __________

    1990       9          11            2         1810         1812        1939         1930
    1990      10          27            6         1353         1355        1634         1640
    1990      10          23            2         1057         1055        1205         1155
    1990      10           8            1         1515         1440        1609         1535
    1990      10          19            5         1130         1120        1203         1154
    1990      10          12            5         1755         1733        1858         1820
    2001      11          22            4         1345         1355        1530         1549
    2001      11          26            1         2105         2110        2209         2237
```

Read Data in `DatabaseDatastore` Object

Read the first 10 records.

```
dbds.ReadSize = 10;
read(dbds)
```

```
ans=10×29 table
    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1990      9          11            2         1810         1812        1939         1930
    1990     10          27            6         1353         1355        1634         1640
    1990     10          23            2         1057         1055        1205         1155
    1990     10           8            1         1515         1440        1609         1535
    1990     10          19            5         1130         1120        1203         1154
    1990     10          12            5         1755         1733        1858         1820
    2001     11          22            4         1345         1355        1530         1549
    2001     11          26            1         2105         2110        2209         2237
    2001     11          18            7         1407         1415        1442         1457
    2001     12          23            7         1327         1310        1530         1530
```

Read the `DatabaseDatastore` object two more times by using the counter `n`. Read 10 records at a time.

```
n = 0;
while(hasdata(dbds) && n~=2)
    read(dbds)
    n = n+1;
end
```

```
ans=10×29 table
    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    2001     12           8            6         1402         1410        1642         1626
    2001     12          22            6         1707         1715        1823         1821
    2001     12           9            7          656          650         824          823
    2002      6          19            3          632          640         748          756
    2002      6          10            1          927          930        1031         1031
    2002      6          15            6         1120         1115        1401         1413
    2002      6           8            6         1557         1600        1703         1711
    2002      6          26            3         2026         1840          47         2257
    2002      6           5            3         2032         2031        2233         2248
    2002      7          25            4         1032         1035        1853         1852

ans=10×29 table
    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1987     10          30            5         1329         1329        1434         1436
    1987     11           7            6         1316         1315        1713         1647
    1987     11          28            6          815          815        1015         1015
    1987     11           2            1          700          700         800          800
    1987     11          14            6          840          840        1127         1120
    1987     11           1            7         1625         1625        1823         1758
    1987     11          26            4         1314         1315        1538         1542
    1992      7          18            6         1538         1540        1703         1720
    1992      7          19            7          932          932        1130         1052
    1992      8           4            2          NaN         1815         NaN         1940
```

Reset `DatabaseDatastore` Object

Reset the `DatabaseDatastore` object to its original state, where no data has been read from it. Resetting allows you to reread from the same `DatabaseDatastore` object.

```
reset(dbds)
```

Read Every Record in `DatabaseDatastore` Object

Read every record in the `DatabaseDatastore` object in increments of 50,000 records at a time.

```
dbds.ReadSize = 50000;
data = readall(dbds);
```

Display the first three records of the full data set.

```
head(data,3)
```

```
ans=3×29 table
    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1990      9          11            2         1810         1812        1939         1930
    1990     10          27            6         1353         1355        1634         1640
    1990     10          23            2         1057         1055        1205         1155
```

Close `DatabaseDatastore` Object and Database Connection

```
close(dbds)
```

See Also

`mysql` | `close` | `hasdata` | `preview` | `read` | `readall` | `databaseDatastore`

More About

- "Import Data from MySQL Database Table" on page 6-6

Insert Data into Database Table Using MySQL Native Interface

This example shows how to import data from a database into MATLAB®, perform calculations on the data, and export the results to a database table.

The example assumes that you are connecting to a MySQL® database that contains tables named `salesVolume` and `yearlySales`. Also, the example uses a MySQL database with the MariaDB® C Connector driver. The `salesVolume` table contains the column names for each month. The `yearlySales` table contains the column names `Month` and `SalesTotal`.

Create Database Connection

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Calculate Sum of Sales Volume for One Month

Import sales volume data for the month of March using the database connection. The `salesVolume` database table contains sales volume data.

```
tablename = "salesVolume";
data = sqlread(conn,tablename);
```

Display the first three rows of sales volume data. The fourth variable contains the data for the month of March.

```
head(data(:,4),3)
```

```
ans=3×1 table
    March
    _____

     981
    1414
     890
```

Calculate the sum of the March sales. Assign the result to the MATLAB workspace variable `total` and display the result.

```
total = sum(data.March)
```

```
total = 14606
```

Insert Total Sales for One Month into Database

Retrieve the name of the month from the sales volume data.

```
month = data.Properties.VariableNames(4);
```

Define the names of the columns for the data to insert as a string array.

```
colnames = ["Month" "SalesTotal"];
```

Create a MATLAB table that stores the data to export.

```
results = table(month,total,'VariableNames',colnames);
```

Determine the status of the `AutoCommit` database flag. This status determines whether or not the insert action can be undone.

```
conn.AutoCommit
```

```
ans = 
"on"
```

The `AutoCommit` flag is set to `on`. The database commits the exported data automatically to the database, and this action cannot be undone.

Insert the sum of sales for the month of March into the `yearlySales` table using the `toystore_doc` catalog.

```
tablename = "yearlySales";
sqlwrite(conn,tablename,results,'Catalog','toystore_doc')
```

Import the data from the `yearlySales` table. This data contains the calculated result.

```
data = sqlread(conn,tablename)
```

```
data=1×2 table
     Month     SalesTotal
    _______    __________

    "March"      14606
```

Close Database Connection

```
close(conn)
```

See Also

`mysql` | `close` | `sqlread` | `sqlwrite`

More About

- “Import Data from MySQL Database Table” on page 6-6
- “Delete Data from Database Using MySQL Native Interface” on page 6-19
- “Roll Back Data in Database Using MySQL Native Interface” on page 6-16

Roll Back Data in Database Using MySQL Native Interface

This example shows how to connect to a database, insert a row into an existing database table, and roll back the insert using the MySQL® native interface. The example uses a MySQL database with the MariaDB® C Connector driver. The database contains the table `productTable`.

Create Database Connection

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Append Data to Existing Database Table

Set the `AutoCommit` property of the `connection` object to `off`. Any updates you make after turning off this flag do not commit to the database automatically.

```
conn.AutoCommit = "off";
```

To view the existing database table `productTable` before appending data, import its contents into MATLAB® and display the last few rows.

```
tablename = "productTable";
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17           "Pancakes"
         14           5.101e+05          1011            19           "Shawl"
         15          8.9975e+05          1011            20           "Snacks"
```

Create a MATLAB table that contains the data for one product.

```
data = table(30,500000,1000,25,"Rubik's Cube", ...
    'VariableNames',["productnumber" "stocknumber" ...
    "suppliernumber" "unitcost" "productdescription"]);
```

Append the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17          "Pancakes"
```

```
         14           5.101e+05          1011            19          "Shawl"
         15          8.9975e+05          1011            20          "Snacks"
         30               5e+05          1000            25          "Rubik's Cube"
```

Roll Back Data

Roll back the inserted row.

```
rollback(conn)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results no longer contain the inserted row.

```
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17            "Pancakes"
         14           5.101e+05          1011            19            "Shawl"
         15          8.9975e+05          1011            20            "Snacks"
```

Close Database Connection

```
close(conn)
```

See Also

mysql | close | sqlread | sqlwrite | rollback

More About

- “Create Table and Add Column Using MySQL Native Interface” on page 6-18
- “Delete Data from Database Using MySQL Native Interface” on page 6-19

Create Table and Add Column Using MySQL Native Interface

This example shows how to connect to a database and manage the database structure using the MySQL® native interface. You can manage the database structure using the `execute` function.

Create Database Connection

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Create Database Table

Use the SQL CREATE statement to create the database table `Person`.

```
sqlquery = strcat("CREATE TABLE Person(lastname VARCHAR(250), ", ...
    "firstname VARCHAR(250), address VARCHAR(300), age INT)");
```

Create the table in the database using the database connection.

```
execute(conn,sqlquery)
```

Add Database Column

Use the SQL ALTER statement to add the database column `city` to the table `Person`.

```
sqlquery = "ALTER TABLE Person ADD city VARCHAR(30)";
execute(conn,sqlquery)
```

Close Database Connection

```
close(conn)
```

See Also
`mysql` | `close` | `execute`

More About

- "Delete Data from Database Using MySQL Native Interface" on page 6-19
- "Roll Back Data in Database Using MySQL Native Interface" on page 6-16

External Websites
- MySQL Documentation

Delete Data from Database Using MySQL Native Interface

This example shows how to delete data from a database using MATLAB®. Create the SQL statement using deletion SQL syntax; consult your database documentation for the correct syntax. Execute the delete operation on your database using the `execute` function with the SQL statement. This example demonstrates deleting records from a MySQL® database.

Create Database Connection

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

The SQL query `sqlquery` selects all rows of data in the table `inventoryTable`. Execute this SQL query using the database connection. Import the data from the executed query using the `fetch` function, and display the last few rows.

```
sqlquery = "SELECT * FROM inventoryTable";
data = fetch(conn,sqlquery);
tail(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _____________________

         11             567          0    "2012-09-11 00:30:24"
         12            1278          0    "2010-10-29 18:17:47"
         13            1700       14.5    "2009-05-24 10:58:59"
```

Delete Specific Record

Delete the record for the product number `13` from the table `inventoryTable`. Specify the product number using the `WHERE` clause in the SQL statement `sqlquery`.

```
sqlquery = "DELETE FROM inventoryTable WHERE productnumber = 13";
execute(conn,sqlquery)
```

Display the data in the table `inventorytable` after the deletion. The record with product number `13` is missing.

```
sqlquery = "SELECT * FROM inventoryTable";
data = fetch(conn,sqlquery);
tail(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _____________________

         10             723        24     "2012-03-14 13:13:09"
         11             567         0     "2012-09-11 00:30:24"
         12            1278         0     "2010-10-29 18:17:47"
```

Close Database Connection

```
close(conn)
```

See Also

`mysql` | `close` | `fetch` | `execute`

More About

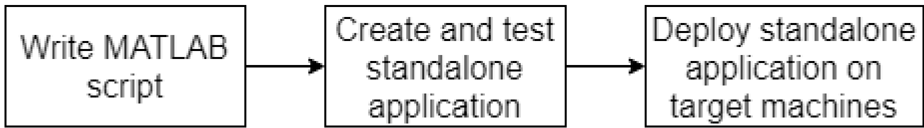
- “Create Table and Add Column Using MySQL Native Interface” on page 6-18
- “Roll Back Data in Database Using MySQL Native Interface” on page 6-16

External Websites

- MySQL Documentation

Deploy MySQL Native Interface Database Application with MATLAB Compiler

This example shows how to write a script to analyze data stored in a MySQL® database using the MySQL native interface, and deploy the script as a standalone application. Write code that connects to a database, imports data from the database into MATLAB®, analyzes the data, and closes the database connection. Then, you can deploy the code by compiling it as a standalone application using the Application Compiler (MATLAB Compiler) app, and then running the application on other machines.



The example uses the MySQL native interface to create the database connection. Overall, the example follows the steps described in “Create Standalone Application from MATLAB Function” (MATLAB Compiler) and updates the steps for a standalone database application.

Before you begin, note the following:

- You must first install the MySQL/C++ Connector file on each machine where you plan to run the standalone application. For details about configuring the data source, see “Configure MySQL Native Interface Data Source” on page 6-2.
- You must have administrator privileges on each machine where you plan to run the standalone application.

Create Function in MATLAB

Create a MATLAB script named `importMySQLNative.m` and save it in a file location of your choice. The script contains the `importMySQLNative` function, which returns the maximum product number from the data in the `productTable` database table. The function connects to a MySQL database and imports all data from `productTable`. Then, the function calculates the maximum product number.

You must use the syntax with name-value pair arguments when you connect to the database using the `mysql` function.

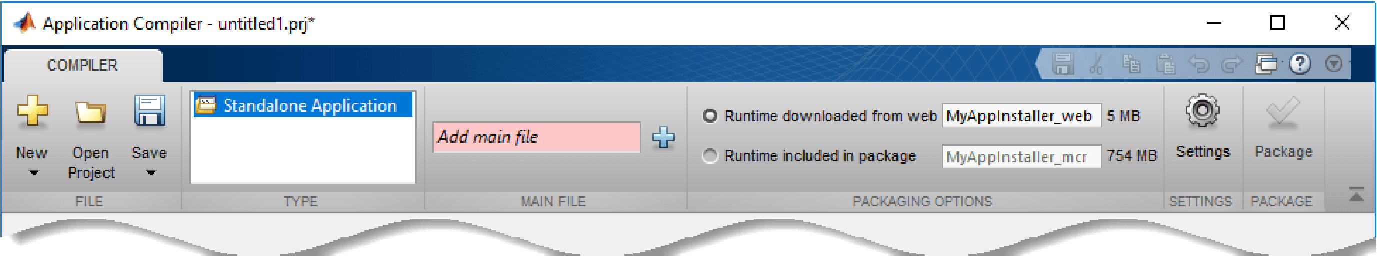
```
type importMySQLNative.m
```

```
function maxProdNum = importMySQLNative
%  IMPORTMYSQLNATIVE The importMySQLNative function connects to a MySQL®
%  database using the MySQL native interface, imports data from the
%  database into MATLAB®, performs a simple data analysis, and closes the
%  database connection. The database contains a table named |productTable|.

%%
% Connect to the database by using name-value pair arguments of the |mysql|
% function to specify a connection to a MySQL database. For example, this
% code assumes that you are using the user name |username|, password |pwd|,
% database |dbname|, database server |sname|, and port number |3306|.
conn = mysql("username","pwd", ...
    "DatabaseName","dbname",  ...
    "Server","sname", ...
```

```
    "PortNumber",3306);
%%
% Import data from the |productTable| database table.
tablename = "productTable";
data = sqlread(conn,tablename);
%%
% Determine the highest product number among products.
prodNums = data.productnumber;
maxProdNum = max(prodNums);
%%
% Close the database connection.
close(conn)
end
```

Create Standalone Application Using Application Compiler App

On the **MATLAB Apps** tab, on the far right of the **Apps** section, click the arrow to open the apps gallery. Under **Application Deployment**, click **Application Compiler**.



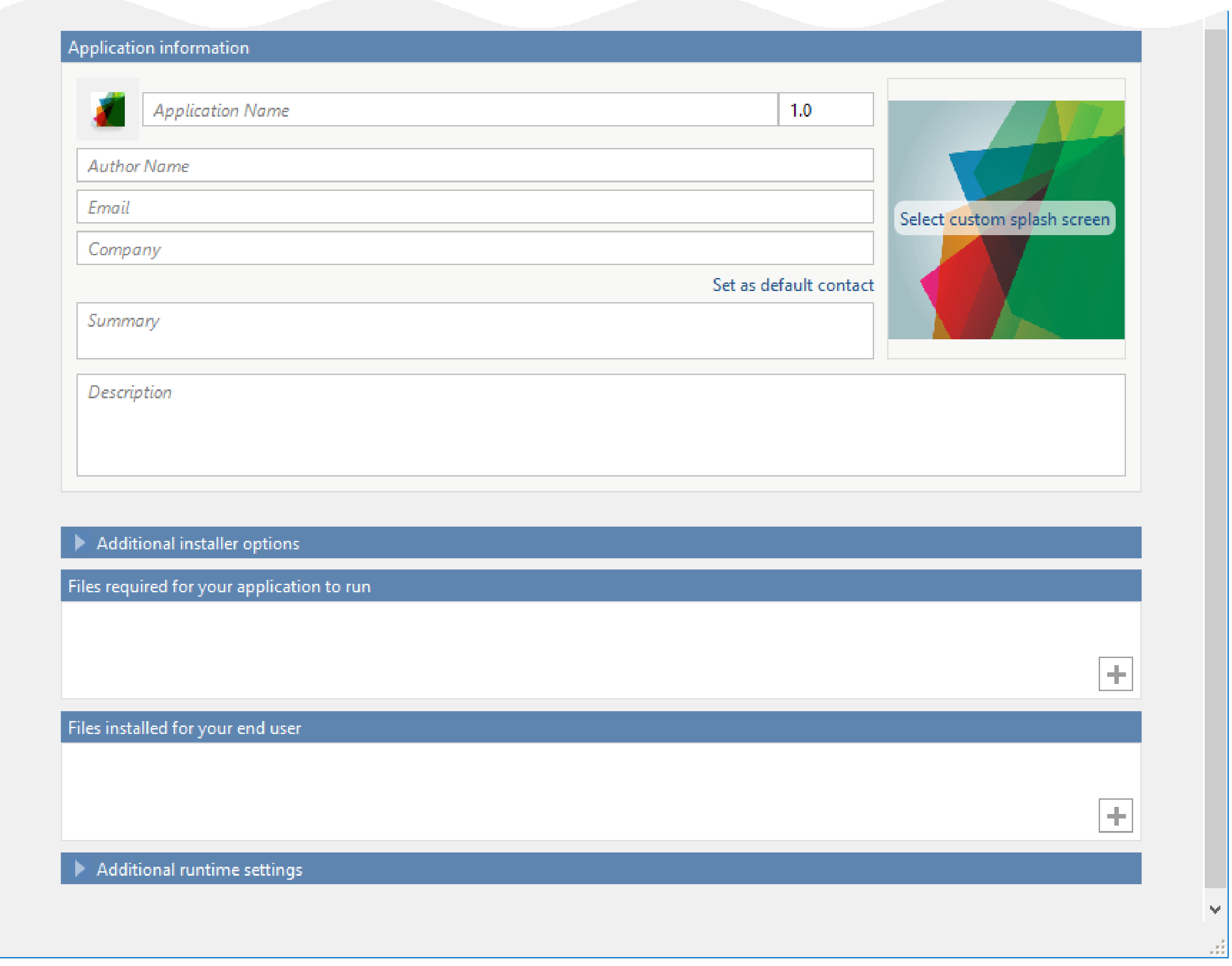
In the **MATLAB Compiler** project window, specify the main file of the MATLAB application that you want to deploy.

1. In the **Main File** section of the toolstrip, click the plus sign button to add a main file.
2. In the **Add Files** dialog box, browse to the file location that contains your saved script. Select `importMySQLNative.m` and click **Open**. The Application Compiler app adds the `importMySQLNative` function to the list of main files.

Decide whether to include the MATLAB Runtime installer in the generated application by selecting one of the two options in the **Packaging Options** section:

- **Runtime downloaded from web** — Generates an installer that downloads MATLAB Runtime and installs it along with the deployed MATLAB application
- **Runtime included in package** — Generates an installer that includes the MATLAB Runtime installer

Customize the packaged application and its appearance by specifying the following options:



- **Application information** — Editable information about the deployed application. You can also customize the appearance of the standalone application by changing the application icon and splash screen. The generated installer uses this information to populate the installed application metadata.
- **Additional installer options** — Options for editing the default installation path for the generated installer and selecting a custom logo.
- **Files required for your application to run** — Additional files required by the generated application to run. The software includes these files in the generated application installer.
- **Files installed for your end user** — Files that are installed with your application. These files include the generated `readme.txt` file and the generated executable for the target platform. To create a database connection using the standalone application, add the MySQL/C++ Connector file.
- **Additional runtime settings** — Platform-specific options for controlling the generated executable.

For details about these options, see “Customize an Application” (MATLAB Compiler).

To generate the packaged application, click **Package** in the **Package** section on the toolstrip. In the Save Project dialog box, specify the location in which to save the project.

In the **Package** dialog box, verify that the option **Open output folder when process completes** is selected.

When the deployment process is complete, examine the generated output:

- `for_redistribution` — Folder containing the file that installs the application and MATLAB Runtime.
- `for_testing` — Folder containing all the artifacts created by `mcc` (such as binary, JAR, header, and source files for a specific target). Use these files to test the installation.
- `for_redistribution_files_only` — Folder containing the files required for redistributing the application. Distribute these files to users who have MATLAB or MATLAB Runtime installed on their machines.
- `PackagingLog.txt` — Log file generated by MATLAB Compiler™.

Install and Run Standalone Application

To install the standalone application, double-click the `MyAppInstaller_web` executable in the `for_redistribution` folder.

If you want to connect to the Internet using a proxy server, click **Connection Settings**. Enter the proxy server settings in the provided dialog box. Click **OK**.

To complete the installation, follow the instructions in the installation wizard.

To run your standalone application:

1. Open a terminal window.
2. Navigate to the folder in which you installed the application.
3. Run the application.

Test Standalone Application on Target Machine

Choose one target machine to test the MATLAB generated standalone application.

Copy the files in the `for_testing` folder to the target machine.

To test your standalone application:

1. Open a terminal window.
2. Navigate to the `for_testing` folder.
3. Run the application.

Deploy Standalone Application on Target Machines

Copy the `for_redistribution_files_only` folder to a file location on all target machines where MATLAB or MATLAB Runtime is installed.

Run the MATLAB generated standalone application on all target machines by using the executable in the `for_redistribution_files_only` folder.

See Also

`mysql` | `close` | `sqlread`

More About

- "Create Functions in Files"
- "Create Standalone Application from MATLAB Function" (MATLAB Compiler)
- "Customize an Application" (MATLAB Compiler)
- "Import Data from MySQL Database Table" on page 6-6

External Websites

- MySQL Documentation

7

PostgreSQL Native Interface Topics

Configure PostgreSQL Native Interface Data Source

This tutorial shows how to set up a PostgreSQL native interface data source and connect to a PostgreSQL database using the Database Explorer app or the command line. The tutorial uses the libpq driver version 10.12 to connect to a PostgreSQL version 9.405 database.

The configuration steps show configuring the PostgreSQL native data source on the Windows platform. The same steps work on Linux and macOS platforms.

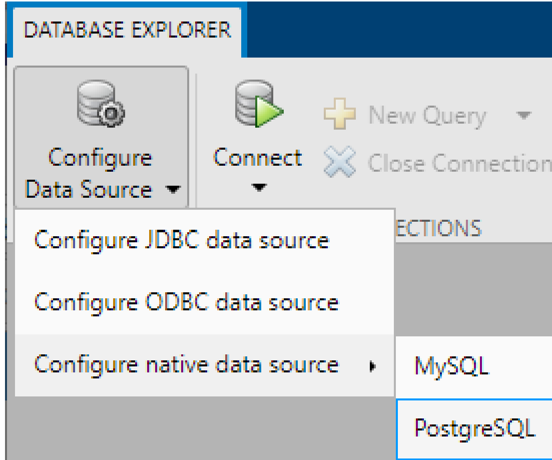
Database Toolbox includes the libpq driver. Therefore, you do not have to install and configure the driver.

Step 1. Set up the data source.

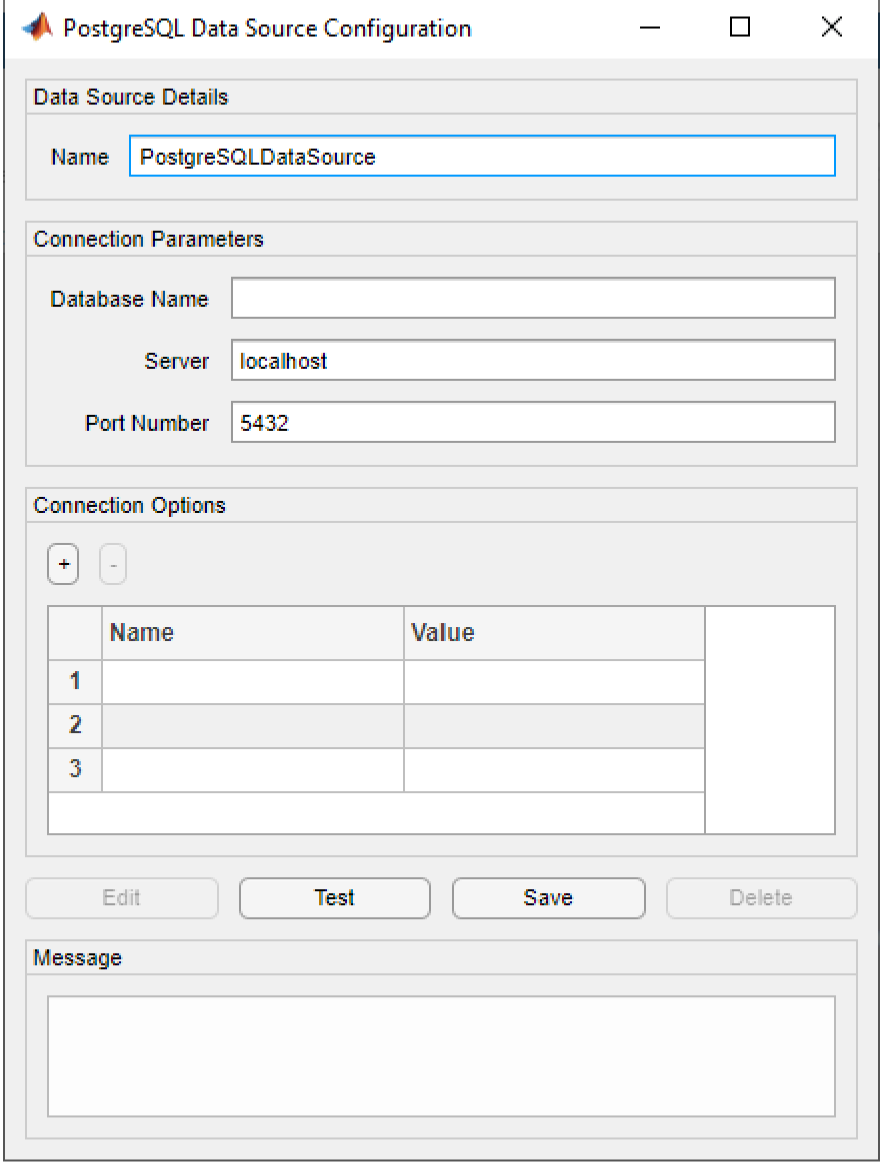
You can set up a data source using the Database Explorer app or the command line.

Set Up Data Source Using Database Explorer App

1. Open the Database Explorer app by clicking the **Apps** tab on the MATLAB Toolstrip. Then, on the right of the **Apps** section, click the **Show more** arrow to open the apps gallery. Under **Database Connectivity and Reporting**, click **Database Explorer**. Alternatively, enter `databaseExplorer` at the command line.
2. In the **Data Source** section, select **Configure Data Source** > **Configure native data source** > **PostgreSQL**.



   The PostgreSQL Data Source Configuration dialog box opens.
3. In the **Name** box, enter the name of your data source. (This example uses a data source named `PostgreSQLDataSource`.) You use this name to establish a connection to your database.



4 In the **Database Name** box, enter the name of your database. In the **Server** box, enter the name of your database server. Consult your database administrator for the name of your database server. In the **Port Number** box, enter the port number.

5 Under **Connection Options**, in the **Name** column, enter the name of an additional driver-specific option. Then, in the **Value** column, enter the value of the driver-specific option. Click the plus sign **+** to specify additional driver-specific options.

6 Click **Test**. The Test Connection dialog box opens. Enter the user name and password for your database. Click **Test**.

   If your connection succeeds, the Database Explorer dialog box displays a message indicating the connection is successful. Otherwise, it displays an error message.

7 Click **Save**. The PostgreSQL Data Source Configuration dialog box displays a message indicating the data source is saved successfully. Close this dialog box.

Set Up Data Source Using Command Line

1. Create a PostgreSQL native interface data source for a PostgreSQL database.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("native",vendor);
```

2. Set the database connection options. For example, this code assumes that you are connecting to a data source named `PostgreSQLDataSource`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432);
```

3. Test the database connection by specifying the user name and password.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password);
```

4. Save the data source.

```
saveAsDataSource(opts)
```

After you complete the data source setup, connect to the PostgreSQL database using the Database Explorer app or the command line.

Step 2. Connect using the Database Explorer app or the command line.

Connect to PostgreSQL Using Database Explorer App

1. On the **Database Explorer** tab, in the **Connections** section, click **Connect** and select the data source for the connection.
2. In the connection dialog box, enter a user name and password. Click **Connect**.

   The Catalog and Schema dialog box opens.
3. Select the catalog and schema from the **Catalog** and **Schema** lists. Click **OK**.

   The app connects to the database and displays its tables in the **Data Browser** pane. A data source tab appears to the right of the pane. The title of the data source tab is the data source name that you defined during the setup. The data source tab contains empty **SQL Query** and **Data Preview** panes.
4. Select tables in the **Data Browser** pane to query the database.
5. Close the data source tab to close the SQL query. In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Connect to PostgreSQL Using Command Line

1 Connect to a PostgreSQL database using the configured PostgreSQL native interface data source, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

2 Close the database connection.

```
close(conn)
```

See Also

Apps
Database Explorer

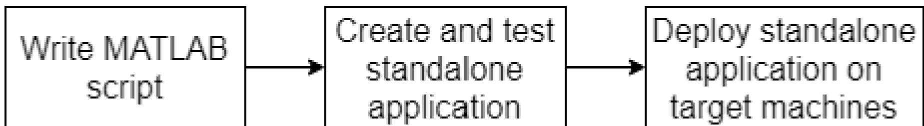
Functions
`databaseConnectionOptions` | `saveAsDataSource` | `setoptions` | `testConnection` | `postgresql` | `close`

More About

- "Create SQL Queries Using Database Explorer App" on page 4-2
- "Join Tables Using Database Explorer App" on page 4-10
- "Data Preview Using Database Explorer App" on page 4-14
- "Modify and Delete Data Sources" on page 4-17
- "Database Explorer App Error Messages" on page 3-14

Deploy PostgreSQL Native Interface Database Application with MATLAB Compiler

This example shows how to write a script to analyze data stored in a PostgreSQL database using the PostgreSQL native interface, and deploy the script as a standalone application. Write code that connects to a database using the PostgreSQL native interface, imports data from the database into MATLAB®, analyzes the data, and closes the database connection. Then, you can deploy the code by compiling it as a standalone application using the Application Compiler (MATLAB Compiler) app, and then running the application on other machines.



Overall, the example follows the steps described in “Create Standalone Application from MATLAB Function” (MATLAB Compiler) and updates the steps for a standalone database application.

You must have administrator privileges on each machine where you plan to run the standalone application.

Create Function in MATLAB

Create a MATLAB script named `importPostgreSQLNative.m` and save it in a file location of your choice. The script contains the `importPostgreSQLNative` function, which returns the maximum product number from the data in the `productTable` database table. The function connects to a PostgreSQL database and imports all data from `productTable`. Then, the function calculates the maximum product number.

You must use the syntax with name-value pair arguments when you connect to the database using the `postgresql` function.

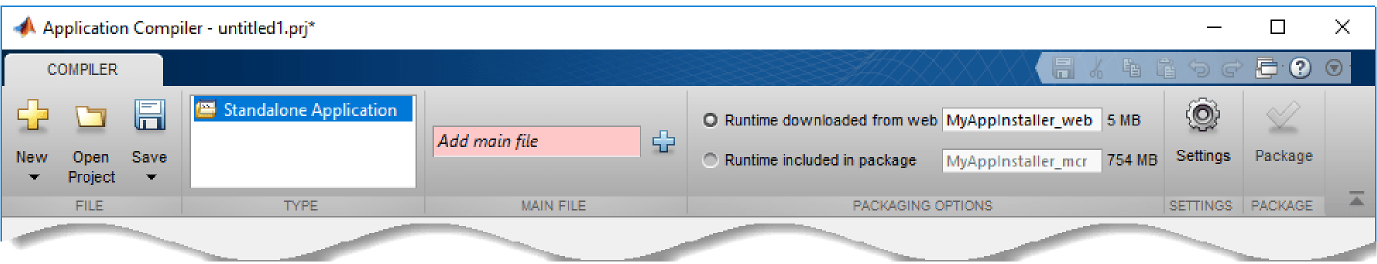
```
type importPostgreSQLNative.m
```

```
function maxProdNum = importPostgreSQLNative
% IMPORTPOSTGRESQLNATIVE The importPostgreSQLNative function connects to a
% PostgreSQL database using the PostgreSQL native interface, imports data
% from the database into MATLAB®, performs a simple data analysis, and
% closes the database connection. The database contains a table named
% |productTable|.
%%
% Connect to the database by using name-value pair arguments of the
% |postgresql| function to specify a connection to a PostgreSQL database.
% For example, this code assumes that you are using the user name
% |username|, password |pwd|, database |dbname|, database server |sname|,
% and port number |5432|.
conn = postgresql("username","pwd", ...
    "DatabaseName","dbname", ...
    "Server","sname", ...
    "PortNumber",5432);
%%
% Import data from the |productTable| database table.
tablename = "productTable";
data = sqlread(conn,tablename);
```

```
%%
% Determine the highest product number among products.
prodNums = data.productnumber;
maxProdNum = max(prodNums);
%%
% Close the database connection.
close(conn)
end
```

Create Standalone Application Using Application Compiler App

On the **MATLAB Apps** tab, on the far right of the **Apps** section, click the arrow to open the apps gallery. Under **Application Deployment**, click **Application Compiler**.



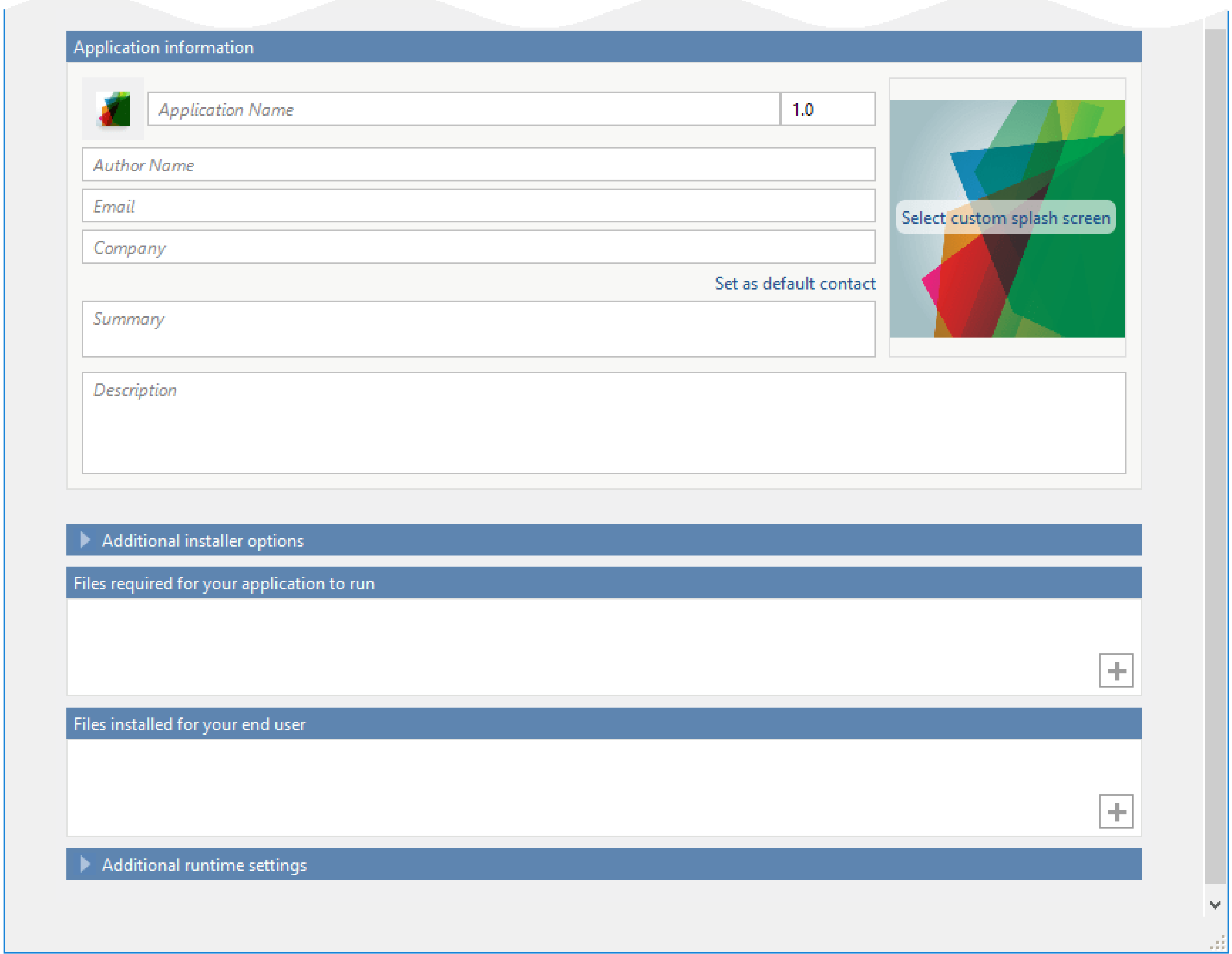
In the **MATLAB Compiler** project window, specify the main file of the MATLAB application that you want to deploy.

1. In the **Main File** section of the toolstrip, click the plus sign button to add a main file.
2. In the **Add Files** dialog box, browse to the file location that contains your saved script. Select `importPostgreSQLNative.m` and click **Open**. The Application Compiler app adds the `importPostgreSQLNative` function to the list of main files.

Decide whether to include the MATLAB Runtime installer in the generated application by selecting one of the two options in the **Packaging Options** section:

- **Runtime downloaded from web** — Generates an installer that downloads MATLAB Runtime and installs it along with the deployed MATLAB application
- **Runtime included in package** — Generates an installer that includes the MATLAB Runtime installer

Customize the packaged application and its appearance by specifying the following options:



- **Application information** — Editable information about the deployed application. You can also customize the appearance of the standalone application by changing the application icon and splash screen. The generated installer uses this information to populate the installed application metadata.
- **Additional installer options** — Options for editing the default installation path for the generated installer and selecting a custom logo.
- **Files required for your application to run** — Additional files required by the generated application to run. The software includes these files in the generated application installer.
- **Files installed for your end user** — Files that are installed with your application. These files include the generated `readme.txt` file and the generated executable for the target platform.
- **Additional runtime settings** — Platform-specific options for controlling the generated executable.

For details about these options, see "Customize an Application" (MATLAB Compiler).

To generate the packaged application, click **Package** in the **Package** section on the toolstrip. In the Save Project dialog box, specify the location in which to save the project.

In the **Package** dialog box, verify that the option **Open output folder when process completes** is selected.

When the deployment process is complete, examine the generated output:

- `for_redistribution` — Folder containing the file that installs the application and MATLAB Runtime.
- `for_testing` — Folder containing all the artifacts created by `mcc` (such as binary, JAR, header, and source files for a specific target). Use these files to test the installation.
- `for_redistribution_files_only` — Folder containing the files required for redistributing the application. Distribute these files to users who have MATLAB or MATLAB Runtime installed on their machines.
- `PackagingLog.txt` — Log file generated by MATLAB Compiler™.

Install and Run Standalone Application

To install the standalone application, double-click the `MyAppInstaller_web` executable in the `for_redistribution` folder.

If you want to connect to the Internet using a proxy server, click **Connection Settings**. Enter the proxy server settings in the provided dialog box. Click **OK**.

To complete the installation, follow the instructions in the installation wizard.

To run your standalone application:

1. Open a terminal window.
2. Navigate to the folder in which you installed the application.
3. Run the application.

Test Standalone Application on Target Machine

Choose one target machine to test the MATLAB generated standalone application.

Copy the files in the `for_testing` folder to the target machine.

To test your standalone application:

1. Open a terminal window.
2. Navigate to the `for_testing` folder.
3. Run the application.

Deploy Standalone Application on Target Machines

Copy the `for_redistribution_files_only` folder to a file location on all target machines where MATLAB or MATLAB Runtime is installed.

Run the MATLAB generated standalone application on all target machines by using the executable in the `for_redistribution_files_only` folder.

See Also

`postgresql` | `close` | `sqlread`

More About

- "Create Functions in Files"
- "Create Standalone Application from MATLAB Function" (MATLAB Compiler)
- "Customize an Application" (MATLAB Compiler)
- "Import Data from PostgreSQL Database Table" on page 7-11

Import Data from PostgreSQL Database Table

This example shows how to import data from a table in a PostgreSQL database into the MATLAB® workspace using the `sqlread` and `fetch` functions with the PostgreSQL native interface.

Connect to Database

Create a PostgreSQL native interface database connection using the data source name `PostgreSQLDataSource` and a user name and password. The PostgreSQL database contains the table `productTable`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Import Data from Database Table Using `sqlread` Function

Import product data from the database table `productTable` by using the `sqlread` function and the database connection. This function imports data as a MATLAB table.

```
tablename = "productTable";
data = sqlread(conn,tablename);
```

Display the product number and description in the imported data.

```
data(:,[1 5])
```

```
ans=11×2 table
    productnumber    productdescription
    _____________    __________________

          9          "Victorian Doll"
          8          "Train Set"
          7          "Engine Kit"
          2          "Painting Set"
          4          "Space Cruiser"
          1          "Building Blocks"
          5          "Tin Soldier"
          6          "Sail Boat"
          3          "Slinky"
         10          "Teddy Bear"
         30          "Rubik's Cube"
```

Import Data from Database Table Using `fetch` Function

Import product data from the database table `productTable` by using the `fetch` function and the database connection. Create an SQL query to import data that is sorted by product description alphabetically. The `fetch` function imports data as a MATLAB table.

```
sqlquery = "SELECT * FROM productTable ORDER BY productDescription ASC";
data = fetch(conn,sqlquery);
```

Display the product number and description in the imported data.

```
data(:,[1 5])
```

```
ans=11×2 table
    productnumber    productdescription
    _____________    __________________

          1          "Building Blocks"
          7          "Engine Kit"
          2          "Painting Set"
         30          "Rubik's Cube"
          6          "Sail Boat"
          3          "Slinky"
          4          "Space Cruiser"
         10          "Teddy Bear"
          5          "Tin Soldier"
          8          "Train Set"
          9          "Victorian Doll"
```

Close Database Connection

```
close(conn)
```

See Also

`postgresql` | `close` | `sqlread` | `fetch`

More About

- "Customize Options for Importing Data from PostgreSQL Database into MATLAB" on page 7-13

External Websites

- PostgreSQL Documentation

Customize Options for Importing Data from PostgreSQL Database into MATLAB

This example shows how to customize import options when importing data from a database table using the PostgreSQL native interface. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for multiple database columns. Import data using the `sqlread` function.

The example uses the `patients.xls` spreadsheet, which contains patient information. Also, the example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Create Database Connection

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Load Example Data

Load patient information into the MATLAB® workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Create `SQLImportOptions` Object

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Display the default data types of the variables by accessing the `VariableNames` and `VariableTypes` properties of the `SQLImportOptions` object using dot notation.

```
disp([opts.VariableNames' opts.VariableTypes'])
```

```
    {'lastname'                }    {'string' }
    {'gender'                  }    {'string' }
    {'age'                     }    {'double' }
    {'location'                }    {'string' }
    {'height'                  }    {'double' }
    {'weight'                  }    {'double' }
    {'smoker'                  }    {'logical'}
    {'systolic'                }    {'double' }
    {'diastolic'               }    {'double' }
    {'selfassessedhealthstatus'}    {'string' }
```

Customize Import Options

Change the data types of multiple variables. Convert the data type for all text variables to `char`. Also, convert the data type for all numeric variables to `single`.

```
textvars = ["lastname" "gender" "location" "selfassessedhealthstatus"];
opts = setoptions(opts,textvars,'Type',"char");

numvars = ["age" "height" "weight" "systolic" "smoker" "diastolic"];
opts = setoptions(opts,numvars,'Type',"single");
```

Display the updated data types of the variables.

```
disp([opts.VariableNames' opts.VariableTypes'])
```

```
    {'lastname'                }    {'char'  }
    {'gender'                  }    {'char'  }
    {'age'                     }    {'single'}
    {'location'                }    {'char'  }
    {'height'                  }    {'single'}
    {'weight'                  }    {'single'}
    {'smoker'                  }    {'single'}
    {'systolic'                }    {'single'}
    {'diastolic'               }    {'single'}
    {'selfassessedhealthstatus'}    {'char'  }
```

Set the import options to replace missing data in the specified variables with the fill value `unknown`.

```
varnames = ["lastname" "location"];
opts = setoptions(opts,varnames,'FillValue',"unknown");
```

Set the import options to omit rows with missing data in the `lastname` variable.

```
varname = "lastname";
opts = setoptions(opts,varname,'MissingRule',"omitrow");
```

Preview Data Before Importing

Before importing the data, preview it by using the customized import options.

```
T = preview(opts)
```

```
T=8×10 table
      lastname        gender      age              location              height    weight    smo
    ____________    __________    ___    _____________________________    ______    ______    ___

    {'Smith'   }    {'Male'  }    38     {'County General Hospital'  }      71       176       1
    {'Johnson' }    {'Male'  }    43     {'VA Hospital'              }      69       163       0
    {'Williams'}    {'Female'}    38     {'St. Mary's Medical Center'}      64       131       0
    {'Jones'   }    {'Female'}    40     {'VA Hospital'              }      67       133       0
    {'Brown'   }    {'Female'}    49     {'County General Hospital'  }      64       119       0
    {'Davis'   }    {'Female'}    46     {'St. Mary's Medical Center'}      68       142       0
    {'Miller'  }    {'Female'}    33     {'VA Hospital'              }      64       142       1
    {'Wilson'  }    {'Male'  }    40     {'VA Hospital'              }      68       180       0
```

Import Data Using Import Options

Import the variables with the customized data types by using the `sqlread` function, and display the first eight rows of imported data.

```
T = sqlread(conn,tablename,opts);
head(T)
```

```
ans=8×10 table
      lastname        gender      age               location               height    weight    smo
    _____________    __________    ___    _______________________________    ______    ______    ___

    {'Smith'    }    {'Male'  }    38     {'County General Hospital'  }        71       176       
    {'Johnson'  }    {'Male'  }    43     {'VA Hospital'              }        69       163       
    {'Williams'}     {'Female'}    38     {'St. Mary's Medical Center'}        64       131       
    {'Jones'    }    {'Female'}    40     {'VA Hospital'              }        67       133       
    {'Brown'    }    {'Female'}    49     {'County General Hospital'  }        64       119       
    {'Davis'    }    {'Female'}    46     {'St. Mary's Medical Center'}        68       142       
    {'Miller'   }    {'Female'}    33     {'VA Hospital'              }        64       142       
    {'Wilson'   }    {'Male'  }    40     {'VA Hospital'              }        68       180       
```

Delete Example Data and Close Database Connection

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

See Also

Objects
`SQLImportOptions`

Functions
`postgresql` | `close` | `sqlread` | `databaseImportOptions` | `preview` | `setoptions` | `sqlwrite` | `execute`

More About

- “Import Data from PostgreSQL Database Table” on page 7-11

External Websites

- PostgreSQL Documentation

Import Large PostgreSQL Data Using DatabaseDatastore Object

This example shows how to use the `databaseDatastore` function to create a `DatabaseDatastore` object for accessing collections of data stored in a PostgreSQL database. After creating a `DatabaseDatastore` object, you can preview data, read data in chunks, and read every record in the data set.

To analyze large data, you can run algorithms on large data sets using a tall array. Alternatively, you can write a MapReduce algorithm that defines the chunking and reduction of the data.

This example uses a preconfigured PostgreSQL data source to create the database connection. For more information, see the `databaseConnectionOptions` function.

Create DatabaseDatastore Object

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This query retrieves all data from the `airlinesmall` table.

```
sqlquery = "select * from airlinesmall";
dbds = databaseDatastore(conn,sqlquery);
```

Preview Data in DatabaseDatastore Object

Preview the first eight records in the data set returned by executing the SQL query.

```
preview(dbds)
```

```
ans=8×29 table
    year    month    dayofmonth    dayofweek    deptime    crsdeptime    arrtime    crsarrtime
    ____    _____    __________    _________    _______    __________    _______    __________

    1990      9          11            2         1810         1812        1939         1930
    1990     10          27            6         1353         1355        1634         1640
    1990     10          23            2         1057         1055        1205         1155
    1990     10           8            1         1515         1440        1609         1535
    1990     10          19            5         1130         1120        1203         1154
    1990     10          12            5         1755         1733        1858         1820
    2001     11          22            4         1345         1355        1530         1549
    2001     11          26            1         2105         2110        2209         2237
```

Read Data in DatabaseDatastore Object

Read the data and display the first few records.

```
data = read(dbds);
head(data)
```

```
ans=8×29 table
    year    month    dayofmonth    dayofweek    deptime    crsdeptime    arrtime    crsarrtime
    ____    _____    __________    _________    _______    __________    _______    __________

    1990      9          11            2         1810         1812        1939         1930
    1990     10          27            6         1353         1355        1634         1640
    1990     10          23            2         1057         1055        1205         1155
    1990     10           8            1         1515         1440        1609         1535
    1990     10          19            5         1130         1120        1203         1154
    1990     10          12            5         1755         1733        1858         1820
    2001     11          22            4         1345         1355        1530         1549
    2001     11          26            1         2105         2110        2209         2237
```

Read the `DatabaseDatastore` object two more times by using the counter `n`. Read 10 records at a time.

```
n = 0;
while(hasdata(dbds) && n~=2)
    read(dbds)
    n = n+1;
end
```

```
ans=10000×29 table
    year    month    dayofmonth    dayofweek    deptime    crsdeptime    arrtime    crsarrtime
    ____    _____    __________    _________    _______    __________    _______    __________

    1997     12          10            3         1812         1730        2149         2047
    1997     12          17            3         1806         1800        1932         1933
    1997     12          27            6         1803         1805        1947         1945
    1997     12          27            6          807          800        1138         1130
    1997     12          20            6         1501         1120        1828         1432
    1998      1          18            7         1207         1211        1358         1355
    1998      1          22            4         2022            0        2151            0
    1998      1           6            2          730          730         840          840
    1998      1           5            1          730          730        1040         1100
    1998      1          16            5         1415         1415        1623         1615
    1998      1          28            3         1017         1000        1222         1210
    1998      1           7            3         2018         2020        2231         2242
    1998      1           2            5          915          915        1113         1115
    1998      1           4            7         1035         1030        1332         1356
    1998      1          16            5         1235         1210        1436         1415
    1998      1          13            2          802          800        1047         1053
      ⋮

ans=10000×29 table
    year    month    dayofmonth    dayofweek    deptime    crsdeptime    arrtime    crsarrtime
    ____    _____    __________    _________    _______    __________    _______    __________

    1988      1           5            2         2149         2045        2333         2232
    1988      1          28            4         1005         1000        1137         1131
    1988      1          13            3         1159         1200        1514         1518
    1988      1          25            1          630          630         948          944
    1988      1          12            2         2005         1900        2131         2036
    1988      1           3            7         1153         1155        1202         1205
    1988      1           8            5         1227         1200        1413         1330
    1988      1          29            5         1456         1500        1520         1526
```

```
    1988      1          27           3          37          40         107         115
    1988      1          25           1         638         640        1119        1039
    1988      1          11           1        1313        1130        1615        1434
    1988      1          19           2         901         842        1051        1036
    1988      1          12           2        1737        1730        1953        1947
    1988      1          12           2        1122        1125        1357        1407
    1988      1          13           3        1728        1720        1957        1942
    1988      1          12           2        1559        1500        1844        1745
      ⋮
```

Reset DatabaseDatastore Object

Reset the `DatabaseDatastore` object to its original state, where no data has been read from it. Resetting allows you to reread from the same `DatabaseDatastore` object.

```
reset(dbds)
```

Read Every Record in DatabaseDatastore Object

Read every record in the `DatabaseDatastore` object.

```
data = readall(dbds);
```

Display the first three records of the full data set.

```
head(data,3)
```

```
ans=3×29 table
    year    month    dayofmonth    dayofweek    deptime    crsdeptime    arrtime    crsarrtime
    ____    _____    __________    _________    _______    __________    _______    __________

    1990      9          11            2         1810         1812        1939         1930
    1990     10          27            6         1353         1355        1634         1640
    1990     10          23            2         1057         1055        1205         1155
```

Close DatabaseDatastore Object and Database Connection

```
close(dbds)
```

See Also

`postgresql` | `databaseDatastore` | `preview` | `read` | `readall` | `reset` | `close`

More About

- “Import Data from PostgreSQL Database Table” on page 7-11

External Websites

- PostgreSQL Documentation

Insert Data into Database Table Using PostgreSQL Native Interface

This example shows how to import data from a database into MATLAB®, perform calculations on the data, and export the results to a database table.

The example assumes that you are connecting to a PostgreSQL database that contains tables named `salesvolume` and `yearlysales`. The `salesvolume` table contains the column names for each month. The `yearlysales` table contains the column names `month` and `salestotal`. Also, the example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Create Database Connection

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Calculate Sum of Sales Volume for One Month

Import sales volume data for the month of March using the database connection. The `salesvolume` database table contains sales volume data.

```
tablename = "salesvolume";
data = sqlread(conn,tablename);
```

Display the first three rows of sales volume data. The fourth variable contains the data for the month of March.

```
head(data(:,4),3)
```

```
ans=3×1 table
    march
    _____

     981
    1414
     890
```

Calculate the sum of the March sales. Assign the result to the MATLAB workspace variable `total` and display the result.

```
total = sum(data.march)
```

```
total = 14606
```

Insert Total Sales for One Month into Database

Retrieve the name of the month from the sales volume data.

```
month = data.Properties.VariableNames(4);
```

Define the names of the columns for the data to insert as a string array.

```
colnames = ["month" "salestotal"];
```

Create a MATLAB table that stores the data to export.

```
results = table(month,total,'VariableNames',colnames);
```

Determine the status of the `AutoCommit` database flag. This status determines whether or not the insert action can be undone.

```
conn.AutoCommit
```

```
ans =
"on"
```

The `AutoCommit` flag is set to `on`. The database commits the exported data automatically to the database, and this action cannot be undone.

Insert the sum of sales for the month of March into the `yearlysales` table.

```
tablename = "yearlysales";
sqlwrite(conn,tablename,results)
```

Import the data from the `yearlysales` table. This data contains the calculated result.

```
data = sqlread(conn,tablename)
```

```
data=1×2 table
     month     salestotal
    _______    __________

    "march"      14606
```

Close Database Connection

```
close(conn)
```

See Also

`postgresql` | `close` | `sqlread` | `sqlwrite`

More About

- "Import Data from PostgreSQL Database Table" on page 7-11

Roll Back Data in Database Using PostgreSQL Native Interface

This example shows how to connect to a database, insert a row into an existing database table, and then roll back (or reverse) the insert using the PostgreSQL native interface. The example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12. The database contains the table `productTable`.

Create Database Connection

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Append Data to Existing Database Table

Set the `AutoCommit` property of the `connection` object to `off`. Any updates you make after turning off this flag are not committed to the database automatically.

```
conn.AutoCommit = "off";
```

To view the existing database table `productTable` before appending data, import its contents into MATLAB® and display the last few rows.

```
tablename = "productTable";
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans=3×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          6          4.0088e+05          1004             8           "Sail Boat"
          3            4.01e+05          1009            17           "Slinky"
         10          8.8865e+05          1006            24           "Teddy Bear"
```

Create a MATLAB table that contains the data for one product.

```
data = table(30,500000,1000,25,"Rubik's Cube", ...
    'VariableNames',["productnumber" "stocknumber" ...
    "suppliernumber" "unitcost" "productdescription"]);
```

Append the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again, and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans=4×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          6          4.0088e+05          1004             8         "Sail Boat"
          3            4.01e+05          1009            17         "Slinky"
         10          8.8865e+05          1006            24         "Teddy Bear"
         30               5e+05          1000            25         "Rubik's Cube"
```

Roll Back Data

Roll back the inserted row.

```
rollback(conn)
```

Import the contents of the database table into MATLAB again, and display the last few rows. The results no longer contain the inserted row.

```
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans=3×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          6          4.0088e+05          1004             8          "Sail Boat"
          3            4.01e+05          1009            17          "Slinky"
         10          8.8865e+05          1006            24          "Teddy Bear"
```

Close Database Connection

```
close(conn)
```

See Also

`postgresql` | `close` | `sqlread` | `sqlwrite` | `rollback`

More About

- “Import Data from PostgreSQL Database Table” on page 7-11
- “Insert Data into Database Table Using PostgreSQL Native Interface” on page 7-19

Create Table and Add Column Using PostgreSQL Native Interface

This example shows how to connect to a database and manage the database structure using the PostgreSQL native interface. You can manage the database structure using the `execute` function.

Create Database Connection

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Create Database Table

Use the SQL CREATE statement to create the database table `Person`.

```
sqlquery = strcat("CREATE TABLE Person(lastname varchar,", ...
    "firstname varchar,address varchar,age numeric)");
```

Create the table in the database using the database connection.

```
execute(conn,sqlquery)
```

Add Database Column

Use the SQL ALTER statement to add the database column `city` to the table `Person`.

```
sqlquery = "ALTER TABLE Person ADD city varchar(30)";
execute(conn,sqlquery)
```

Close Database Connection

```
close(conn)
```

See Also

`postgresql` | `close` | `execute`

More About

- “Insert Data into Database Table Using PostgreSQL Native Interface” on page 7-19
- “Roll Back Data in Database Using PostgreSQL Native Interface” on page 7-21

External Websites

- PostgreSQL Documentation

Delete Data from Database Using PostgreSQL Native Interface

This example shows how to delete data from a PostgreSQL database using MATLAB®. First, create an SQL statement with the deletion SQL syntax. Consult your database documentation for the correct syntax. Execute the delete operation on your database using the `execute` function with the SQL statement.

Create Database Connection

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

The SQL query `sqlquery` selects all rows of data in the table `inventorytable`. Execute this SQL query using the database connection. Import the data from the executed query using the `fetch` function, and display the last few rows.

```
sqlquery = "SELECT * FROM inventorytable";
data = fetch(conn,sqlquery);
tail(data,3)
```

```
ans=3×4 table
    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

         11             567         0     "2012-09-11 00:30:24"
         12            1278         0     "2010-10-29 18:17:47"
         13            1700      14.5     "2009-05-24 10:58:59"
```

Delete Specific Record

Delete the record for the product number `13` from the table `inventorytable`. Specify the product number using the `WHERE` clause in the SQL statement `sqlquery`.

```
sqlquery = "DELETE FROM inventorytable WHERE productnumber = 13";
execute(conn,sqlquery)
```

Display the data in the table `inventorytable` after the deletion. The record with product number `13` is no longer included.

```
sqlquery = "SELECT * FROM inventorytable";
data = fetch(conn,sqlquery);
tail(data,3)
```

```
ans=3×4 table
    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

         10             723       24      "2012-03-14 13:13:09"
         11             567        0      "2012-09-11 00:30:24"
         12            1278        0      "2010-10-29 18:17:47"
```

Close Database Connection

```
close(conn)
```

See Also

`postgresql` | `close` | `execute` | `fetch`

More About

- “Insert Data into Database Table Using PostgreSQL Native Interface” on page 7-19
- “Roll Back Data in Database Using PostgreSQL Native Interface” on page 7-21

External Websites

- PostgreSQL Documentation

8

Object Relational Mapping

Read and Write Objects to Relational Database Using ORM Workflow

This example shows the basic operations for reading and writing objects to a relational database using Object Relational Mapping (ORM). This example depends on the `Product` class that maps to a database table. This class contains several properties that map to the database, as well as some methods that alter those properties.

```
classdef (TableName = "products") Product < database.orm.mixin.Mappable

    properties(PrimaryKey,ColumnName = "ProductNumber")
        ID int32
    end

    properties
        Name string
        Description string
        Quantity int32
    end

    properties(ColumnName = "UnitCost")
        CostPerItem double
    end

    properties(ColumnName = "Manufacturer")
        Supplier string
    end

    properties(ColumnType = "date")
        InventoryDate datetime
    end

    methods
        function obj = Product(id,name,description,supplier,cost,quantity,inventoryDate)
            if nargin ~= 0
                inputElements = numel(id);
                if numel(name) ~= inputElements || ...
                        numel(description) ~= inputElements || ...
                        numel(supplier) ~= inputElements || ...
                        numel(cost) ~= inputElements || ...
                        numel(quantity) ~= inputElements || ...
                        numel(inventoryDate) ~= inputElements
                    error('All inputs must have the same number of elements')
                end

                % Preallocate by creating the last object first
                obj(inputElements).ID = id(inputElements);
                obj(inputElements).Name = name(inputElements);
                obj(inputElements).Description = description(inputElements);
                obj(inputElements).Supplier = supplier(inputElements);
                obj(inputElements).CostPerItem = cost(inputElements);
                obj(inputElements).Quantity = quantity(inputElements);
                obj(inputElements).InventoryDate = inventoryDate(inputElements);

                for n = 1:inputElements-1
```

```
                    % Fill in the rest of the objects
                    obj(n).ID = id(n);
                    obj(n).Name = name(n);
                    obj(n).Description = description(n);
                    obj(n).Supplier = supplier(n);
                    obj(n).CostPerItem = cost(n);
                    obj(n).Quantity = quantity(n);
                    obj(n).InventoryDate = inventoryDate(n);
                end
            end
        end
        function obj = adjustPrice(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBeNumeric}
            end
           obj.CostPerItem = obj.CostPerItem + amount;
        end

        function obj = shipProduct(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBePositive,mustBeInteger}
            end

            obj.Quantity = obj.Quantity - amount;
        end

        function obj = recieveProduct(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBePositive,mustBeInteger}
            end

            obj.Quantity = obj.Quantity + amount;
            obj.InventoryDate = datetime('today');
        end

    end

end
```

Create a Database Connection

To read and write to a database using ORM, create a `sqlite` database file that does not require a connection to a live database.

```
filename = "orm_demo.db";
if exist(filename,"file")
    conn = sqlite(filename);
else
    conn = sqlite(filename,"create");
end

% Remove it to maintain consistency
execute(conn,"DROP TABLE IF EXISTS products");
```

Populate Database Table with Objects

The `orm2sql` function shows how a mapped MATLAB® class is respresented as a database table. Display the database column information based on the class defined in Product.m.

```
orm2sql(conn,"Product")
```

```
ans = 
    "CREATE TABLE products
     (ProductNumber double,
     Name text,
     Description text,
     Quantity double,
     UnitCost double,
     Manufacturer text,
     InventoryDate date,
     PRIMARY KEY (ProductNumber))"
```

Use the `sqlfind` function to verify that the `products` table does not exist.

```
sqlfind(conn,"products")
```

```
ans =

  0×5 empty table

    Catalog    Schema    Table    Columns    Type
    _______    ______    _____    _______    ____
```

Insert a Scalar Object

Create a `Product` object and use it to create and populate a table.

```
toy = Product(1,"Toy1","Descr1","CompanyA",24.99,0,datetime(2023,1,1))
```

```
toy = 
  Product with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 0
      CostPerItem: 24.9900
         Supplier: "CompanyA"
    InventoryDate: 01-Jan-2023
```

Use the `ormwrite` function to populate the database with the data from `toy`, and use the `sqlread` function to read the table and verify the results.

```
ormwrite(conn,toy);
sqlread(conn,"products")
```

```
ans=1×7 table
    ProductNumber    Name    Description    Quantity    UnitCost    Manufacturer        Inve
    _____________    ______  ___________    ________    ________    ____________    __________
```

```
        1           "Toy1"      "Descr1"         0         24.99       "CompanyA"      "2023-01-01
```

Insert an Array of Objects

Instantiate a `Product` class with an array of objects.

```
productArray = Product(2:10,...
    ["Toy2","Toy3","Toy4","Toy5","Toy6","Toy7","Toy8",...
    "Toy9","Toy10"],...
    ["Descr2","Descr3","Descr4","Descr5","Descr6","Descr7",...
    "Descr8","Descr9","Descr10"],...
    ["CompanyB","CompanyA","CompanyC","CompanyB","CompanyA","CompanyD","CompanyE","CompanyF","Com
    [5.99,4.99,14.99,12.99,17.99,4.99,149.99,10.99,5.99],...
    [1000,350,225,25,600,300,50,100,1250],...
    repmat(datetime(2023,1,1),1,9))
% View the last object
productArray(end)
```

```
ans =
  Product with properties:

             ID: 10
           Name: "Toy10"
    Description: "Descr10"
       Quantity: 1250
    CostPerItem: 5.9900
       Supplier: "CompanyG"
  InventoryDate: 01-Jan-2023
```

Use `ormwrite` to insert multiple objects at the same time.

```
% Insert the object array into the database and view the results
ormwrite(conn,productArray);
sqlread(conn,"products")
```

```
ans=10×7 table
    ProductNumber      Name       Description    Quantity    UnitCost    Manufacturer         Inv
    _____________    _______    ___________    ________    ________    ____________    ________

          1          "Toy1"      "Descr1"           0        24.99      "CompanyA"      "2023-01-0
          2          "Toy2"      "Descr2"        1000         5.99      "CompanyB"      "2023-01-0
          3          "Toy3"      "Descr3"         350         4.99      "CompanyA"      "2023-01-0
          4          "Toy4"      "Descr4"         225        14.99      "CompanyC"      "2023-01-0
          5          "Toy5"      "Descr5"          25        12.99      "CompanyB"      "2023-01-0
          6          "Toy6"      "Descr6"         600        17.99      "CompanyA"      "2023-01-0
          7          "Toy7"      "Descr7"         300         4.99      "CompanyD"      "2023-01-0
          8          "Toy8"      "Descr8"          50       149.99      "CompanyE"      "2023-01-0
          9          "Toy9"      "Descr9"         100        10.99      "CompanyF"      "2023-01-0
         10          "Toy10"     "Descr10"       1250         5.99      "CompanyG"      "2023-01-0
```

Read Objects from a Database

Once a class has been mapped to an existing database table, objects of that class can be constructed by reading data from the database.

Use the `ormread` method to read data from the database. This method uses the mapping to determine which tables to read, and also determines how the column values correspond to the properties.

```
% Clear all Product objects from the workspace
clear toy productArray

% Recreate the objects by reading from the database and view the first and
% last
allProducts = ormread(conn,"Product")
allProducts(1)
```

```
ans =
  Product with properties:

                ID: 1
              Name: "Toy1"
       Description: "Descr1"
          Quantity: 0
       CostPerItem: 24.9900
          Supplier: "CompanyA"
     InventoryDate: 01-Jan-2023
```

```
allProducts(end)
```

```
ans =
  Product with properties:

                ID: 10
              Name: "Toy10"
       Description: "Descr10"
          Quantity: 1250
       CostPerItem: 5.9900
          Supplier: "CompanyG"
     InventoryDate: 01-Jan-2023
```

Read in a Subset of Objects

Use the `ormread` method with the `RowFilter` name-value argument to import a subset of the objects in the database.

Filter the items where `CostPerItem` is less than $10.

```
rf = rowfilter("CostPerItem");
rf = rf.CostPerItem < 10;
inexpensiveItems = ormread(conn,"Product",RowFilter=rf)

% Verify by checking the properties of one of the objects
inexpensiveItems(1)
```

```
ans =
  Product with properties:

                ID: 2
              Name: "Toy2"
       Description: "Descr2"
          Quantity: 1000
```

```
      CostPerItem: 5.9900
         Supplier: "CompanyB"
    InventoryDate: 01-Jan-2023
```

Update the Database with Objects

The `ormupdate` method updates existing rows in a database table based on changes to one or more mapped MATLAB® objects.

Use the `receiveProduct` method of the `Product` class to increase the inventory of `Toy1`.

```
% Find the Toy1 product on the database
rf = rowfilter("Name");
rf = rf.Name == "Toy1";
toy = ormread(conn,"Product",RowFilter=rf)
```

```
toy = 
  Product with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 0
      CostPerItem: 24.9900
         Supplier: "CompanyA"
    InventoryDate: 01-Jan-2023
```

```
% Use the receiveProduct method of Product to increase the amount of
% products in the inventory
toy = recieveProduct(toy,500)
```

```
toy = 
  Product with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 500
      CostPerItem: 24.9900
         Supplier: "CompanyA"
    InventoryDate: 14-Dec-2023
```

Use the `fetch` function to see that these changes are not reflected in the database.

```
fetch(conn,"SELECT * FROM products WHERE Name = 'Toy1'")
```

ans=*1×7 table*

ProductNumber	Name	Description	Quantity	UnitCost	Manufacturer	Inve
1	"Toy1"	"Descr1"	0	24.99	"CompanyA"	"2023-01-0

Use the `ormupdate` method to push the changes made in MATLAB® to the database. Then, use the `fetch` function to verify that `Quantity` and `InventoryDate` are updated in the database.

```
ormupdate(conn,toy);
fetch(conn,"SELECT * FROM products WHERE Name = 'Toy1'")
```

```
ans=1×7 table
    ProductNumber     Name      Description    Quantity    UnitCost    Manufacturer          Inve
    _____________    ______    ___________    ________    ________    ____________    __________

          1          "Toy1"     "Descr1"         500        24.99      "CompanyA"     "2023-12-14
```

Refresh Objects to Match the Database

You can refresh an object in MATLAB® to reflect the current state of the database. First, change the quantity of `Toy1` to `1000` and view the result using the `fetch` function.

```
execute(conn,"UPDATE products SET Quantity = 1000 WHERE Name = 'Toy1'");
fetch(conn,"SELECT * FROM products WHERE Name = 'Toy1'")
```

```
ans=1×7 table
    ProductNumber     Name      Description    Quantity    UnitCost    Manufacturer          Inve
    _____________    ______    ___________    ________    ________    ____________    __________

          1          "Toy1"     "Descr1"         1000       24.99      "CompanyA"     "2023-12-14
```

Use the `ormread method` to refresh the properties of the object.

```
toy = ormread(conn,toy)
```

```
toy = 
  Product with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 1000
      CostPerItem: 24.9900
         Supplier: "CompanyA"
    InventoryDate: 14-Dec-2023
```

```
clear allProducts inexpensiveItems toy
close(conn)
```

Resolve Issues with Object Relational Mapping

This table describes how to address common errors you might encounter while working with ORM methods.

Error Message	Probable Cause	Solution
`Persisted properties must have public access or provide set and get access to database.relational.connection.`	The Database Toolbox connection object needs access to the properties mapped to the database in order to read and write them properly.	For any properties without the `ExcludeFromDatabase` attribute, set the access to one of the following: • Public • ? database.relational.connection
`Mappable requires at least one property to have the PrimaryKey attribute.`	ORM requires that you specify the primary key as the link between a MATLAB object and its corresponding entry in a database table.	Add a property with the `PrimaryKey` attribute. You can add the `AutoIncrement` attribute instead of specifying the `PrimaryKey` value.
`Unknown AutoIncrement syntax for myVendor.`	Database Toolbox does not have information on how to create the autoincrementing keys for this vendor.	Use the `execute` function to create the table with an SQL query.
`AutoIncrement properties cannot be written to the database with specified values. Set the property to an empty or missing value to allow the database to set the value automatically.`	The `ormwrite` method does not support inserting known values to an autoincrementing primary key column. Inserting known values differs from vendor to vendor.	Set the value of the `AutoIncrement` property to an empty value to insert a new row into the database table.
`Properties with the AutoIncrement attribute must also have the PrimaryKey attribute.`	Database Toolbox supports the `AutoIncrement` attribute for properties that also have the `PrimaryKey` attribute.	If you want the property with the `AutoIncrement` attribute to also be a primary key, add the `PrimaryKey` attribute to it. If the property is not a primary key, remove the `AutoIncrement` attribute and set the value of the property manually.
`AutoIncrement properties must have integer types.`	A property with the `AutoIncrement` attribute was assigned a non-integer class validation.	Specify the class validation of the property as an integer type.

Error Message	Probable Cause	Solution
`Unknown syntax to return inserted keys for Oracle.`	Oracle does not specify a syntax for retrieving the primary keys after rows have been inserted.	Do not specify an output to `ormwrite` when using autoincrementing values with Oracle ODBC. To access the values of inserted keys, use `ormread` with an appropriate `RowFilter` value to return your object to MATLAB.

9

Apache Cassandra Database C++ Interface Topics

Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface

When you import data into MATLAB using the Apache Cassandra database C++ interface, the `partitionRead` and `executecql` functions convert the Cassandra Query Language (CQL) data types to MATLAB data types. When you export from MATLAB into a Cassandra database, the `upsert` function converts MATLAB data types to CQL data types. This table describes the CQL data types and shows their corresponding MATLAB data types for data import and export.

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable for Data Import	Data Type of MATLAB Table Variable for Data Export
`ascii`	US-ASCII character string	`string`	`char`, `string`, or cell array of character vectors
`bigint`	64-bit signed long integer	`int64`	• `double` • `single` • `int8` • `int16` • `int32` • `int64` • `uint8` • `uint16` • `uint32` • `uint64` • `logical`
`blob`	Arbitrary bytes (no validation)	`uint8`	cell array of numeric vectors
`boolean`	`true` or `false`	`logical`	• `double` • `single` • `int8` • `int16` • `int32` • `int64` • `uint8` • `uint16` • `uint32` • `uint64` • `logical`
`counter`	Distributed counter value (64-bit long integer)	`int64`	Not supported by the `upsert` function

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable for Data Import	Data Type of MATLAB Table Variable for Data Export
date	Value is a date with no corresponding time value. Cassandra encodes the date as a 32-bit integer representing days since epoch (January 1, 1970).	datetime array without the time component and time zone	datetime array, char, string, or cell array of character vectors
decimal	Variable-precision decimal	string	• string • cell array of character vectors • double • single • int8 • int16 • int32 • int64 • uint8 • uint16 • uint32 • uint64 • sym
double	64-bit IEEE®-754 floating point	double	• double • single • int8 • int16 • int32 • int64 • uint8 • uint16 • uint32 • uint64 • logical

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable for Data Import	Data Type of MATLAB Table Variable for Data Export
float	32-bit IEEE-754 floating point	single	• double • single • int8 • int16 • int32 • int64 • uint8 • uint16 • uint32 • uint64 • logical
inet	IP address string in IPv4 or IPv6 format	string	char, string, or cell array of character vectors
int	32-bit signed integer	int32	• double • single • int8 • int16 • int32 • int64 • uint8 • uint16 • uint32 • uint64 • logical
list<*type*>	Collection of one or more ordered elements (for example, [literal, literal, literal])	Array of data types, one for each item in the collection. For example, if a Cassandra database table column has the list<int> data type, then each row in the MATLAB table contains an array of int32 data types. In this case, the data type of the MATLAB table variable is a cell array of arrays.	Cell array of vectors, where each vector is compatible with the type of the list. For example, if the Cassandra database table contains list<int>, then the MATLAB table must contain a cell array of numeric vectors.

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable for Data Import	Data Type of MATLAB Table Variable for Data Export
`map<`*`keyType`*`,`*`valueType`*`>`	JSON-style array of literals (for example, `{ literal : literal, literal : literal, ...}`)	An *n*-by-2 MATLAB table where *n* is the number of key-value pairs in the map. The first variable `Keys` has the keys of the map. The data type for this variable depends on the key type defined for the map. Similarly, the `Values` variable has the values that correspond to each key. The data type for the `Values` variable depends on the value type defined for the map. For example, if a Cassandra database table column has the `map<text,double>` data type, then the `partitionRead` and `executecql` functions convert this data type into a MATLAB table. The table has the `Keys` variable as string scalars and the `Values` variable as a `double` array. In this case, the data type of the MATLAB table variable is a cell array of tables.	Cell array of tables, where each table contains the `Keys` and `Values` variables. The data types of these two variables are compatible with the data types of the keys and values of the Cassandra database map. For example, if the Cassandra database table contains `map<int,text>`, then the MATLAB table must contain a cell array of tables, where each table has a `Keys` variable that is numeric and a `Values` variable that is a string.
`set<`*`type`*`>`	Collection of one or more elements (for example, `{literal, literal, literal}`)	Array of data types, one for each item in the collection. For example, if a Cassandra database column has the `set<float>` data type, then each row in the resulting MATLAB table contains an array of `single` values. In this case, the data type of the MATLAB table variable is a cell array of arrays.	Cell array of vectors, where each vector is compatible with the type of the collection. For example, if the Cassandra database table contains `set<int>`, then the MATLAB table must contain a cell array of numeric vectors.

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable for Data Import	Data Type of MATLAB Table Variable for Data Export
`smallint`	2-byte integer	`int16`	• `double` • `single` • `int8` • `int16` • `int32` • `int64` • `uint8` • `uint16` • `uint32` • `uint64` • `logical`
`text`	UTF-8 encoded string	`string`	`char`, `string`, or cell array of character vectors
`time`	Cassandra database encodes this value as a 64-bit signed integer that represents the number of nanoseconds since midnight.	`duration` array	`duration` array, `char`, `string`, or cell array of character vectors
`timestamp`	Date and time with millisecond precision, encoded as 8 bytes since epoch (January 1, 1970)	`datetime` array with the date component and time zone as UTC or GMT	`datetime` array, `char`, `string`, or cell array of character vectors
`timeuuid`	Version 1 UUID only	`string`	`char`, `string`, or cell array of character vectors
`tinyint`	1-byte integer	`int8`	• `double` • `single` • `int8` • `int16` • `int32` • `int64` • `uint8` • `uint16` • `uint32` • `uint64` • `logical`

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable for Data Import	Data Type of MATLAB Table Variable for Data Export
`tuple<`*`Type1,...,TypeN`*`>`	Group of unnamed but typed fields	A 1-by-*n* MATLAB table, where *n* is the number of fields in the tuple. The variable names are `Var1`, `Var2`, `Var3`, and so on, until `Var(`*`n`*`)`. The data type of each variable depends on the Cassandra data types defined in the tuple. For example, if a Cassandra database column has the `tuple<text,smallint,timestamp>` data type, then the `partitionRead` and `executecql` functions convert this data type into a MATLAB table. The table has the `Var1` variable as a `string` array, `Var2` as an `int16` array, and `Var3` as a `datetime` array. In this case, the data type of the MATLAB table variable is a table.	MATLAB table. The position of each variable in the table determines which field the variable maps to in the tuple. The first variable in the table maps to the first field in the tuple, the second variable maps to the second field, and so on. For example, if the Cassandra database table contains `tuple<int,text>`, then the MATLAB table must contain a table where the first variable is numeric and the second variable is a string.
user-defined type (UDT)	Group of named fields	A 1-by-*n* MATLAB table, where *n* is the number of fields in the UDT. Variable names match the field names of the UDT. The data type of each variable depends on the Cassandra data types defined in the UDT. The data type of the MATLAB table variable is a table.	MATLAB table. The names of the variables in the table must match the names of the UDT fields. The data type of each variable in the table must be compatible with the Cassandra data type of the corresponding UDT field.
`uuid`	UUID in standard UUID format	`string`	`char`, `string`, or cell array of character vectors
`varchar`	UTF-8 encoded string	`string`	`char`, `string`, or cell array of character vectors

CQL Data Type	CQL Data Type Description	Data Type of MATLAB Table Variable for Data Import	Data Type of MATLAB Table Variable for Data Export
varint	Arbitrary-precision integer	string	• string • cell array of character vectors • double • single • int8 • int16 • int32 • int64 • uint8 • uint16 • uint32 • uint64 • sym

Note For the CQL data type, if the data type is a collection (for example, list, map, and so on), then the value contains angle brackets (<>). These brackets surround the data types of the items in the collection. For details about valid Cassandra data types, see CQL Data Types.

See Also

partitionRead | upsert | executecql

More About

- “Fill Values for Missing Data from Database Using Apache Cassandra Database C++ Interface” on page 9-9
- “Import Data from Cassandra Database Table Using CQL” on page 9-14

External Websites

- Apache Cassandra Documentation
- CQL Data Types

Fill Values for Missing Data from Database Using Apache Cassandra Database C++ Interface

When you import data from a Cassandra database into MATLAB using the `partitionRead` or `executecql` functions of the Apache Cassandra database C++ interface, these functions convert the fill values for missing data from the Cassandra column to the corresponding MATLAB values. This table identifies the data types in a Cassandra database column (Cassandra Query Language, or CQL, data type) and the corresponding fill value for missing data in the MATLAB table.

CQL Data Type	MATLAB Fill Value
`ascii`	`<missing>`
`bigint`	`0`
`blob`	`[]`
`boolean`	`false`
`counter`	`0`
`date`	`NaT`
`decimal`	`<missing>`
`double`	`NaN`
`float`	`NaN`
`inet`	`<missing>`
`int`	`0`
`list<`*`type`*`>`	`[]`
`map<`*`keyType,valueType`*`>`	`0x2 table` (empty table)
`set<`*`type`*`>`	`[]`
`smallint`	`0`
`text`	`<missing>`
`time`	`NaN`
`timestamp`	`NaT`
`timeuuid`	`<missing>`
`tinyint`	`0`
`tuple<`*`Type1,...,TypeN`*`>`	`1x`*`n`*` table`, where the missing value in each variable is the MATLAB fill value for the corresponding CQL data type
user-defined type (UDT)	`1x`*`n`*` table`, where the missing value in each variable is the MATLAB fill value for the corresponding CQL data type
`uuid`	`<missing>`
`varchar`	`<missing>`

CQL Data Type	MATLAB Fill Value
varint	<missing>

See Also

Objects
connection

Functions
apacheCassandra | partitionRead | executecql

More About

- “Explore and Import Data from Cassandra Database Table” on page 9-11
- “Import Data from Cassandra Database Table Using CQL” on page 9-14

External Websites

- Apache Cassandra Documentation
- CQL Data Types

Explore and Import Data from Cassandra Database Table

This example shows how to explore the structure of an Apache™ Cassandra® database and import data from a Cassandra database table into MATLAB® using a Cassandra database connection with the Apache Cassandra database C++ interface. The Cassandra database stores database tables according to the partition key. The partition key affects how the data is filtered in the database.

In this example, the Cassandra database contains the `employees_by_job` database table with employee data and the `job_id` partition key.

Create Cassandra Database Connection

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Explore Cassandra Database Structure

View the keyspaces in the Cassandra database using the Cassandra database connection. The returned string array contains the keyspaces. A keyspace contains one or more database tables and defines how the database replicates the data in the tables.

```
conn.Keyspaces
```

```
ans = 6×1 string
    "employeedata"
    "system"
    "system_auth"
    "system_distributed"
    "system_schema"
    "system_traces"
```

Return the names of the Cassandra database tables in the `employeedata` keyspace. `t` is a string array that contains the names of the database tables in the `employeedata` keyspace.

```
keyspace = "employeedata";
t = tablenames(conn,keyspace)
```

```
t = 3×1 string
    "employees_by_id"
    "employees_by_job"
    "employees_by_name"
```

Return the names of the Cassandra database columns in the `employees_by_job` database table.

```
tablename = "employees_by_job";
cols = columninfo(conn,keyspace,tablename);
```

Display the first few names of the Cassandra database columns in the `employees_by_job` database table.

```
head(cols)
```

```
ans=8×4 table
          Name             DataType    PartitionKey    ClusteringColumn
    _________________    ________    ____________    ________________

    "job_id"             "text"         true              ""
    "hire_date"          "date"         false             "DESC"
    "employee_id"        "int"          false             "ASC"
    "commission_pct"     "double"       false             ""
    "department_id"      "int"          false             ""
    "email"              "text"         false             ""
    "first_name"         "text"         false             ""
    "last_name"          "text"         false             ""
```

`cols` is a table with these variables:

- `Name` — Cassandra database column name
- `DataType` — Cassandra Query Language (CQL) data type of the Cassandra database column
- `PartitionKey` — Partition key indicator
- `ClusteringColumn` — Clustering column indicator

The value in the `PartitionKey` variable indicates whether the database column is a partition key. The column `job_id` (job identifier) is a partition key in this database table.

Import Data from Cassandra Database

Import data from the `employees_by_job` database table into MATLAB. This database has data about shop clerks, so use the partition key value `SH_CLERK`.

```
keyValue = "SH_CLERK";
results = partitionRead(conn,keyspace,tablename, ...
    keyValue);
```

Display the first few rows of the returned employee data.

```
head(results)
```

```
ans=8×13 table
      job_id       hire_date      employee_id    commission_pct    department_id      email

    __________    ___________    ___________    ______________    _____________    __________

    "SH_CLERK"    03-Feb-2008        183             NaN               50          "GGEONI"
    "SH_CLERK"    13-Jan-2008        199             NaN               50          "DGRANT"
    "SH_CLERK"    19-Dec-2007        191             NaN               50          "RPERKINS"
    "SH_CLERK"    21-Jun-2007        182             NaN               50          "MSULLIVA"
    "SH_CLERK"    21-Jun-2007        198             NaN               50          "DOCONNEL"
    "SH_CLERK"    17-Mar-2007        195             NaN               50          "VJONES"
    "SH_CLERK"    07-Feb-2007        187             NaN               50          "ACABRIO"
    "SH_CLERK"    11-Jul-2006        190             NaN               50          "TGATES"
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close Cassandra Database Connection

```
close(conn)
```

See Also

`apacheCassandra` | `tablenames` | `columninfo` | `partitionRead` | `close`

Related Examples

- “Import Data from Cassandra Database Table Using CQL” on page 9-14
- “Fill Values for Missing Data from Database Using Apache Cassandra Database C++ Interface” on page 9-9

External Websites

- Apache Cassandra
- Apache Cassandra Documentation
- CQL Data Types

Import Data from Cassandra Database Table Using CQL

This example shows how to import data from an Apache™ Cassandra® database table into MATLAB® using the Cassandra Query Language (CQL) and a Cassandra database connection with the Apache Cassandra database C++ interface.

In this example, you use the `executecql` function to execute a CQL query that filters by a clustering column and limits rows in the query results. Alternatively, you can use the `executecql` function to write non-`SELECT` CQL statements. For easy data import using the partition key values of a Cassandra database table, use the `partitionRead` function instead.

For this example, the Cassandra database contains the `employees_by_job` database table with employee data and the `job_id` partition key. The `hire_date` database column is a clustering column.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Write a CQL query that selects all employees who are programmers or shop clerks, and retrieves their job identifiers, hire dates, and email addresses. Filter the query by those employees hired before April 30, 2006, using the `hire_date` clustering column. Limit the returned data to four rows.

```
query = strcat("SELECT job_id,hire_date,email ", ...
    "FROM employeedata.employees_by_job ", ...
    "WHERE job_id IN ('IT_PROG','SH_CLERK') ", ...
    "AND hire_date < '2006-04-30'", ...
    "LIMIT 4;");
```

Execute the CQL query using the Cassandra database connection and display the results.

```
results = executecql(conn,query)
```

```
results=4×3 table
      job_id       hire_date        email
    __________    ___________    __________

    "IT_PROG"     05-Feb-2006    "VPATABAL"
    "IT_PROG"     03-Jan-2006    "AHUNOLD"
    "IT_PROG"     25-Jun-2005    "DAUSTIN"
    "SH_CLERK"    24-Apr-2006    "AWALSH"
```

`results` is a table with the `job_id`, `hire_date`, and `email` variables. The `hire_date` variable is a `datetime` array and the `job_id` and `email` variables are string arrays.

Close the Cassandra database connection.

```
close(conn)
```

See Also

`apacheCassandra` | `executecql` | `close`

Related Examples

- “Explore and Import Data from Cassandra Database Table” on page 9-11
- “Fill Values for Missing Data from Database Using Apache Cassandra Database C++ Interface” on page 9-9

External Websites

- Apache Cassandra
- Apache Cassandra Documentation
- CQL Reference Documentation
- CQL Data Types

Export MATLAB Data into Cassandra Database

This example shows how to export data from a MATLAB® table into an Apache™ Cassandra® database using a Cassandra database connection with the Apache Cassandra database C++ interface.

In this example, the Cassandra database includes the `employees_by_job` database table, which contains employee data and the `job_id` partition key.

Create Cassandra Database Connection

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Explore Data from Cassandra Database

Return the names of the Cassandra database tables in the `employeedata` keyspace. `t` is a string array that contains the names of these tables.

```
keyspace = "employeedata";
t = tablenames(conn,keyspace)
```

```
t = 3×1 string
    "employees_by_id"
    "employees_by_job"
    "employees_by_name"
```

Import employee data into MATLAB from the `employees_by_job` table in the `employeedata` keyspace by using the Cassandra database connection.

```
keyspace = "employeedata";
tablename = "employees_by_job";
results = partitionRead(conn,keyspace,tablename);
```

Display the last few rows of the imported employee data.

```
tail(results)
```

```
ans=8×13 table
       job_id        hire_date     employee_id    commission_pct    department_id      email
    ____________    ___________    ___________    ______________    _____________    __________

    "SH_CLERK"      27-Jan-2004        184              NaN               50         "NSARCHAN"
    "MK_REP"        17-Aug-2005        202             0.25               20         "PFAY"
    "PU_CLERK"      10-Aug-2007        119              NaN               30         "KCOLMENA"
    "PU_CLERK"      15-Nov-2006        118              NaN               30         "GHIMURO"
    "PU_CLERK"      24-Dec-2005        116              NaN               30         "SBAIDA"
    "PU_CLERK"      24-Jul-2005        117              NaN               30         "STOBIAS"
```

```
    "PU_CLERK"      18-May-2003       115               NaN                30         "AKHOO"
    "AC_ACCOUNT"    07-Jun-2002       206               NaN               110         "WGIETZ"
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Display the CQL data types of the columns in the `employees_by_job` database table.

```
cols = columninfo(conn,keyspace,tablename);
cols(:,1:2)
```

```
ans=13×2 table
            Name                DataType
    _____________________    ___________

    "job_id"                 "text"
    "hire_date"              "date"
    "employee_id"            "int"
    "commission_pct"         "double"
    "department_id"          "int"
    "email"                  "text"
    "first_name"             "text"
    "last_name"              "text"
    "manager_id"             "int"
    "office"                 "office"
    "performance_ratings"    "list<int>"
    "phone_number"           "text"
    "salary"                 "int"
```

Insert Data from MATLAB into Cassandra Database

Create a table of data representing one employee to insert into the Cassandra database. Specify the names of the variables. Create a table for the office information. Then, create a table with the employee information that contains the nested table of office information. Set the names of the variables.

```
varnames = ["job_id" "hire_date" "employee_id" ...
    "commission_pct" "department_id" "email" "first_name" ...
```

```
    "last_name" "manager_id" "office" "performance_ratings" ...
    "phone_number" "salary"];
office = table("South",160, ...
    'VariableNames',["building" "room"]);
data = table("IT_ADMIN",datetime('today'),301,0.25,30,"SMITH123", ...
    "Alex","Smith",114,office,{[4 5]},"515.123.2345",3000);
data.Properties.VariableNames = varnames;
```

Insert the employee information into the Cassandra database.

```
upsert(conn,keyspace,tablename,data)
```

Display the inserted data by importing it into MATLAB using the partition key `IT_ADMIN`. The `employees_by_job` table contains a new row.

```
keyValue = "IT_ADMIN";
results = partitionRead(conn,keyspace,tablename,keyValue)
```

```
results=1×13 table
      job_id        hire_date     employee_id    commission_pct    department_id      email
    __________    ___________    ___________    ______________    _____________    __________

    "IT_ADMIN"    07-Oct-2020        301             0.25               30         "SMITH123"
```

Update Data in Cassandra Database

Update the `email` variable in the new row of employee information.

```
results.email = "SMITH456";
upsert(conn,keyspace,tablename,results)
```

Display the updated data by importing it into MATLAB. The row contains the updated data in the `email` variable of the `employees_by_job` table.

```
results = partitionRead(conn,keyspace,tablename,keyValue)
```

```
results=1×13 table
      job_id        hire_date     employee_id    commission_pct    department_id      email
    __________    ___________    ___________    ______________    _____________    __________

    "IT_ADMIN"    07-Oct-2020        301             0.25               30         "SMITH456"
```

Close Cassandra Database Connection

```
close(conn)
```

See Also

`apacheCassandra` | `tablenames` | `upsert` | `partitionRead` | `close`

Related Examples

- “Explore and Import Data from Cassandra Database Table” on page 9-11
- “Import Data from Cassandra Database Table Using CQL” on page 9-14

- “Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface” on page 9-2

External Websites

- Apache Cassandra
- Apache Cassandra Documentation

10

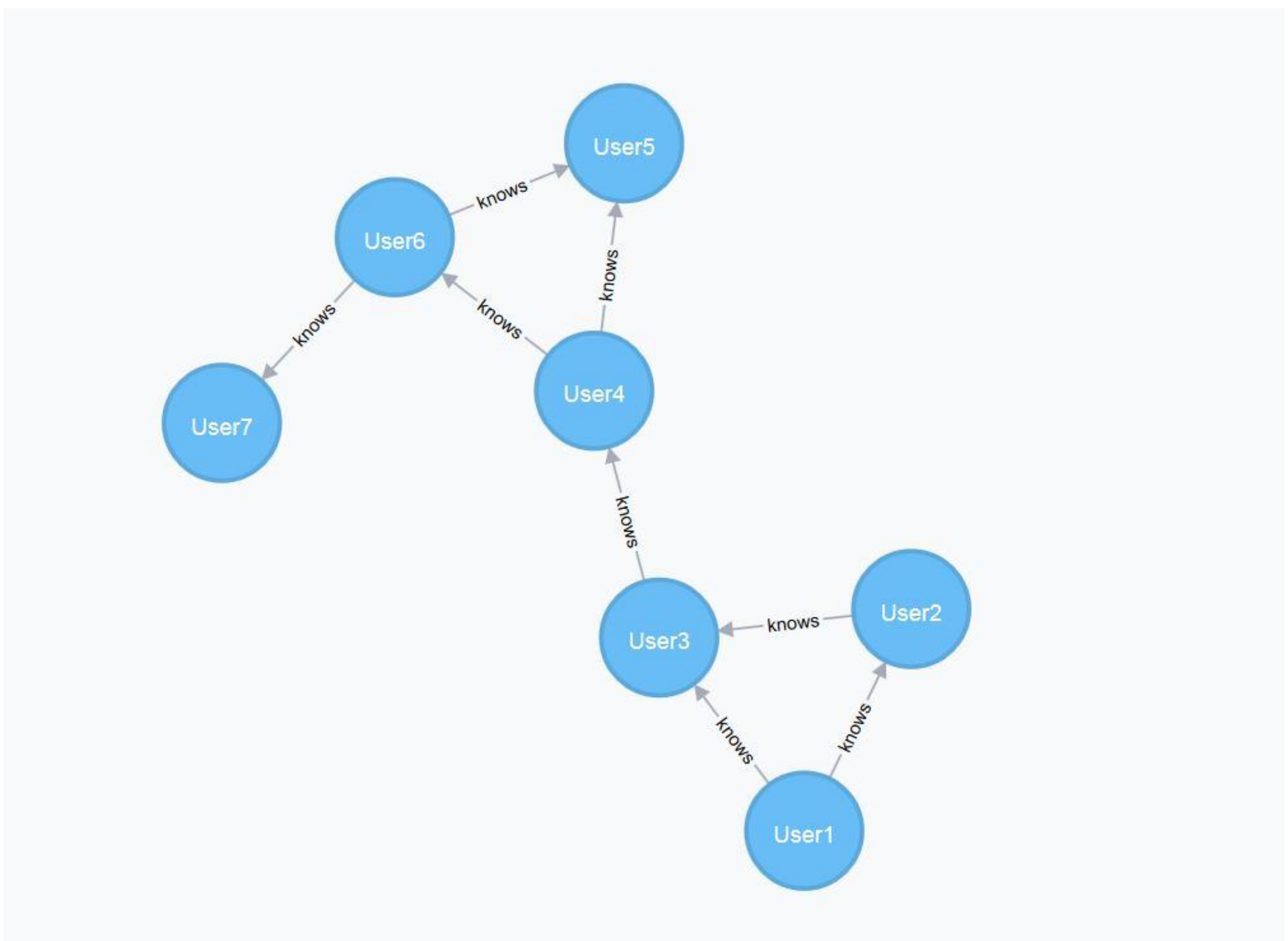
Neo4j Topics

Explore Graph Database Structure

This example shows how to traverse a graph and explore its structure using the MATLAB® interface to Neo4j®. For details about the MATLAB interface to Neo4j, see “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

The local machine hosts the Neo4j database with the port number `7474`, user name `neo4j`, and password `matlab`. This figure provides a visual representation of the data in the database.



Connect to Neo4j Database

Create a Neo4j connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
```

```
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Explore Structure of Entire Graph

Find all the node labels in the Neo4j database using the Neo4j connection object `neo4jconn`.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels = 1×1 cell array
    {'Person'}
```

Find all the relationship types in the Neo4j database.

```
reltypes = relationTypes(neo4jconn)
```

```
reltypes = 1×1 cell array
    {'knows'}
```

Find the property keys in the Neo4j database.

```
propkeys = propertyKeys(neo4jconn)
```

```
propkeys = 15×1 cell array
    {'Name'       }
    {'property'   }
    {'title'      }
    {'Description'}
    {'EndNodes'   }
    {'Location'   }
    {'EndDate'    }
    {'Address'    }
    {'Project'    }
    {'Department' }
    {'StartDate'  }
    {'Title'      }
    {'Date'       }
    {'Weight'     }
    {'name'       }
```

Search for Nodes

Search for all the nodes with the node label `Person`. The `nodesinfo` output argument contains node labels, node data, and the `Neo4jNode` objects for each matched node.

```
nlabel = 'Person';

nodesinfo = searchNode(neo4jconn,nlabel)
```

```
nodesinfo=7×3 table
         NodeLabels      NodeData                  NodeObject
         __________    ____________    ___________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    4     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    5     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    9     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

Search for the node with the node identifier `2`. The `nodeinfo` output argument contains the node identifier, node data, and node labels for the node with node identifier `2`.

```
nodeid = 2;

nodeinfo = searchNodeByID(neo4jconn,nodeid)
```

```
nodeinfo = 
  Neo4jNode with properties:

        NodeID: 2
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

Search for Relationships

Search for incoming relationship types that belong to the node `nodeinfo`.

```
nodereltypes = nodeRelationTypes(nodeinfo,'in')
```

```
nodereltypes = 1×1 cell array
    {'knows'}
```

Search for the degree of all incoming relationships that belong to the node `nodeinfo`.

```
degree = nodeDegree(nodeinfo,'in')
```

```
degree = struct with fields:
    knows: 1
```

Search for the relationship with the node identifier `4`.

```
relationid = 4;

relationinfo = searchRelationByID(neo4jconn,relationid)
```

```
relationinfo = 
  Neo4jRelation with properties:
```

```
      RelationID: 4
    RelationData: [1×1 struct]
     StartNodeID: 3
    RelationType: 'knows'
       EndNodeID: 5
```

Search for all incoming relationships that belong to the node `nodeinfo`. The `relinfo` output argument contains data about the start and end nodes and all matched relationships from the origin node.

```
relinfo = searchRelation(neo4jconn,nodeinfo,'in')
```

```
relinfo = struct with fields:
       Origin: 2
        Nodes: [2×3 table]
    Relations: [1×5 table]
```

Retrieve Entire Graph

Retrieve the entire graph using node labels `nlabels`.

```
graphinfo = searchGraph(neo4jconn,nlabels)
```

```
graphinfo = struct with fields:
        Nodes: [7×3 table]
    Relations: [8×5 table]
```

`graphinfo` contains node data for all start and end nodes for each matched relationship. `graphinfo` also contains relationship data for each matched relationship.

Close Database Connection

```
close(neo4jconn)
```

See Also

`neo4j` | `nodeLabels` | `relationTypes` | `propertyKeys` | `searchNodeByID` | `searchNode` | `nodeRelationTypes` | `nodeDegree` | `searchRelation` | `searchRelationByID`

More About

- “Search Graph Database” on page 10-9
- “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6

External Websites

- Neo4j Documentation

Graph Database Workflow for Neo4j Database Interfaces

You can interact with graph data stored in a Neo4j database using the MATLAB interface to Neo4j or the Database Toolbox Interface for Neo4j Bolt Protocol. The MATLAB interface to Neo4j uses the REST API to create a database connection. The Database Toolbox Interface for Neo4j Bolt Protocol uses the Bolt protocol to make the connection.

The MATLAB interface to Neo4j enables you to:

- Create a Neo4j database connection using the REST API.
- Import graph data from a Neo4j database into MATLAB.
- Perform graph network analysis by creating a directed graph from the imported graph data.
- Create, update, and delete nodes and relationships in the graph database.
- Update node labels and properties and update relationship properties.
- Export a directed graph from MATLAB into a Neo4j database.
- Execute Cypher® queries on the Neo4j database, if you are familiar with the Cypher query language.
- Close the database connection.

The Database Toolbox Interface for Neo4j Bolt Protocol enables you to use the same functionality and the same workflow to interact with graph data stored in a Neo4j database.

About Neo4j Graph Databases

A graph database stores data using a graph data model. This model consists of nodes and relationships. A relationship describes how two or more nodes are related to each other.

Nodes can have one or more node labels and property keys, or zero labels and property keys. Neo4j assigns unique identifiers to nodes and relationships.

Relationships are always directed and have a relationship type. A relationship always has a start node and an end node. A node can have incoming and outgoing relationships. Two nodes can have multiple relationships between them.

For details about graphs, see “Directed and Undirected Graphs”. For details about the Neo4j database, see Why Graph Databases?

Neo4j Graph Database Workflow

This workflow shows how to connect to a Neo4j database, search and update the graph database, store a directed graph, and perform graph network analysis.

1. Connect to a Neo4j database using `neo4j`.
2. Search the graph database.

   Conduct a general search in the graph database using any of these functions:

   - `nodeLabels`
   - `propertyKeys`

- `relationTypes`
- `searchGraph`

Or, conduct a targeted search in the graph database using any of these functions:

- `searchNode`
- `searchNodeByID`
- `searchRelation`
- `searchRelationByID`
- `nodeDegree`
- `nodeRelationTypes`

3. Update the graph database.

   Create nodes and relationships using these functions:

   - `createNode`
   - `createRelation`

   Update nodes and relationships using these functions:

   - `addNodeLabel`
   - `removeNodeLabel`
   - `removeNodeProperty`
   - `removeRelationProperty`
   - `setNodeProperty`
   - `setRelationProperty`
   - `updateNode`
   - `updateRelation`

   Delete nodes and relationships using these functions:

   - `deleteNode`
   - `deleteRelation`
4. Export a directed graph from MATLAB into a Neo4j database by using the `storeDigraph` function.
5. To perform graph network analysis, you can convert output structures to `digraph` objects using `neo4jStruct2Digraph`. For details, see “Directed and Undirected Graphs”.

   Or, if you know the Cypher query language, you can execute a Cypher query using `executeCypher`. For details, see Cypher Query Language.
6. Close the database connection using the `close` function.

Advantage of Database Toolbox Interface for Neo4j Bolt Protocol

You can connect to a Neo4j database using the REST API or the Bolt protocol. The Bolt protocol provides the advantage of sending binary data instead of a JSON payload using the REST API. Binary data is smaller than a JSON payload. Sending data of a smaller size generally improves performance when you use the Bolt protocol.

To use the Bolt protocol, you must install the Database Toolbox Interface for Neo4j Bolt Protocol. For details, see “Database Toolbox Interface for Neo4j Bolt Protocol Installation” on page 10-37. For details about connecting to a Neo4j database using either interface, see the `neo4j` function.

See Also

`neo4j` | `neo4jStruct2Digraph` | `digraph`

More About

- “Find Friends of Friends in Social Neighborhood” on page 10-32
- “Visualize Breadth-First and Depth-First Search”
- “Directed and Undirected Graphs”
- “Update Friend Information in Social Neighborhood” on page 10-11
- “Add and Query Group of Colleagues in Social Neighborhood” on page 10-14
- “Search Graph Database” on page 10-9
- “Error Messages for Neo4j Database Interfaces” on page 10-20

External Websites

- Neo4j Documentation
- Cypher Query Language

Search Graph Database

Search a Neo4j graph database using functions provided by the MATLAB interface to Neo4j and the Database Toolbox Interface for Neo4j Bolt Protocol. You can explore the graph data and perform graph network analysis using MATLAB directed graphs.

Search Functionality

Search graph data in a Neo4j graph database using different parts of the graph:

- Search for one or more nodes using `searchNode`. Search for a node with a specific identifier using `searchNodeByID`.
- Search for relationships from an origin node using `searchRelation`.
- Search for the entire graph database or a subgraph using `searchGraph`.

To access the part of the graph database that you want to analyze, combine these functions and explore the graph data in the output arguments.

General and Targeted Search Workflows

You can search a Neo4j graph database in a general or targeted way. A general search starts from a subgraph or the entire graph. A targeted search starts from an origin node and traverses its relationships.

After finding a part of the graph, you can create a MATLAB directed graph and perform graph network analysis.

Conduct General Search

1. Conduct a general search for a subgraph using `searchGraph`.

   For example, to find the subgraph `graphinfo`, enter this code, which assumes a successful Neo4j database connection `neo4jconn`. The `graphinfo` output argument is a directed graph.

   ```
   nlabel = {'Person'};

   graphinfo = searchGraph(neo4jconn,nlabel, ...
       'DataReturnFormat','digraph');
   ```
2. Perform graph network analysis using the `digraph` object `G`. For details, see “Directed and Undirected Graphs”.

   For example, determine the shortest path between nodes using `distances`.

   ```
   d = distances(G);
   ```

   Or, explore the graph data by executing the `searchGraph` function without the `'DataReturnFormat'` name-value pair argument and accessing the output structure `graphinfo`.

Conduct Targeted Search

1. To start your search, find the origin node using `searchNode` or `searchNodeByID`.

For example, to find the origin node `nodeinfo`, enter this code, which assumes a successful Neo4j database connection `neo4jconn` and the node identifier `2`.

```
nodeinfo = searchNodeByID(neo4jconn,2);
```

2 Search for graph data by using the origin node and `searchRelation`. Or, if you know the relationship identifier, then use the `searchRelationByID` function.

   For example, this code assumes that you are searching for incoming relationships. The `relinfo` output argument is a directed graph.

```
relinfo = searchRelation(neo4jconn,nodeinfo,'in','DataReturnFormat','digraph');
```

3 Perform graph network analysis using the `digraph` object `G`. For details, see “Directed and Undirected Graphs”.

   For example, determine the shortest path between nodes using `distances`.

```
d = distances(G);
```

   Or, explore node information by accessing the output structure `nodeinfo`. Also, explore relationship information by executing the `searchRelation` function without the `'DataReturnFormat'` name-value pair argument and accessing the output structure `relinfo`.

See Also

`searchNode` | `searchNodeByID` | `searchRelation` | `searchGraph` | `nodeDegree`

More About

- “Explore Graph Database Structure” on page 10-2
- “Find Shortest Path Between People in Social Neighborhood” on page 10-27
- “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6
- “Error Messages for Neo4j Database Interfaces” on page 10-20

External Websites

- Neo4j Documentation

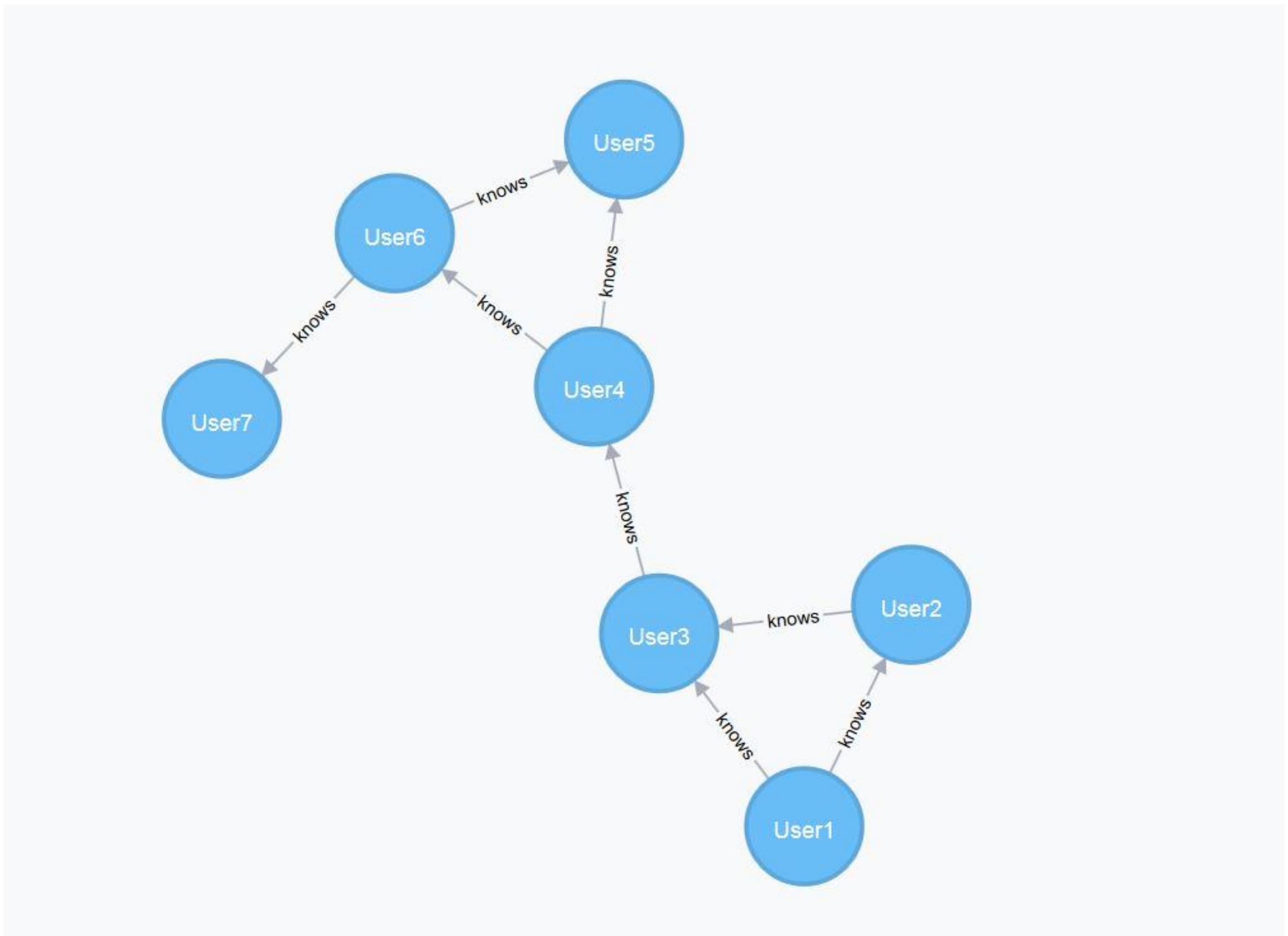
Update Friend Information in Social Neighborhood

This example shows how to create, update, and delete information in a social neighborhood, which is represented by a Neo4j® database, using the MATLAB® interface to Neo4j.

For details about the MATLAB interface to Neo4j, see "Graph Database Workflow for Neo4j Database Interfaces" on page 10-6.

Assume that you have graph data stored in a Neo4j database that represents the social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

The local machine hosts the Neo4j database with the port number `7474`, user name `neo4j`, and password `matlab`. This figure provides a visual representation of the data in the database.



Connect to Neo4j Database

Create a Neo4j connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Add Two Friends to Social Neighborhood

Create two nodes in the database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the label `Person` for each node.

```
label = 'Person';
user8 = createNode(neo4jconn,'Labels',label);
user9 = createNode(neo4jconn,'Labels',label);
```

Search for the node with the label `Person` and the property key `name` set to the value `User7` by using the Neo4j database connection.

```
nlabel = 'Person';
user7 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7');
```

Create two relationships using the Neo4j database connection. Specify the relationship types as `works with` and `studies with`. The two relationships are:

- `User8` works with `User7`
- `User8` studies with `User9`

`relationinfo` is a table that contains the relationship and node information.

```
startnode = [user8,user8];
endnode = [user7,user9];
relationtype = {'works with','studies with'};
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype);
```

Update Node Information for Added Friend

Update the properties of the node `User8`. Create a table with one row that contains the name and job title for this person. `nodeinfo` is a `Neo4jNode` object.

```
properties = table("User8","Analyst",'VariableNames',{'Name','Title'});
nodeinfo = setNodeProperty(neo4jconn,user8,properties);
```

Add the node label `Student` to `User9`.

```
labels = 'Student';
nodeinfo = addNodeLabel(neo4jconn,user9,labels);
```

Update Relationship Information for Added Friends

Create a table that defines the relationship properties. Here, `User8` works with `User7` in the workplace, and `User8` studies with `User9` in the library. Also, `User8` started working with `User7` on January 2, 2017, and `User8` started studying with `User9` on March 6, 2017.

```
properties = table(["Workplace";"Library"],["01/02/2017";"03/06/2017"], ...
    'VariableNames',{'Location','Date'});
```

Update both relationships with these properties. `relationinfo` is a table that contains the updated relationships.

```
relations = relationinfo.RelationObject;
relationinfo = setRelationProperty(neo4jconn,relations,properties);
```

Delete Relationship for Added Friend

Delete the relationship that connects `User8` to `User7`.

```
relation = relations(1);
deleteRelation(neo4jconn,relation)
```

Delete Friends

Delete the added nodes and any associated relationships.

```
nodes = [user8,user9];
deleteNode(neo4jconn,nodes,'DeleteRelations',true)
```

Close Database Connection

```
close(neo4jconn)
```

See Also

`Neo4jNode` | `deleteNode` | `neo4j` | `deleteRelation` | `createNode` | `createRelation` | `addNodeLabel` | `setNodeProperty` | `setRelationProperty` | `close`

More About

- “Find Shortest Path Between People in Social Neighborhood” on page 10-27
- “Find Friends of Friends in Social Neighborhood” on page 10-32
- “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6

External Websites

- Neo4j Documentation

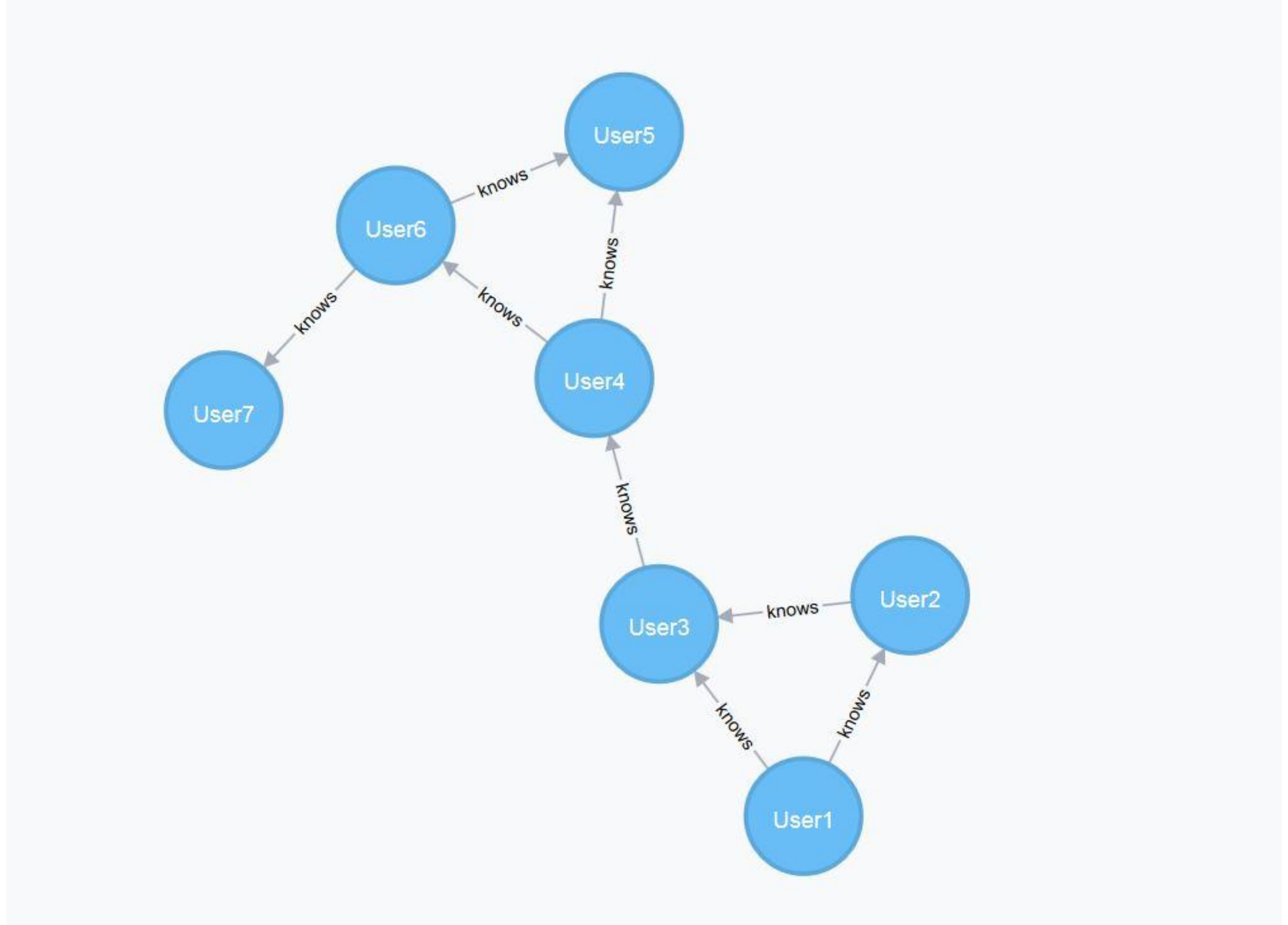
Add and Query Group of Colleagues in Social Neighborhood

This example shows how to add a group of colleagues, stored as a directed graph, to a group of friends in a social neighborhood, stored as nodes and relationships in a Neo4j® database. The example then shows how to query the graph in the database by using the Cypher® query language, which enables you to create custom queries.

For details about the MATLAB® interface to Neo4j, see “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6.

Assume that you have graph data stored in a Neo4j database that represents the social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

The local machine hosts the Neo4j database with the port number `7474`, user name `neo4j`, and password `matlab`. This figure provides a visual representation of the data in the database.



Connect to Neo4j Database

Create a Neo4j connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create Directed Graph

Define a group of four colleagues by creating a directed graph in MATLAB. Create a `digraph` object that has four nodes and three edges.

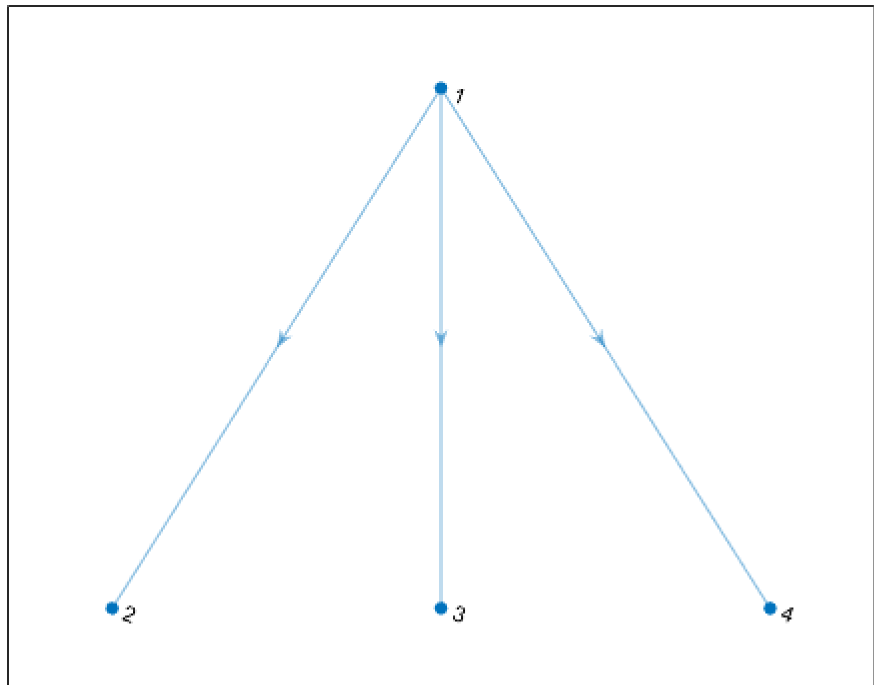
```
s = [1 1 1];
t = [2 3 4];
G = digraph(s,t);
```

Specify names for the nodes.

```
G.Nodes.name = {'User8';'User9';'User10';'User11'};
```

Plot the digraph to view the nodes and edges.

```
plot(G)
```



Store Directed Graph in Neo4j Database

Store the directed graph as a Neo4j graph. Specify two labels for all nodes in the resulting Neo4j graph by using the `GlobalNodeLabel` name-value pair argument. Also, specify the type `works with` for all relationships in the resulting Neo4j graph by using the `GlobalRelationType` name-value pair argument.

```
graphinfo = storeDigraph(neo4jconn,G, ...
    'GlobalNodeLabel',{'Colleague','Person'}, ...
    'GlobalRelationType','works with');
```

Display the node labels of the first node in the graph.

```
graphinfo.Nodes.NodeLabels{1}
```

```
ans = 2×1 cell array
    {'Person'   }
    {'Colleague'}
```

The result is a cell array of character vectors. Each character vector is a node label for the first node.

Display the relationships in the graph.

```
graphinfo.Relations
```

```
ans=3×5 table
          StartNodeID    RelationType    EndNodeID    RelationData                 RelationObject
```

```
            ___________    ____________    _________    ____________    ___________________________

    20         31          'works with'        8        [1×1 struct]    [1x1 database.neo4j.http.Ne
    23         31          'works with'       32        [1×1 struct]    [1x1 database.neo4j.http.Ne
    24         31          'works with'       33        [1×1 struct]    [1x1 database.neo4j.http.Ne
```

`Relations` is a table that contains these variables:

- Start node identifier
- Relationship type
- End node identifier
- Relationship data
- `Neo4jRelation` object

Connect Group of Colleagues to Friends in Existing Graph

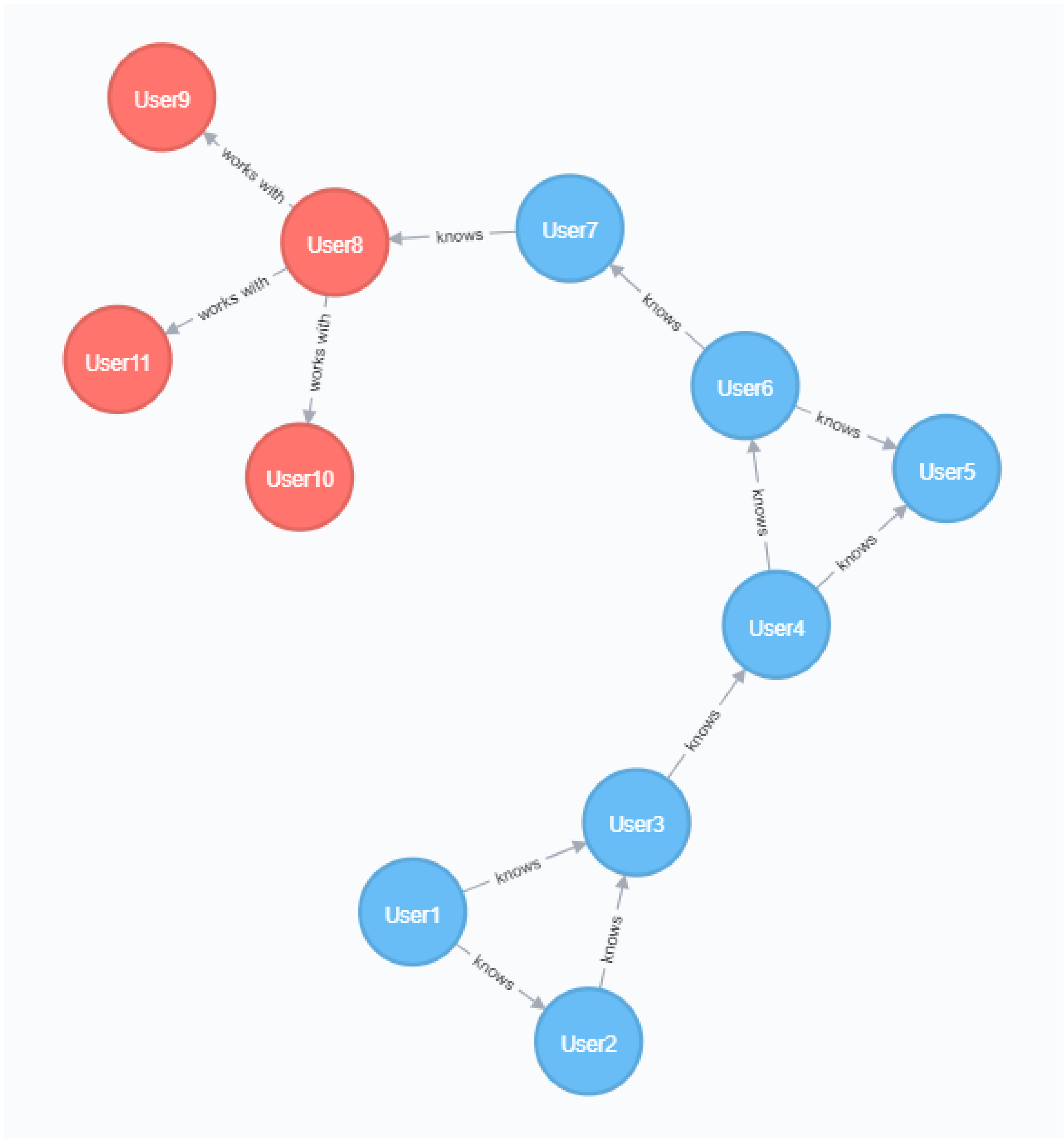
Search for the nodes with the node label `Person` and the property key `name` set to the values `User7` and `User8` by using the Neo4j database connection.

```
nlabel = 'Person';
user7 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7');
user8 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User8');
```

Add a relationship between the nodes `User7` and `User8` to connect the group of colleagues to the group of friends.

```
relationtype = 'knows';
relation = createRelation(neo4jconn,user7,user8,relationtype);
```

Display the resulting graph in the Neo4j database.



Execute Cypher Query on Neo4j Database

Create a Cypher query to find the people who work with people `User7` knows. Display the names of those people.

```
query = ['MATCH (:Person {name: "User7"})-[:knows]->(:Person)-[:`works with`]' ...
    '->(potentialContact:Person) RETURN potentialContact.name'];
results = executeCypher(neo4jconn,query)
```

```
results=3×1 table
    potentialContact_name
    _____________________
```

```
    'User11'
    'User10'
    'User9'
```

`User9`, `User10`, and `User11` all work with someone that `User7` knows. `User7` knows `User8`, who works with `User9`, `User10`, and `User11`.

Close Database Connection

```
close(neo4jconn)
```

See Also

`neo4j` | `storeDigraph`

More About

- “Search Graph Database” on page 10-9
- “Explore Graph Database Structure” on page 10-2

External Websites

- Neo4j Documentation
- Cypher Query Language

Error Messages for Neo4j Database Interfaces

The MATLAB interface to Neo4j, the Database Toolbox Interface for Neo4j Bolt Protocol, and the Neo4j database return error messages.

The Neo4j database error messages always have a status code that starts with `Neo.ClientError`. To troubleshoot these errors, consult the Neo4j Documentation.

The MATLAB interface to Neo4j and the Database Toolbox Interface for Neo4j Bolt Protocol return error messages in plain text. This table describes how to address common errors you can encounter while working with both interfaces.

Error Message	Probable Cause	Resolution
`Invalid connection.`	The Neo4j database connection is invalid.	Connect to the Neo4j database using `neo4j`.
`Unable to connect. Please try again.`	The Neo4j database connection is invalid.	Connect to the Neo4j database using `neo4j`.
`No Nodes found with matching criteria.`	The search cannot find nodes for the specified node label or property keys and values.	Verify the node label or property keys and values. Then, run `searchNode`.
`Unable to find “relationship” relationships for node with id “node identifier” in database.`	The search cannot find relationships for the specified relationships and node in the Neo4j database.	Verify the origin node and direction. Then, run `searchRelation`.
`No node labels found.`	The Neo4j database has no node labels.	Open the Neo4j database and add node labels. For details, see the Neo4j Operations Manual in the Neo4j Documentation. Then, run `nodeLabels`.
`No relationship types found.`	The Neo4j database has no relationship types.	Open the Neo4j database and add relationship types. For details, see the Neo4j Operations Manual in the Neo4j Documentation. Then, run `relationTypes`.
`No property keys found.`	The Neo4j database has no property keys.	Open the Neo4j database and add property keys. For details, see the Neo4j Operations Manual in the Neo4j Documentation. Then, run `propertyKeys`.
`Unable to execute Cypher query.`	The Cypher query is invalid.	Verify the Cypher query. Then, run `executeCypher`. For details about writing Cypher queries, see Cypher Query Language.

Error Message	Probable Cause	Resolution
`Unable to find one or more of the specified nodes in the database.`	When you update or delete nodes, the specified node does not exist in the Neo4j database. Or, when you create a relationship, the specified start node or end node does not exist in the Neo4j database.	Find nodes in the Neo4j database using the `searchNode` function.
`Unable to find one or more of the specified relations in the database.`	When you update or delete relationships, the specified relationship does not exist in the Neo4j database.	Find relationships in the Neo4j database using the `searchRelation` function.
`One or more nodes have relations. Explicitly delete relations. Or, to delete both nodes and all associated relations, set 'DeleteRelations' to true.`	When you delete nodes, the specified nodes have associated relationships.	Delete the node and its associated relationships by using this syntax of the `deleteNode` function: `deleteNode(neo4jconn,node,'DeleteRelations',true)`
`Duplicate nodes not supported.`	When you create or update a node, you cannot specify duplicate nodes.	Remove duplicate nodes from the input arguments of the function you execute.
`Duplicate relations not supported.`	When you create or update a relationship, you cannot specify duplicate relationships.	Remove duplicate relationships from the input arguments of the function you execute.
`Database Toolbox Interface for Neo4j Bolt Protocol has not been installed. Open Add-On Explorer to install the add-on.`	You specify the Bolt database connection URL that starts with the `bolt://` protocol identifier and the Database Toolbox Interface for Neo4j Bolt Protocol is not installed.	Install the Database Toolbox Interface for Neo4j Bolt Protocol. For details, see “Database Toolbox Interface for Neo4j Bolt Protocol Installation” on page 10-37.

See Also

`neo4j` | `searchGraph`

More About

- “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6
- “Search Graph Database” on page 10-9
- “Find Friends of Friends in Social Neighborhood” on page 10-32
- “Explore Graph Database Structure” on page 10-2

External Websites

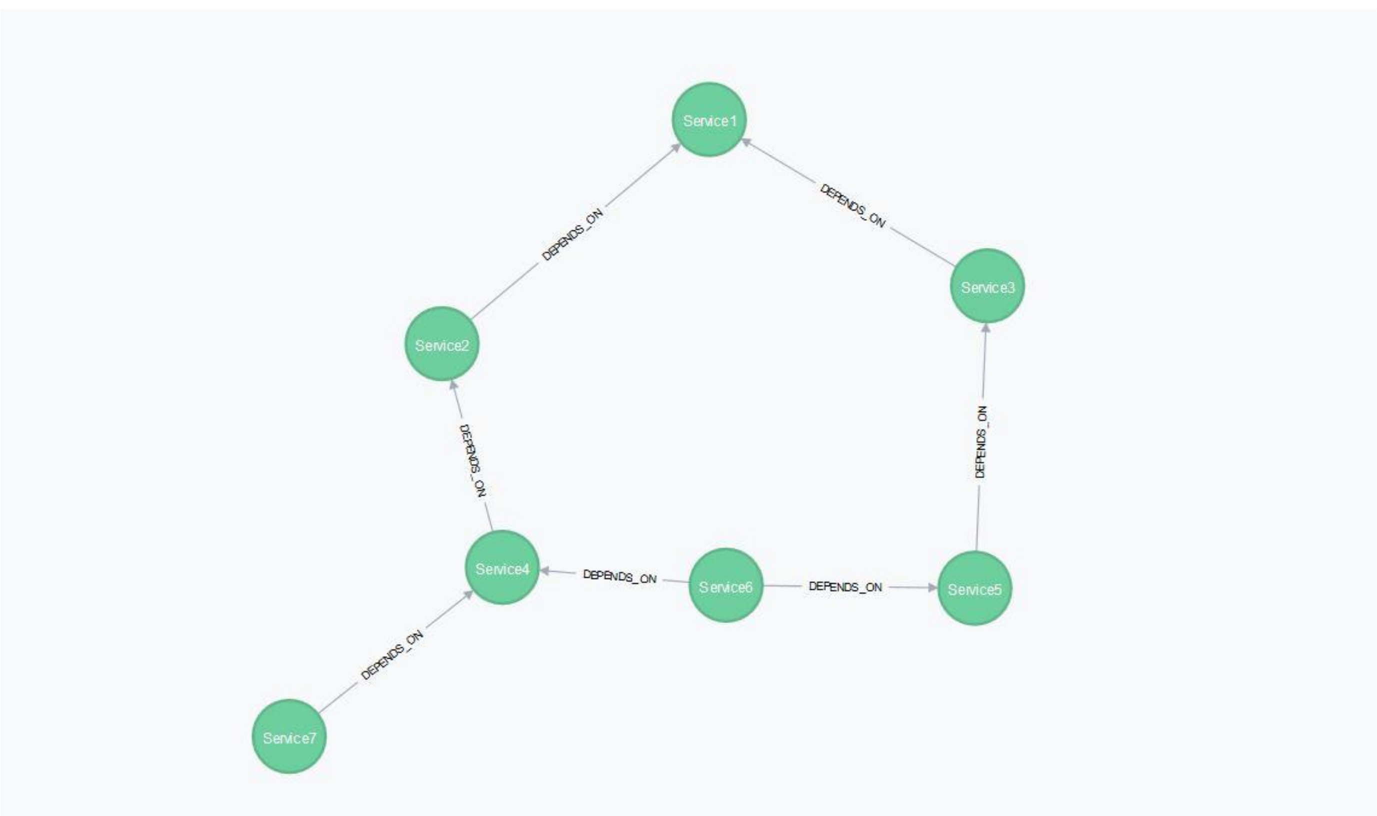
- Neo4j Documentation
- Cypher Query Language

Determine Dependencies of Services in Network

This example shows how to analyze dependencies among services in a network using the MATLAB® interface to Neo4j®. Assume that you have graph data that is stored on a Neo4j database which represents a network. This database has seven nodes and seven relationships. Each node has only one unique property key `name` with values `Service1` through `Service7`. Each relationship has type `DEPENDS_ON`.

To find the number of services each service depends on, use the MATLAB interface to Neo4j and the `digraph` object. For details about the MATLAB interface to Neo4j, see “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6.

The local machine hosts the Neo4j database with port number `7474`, user name `neo4j`, and password `matlab`. For a visual representation of the data in the database, see this figure.



Connect to Neo4j Database

Create a Neo4j connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve Entire Graph

Retrieves all relationships of type `DEPENDS_ON` and all nodes associated with each relationship.

```
network_graphdata = searchGraph(neo4jconn,{'DEPENDS_ON'})
```

```
network_graphdata = struct with fields:
        Nodes: [7×3 table]
    Relations: [7×5 table]
```

Convert Graph Data to Directed Graph

Using the table `network_graphdata.Nodes`, access the `name` property for each node that appears in the `NodeData` variable of the table.

Assign the table `network_graphdata.Nodes` to `nodestable`.

```
nodestable = network_graphdata.Nodes
```

```
nodestable=7×3 table
         NodeLabels      NodeData                    NodeObject
         __________    ____________    ___________________________________

    6    'Service'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    0    'Service'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    4    'Service'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    2    'Service'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3    'Service'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    5    'Service'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1    'Service'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

Assign the row names for each row to `rownames`.

```
rownames = nodestable.Properties.RowNames
```

```
rownames = 7×1 cell array
    {'6'}
    {'0'}
    {'4'}
    {'2'}
    {'3'}
    {'5'}
    {'1'}
```

Access the `NodeData` variable from `nodestable` for each row. `nodedata` contains an array of structures.

```
nodedata = [nodestable.NodeData{rownames}]
```

```
nodedata = 1×7 struct array with fields:
    name
```

To retrieve the `name` field from each structure, index into the array. `nodenames` is a cell array of character vectors that contains node names.

```
nodenames = {nodedata(:).name}
```

```
nodenames = 1×7 cell array
    {'Service7'}    {'Service6'}    {'Service1'}    {'Service3'}    {'Service2'}    {'Service4'}
```

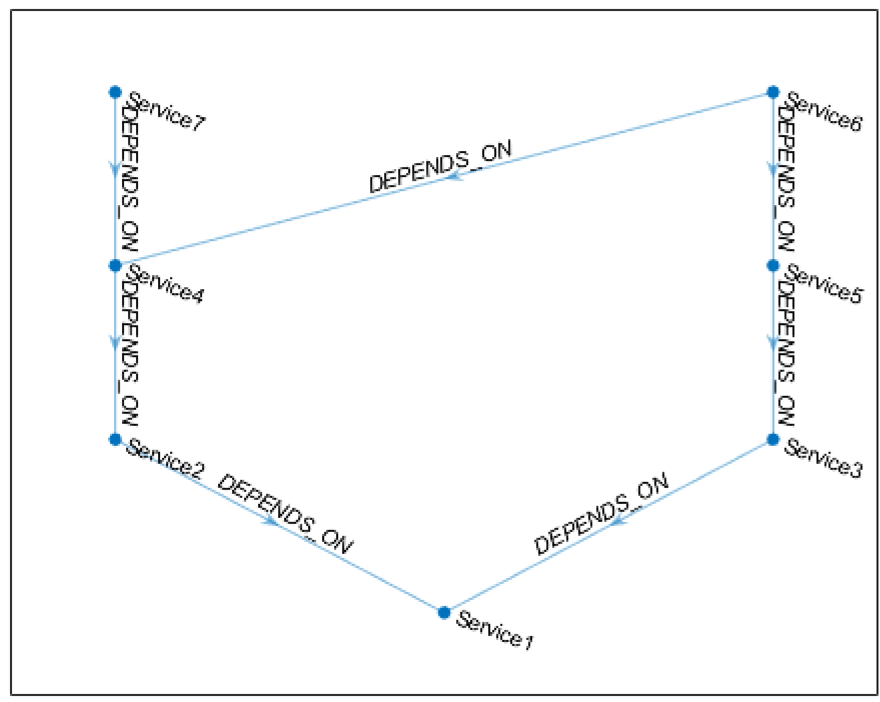
Create the `digraph` object `network_graph` using the `neo4jStruct2Digraph` function and the graph `network_graphdata`.

```
network_graph = neo4jStruct2Digraph(network_graphdata,'NodeNames',nodenames)
```

```
network_graph = 
  digraph with properties:

    Edges: [7×3 table]
    Nodes: [7×3 table]
```

To see a visual representation of the graph, create a figure that displays the graph `network_graph`.

```
plot(network_graph,'EdgeLabel',network_graph.Edges.RelationType)
```



Find Dependency Count of Each Service

Find the number of services that each service depends on in the graph `network_graph`. Determine the dependency count for each node by iterating through the nodes in the graph using a for loop. To determine the dependency count, use the `nearest` function.

Create the table `dependency_count` that stores the count of the dependent services for each service. Sort the rows in the table by dependency count in descending order.

```
dependency_count = table;

for i = 1:height(network_graph.Nodes)
    nodeid = network_graph.Nodes.Name(i);
    nearest_node = nearest(network_graph,nodeid,Inf,'Direction','outgoing');
    nearest_length = length(nearest_node);
    dependency_count = [dependency_count; ...
        table(nodeid,nearest_length, ...
        'VariableNames',{'Node','Dependency_count'})];
end

dependency_count = sortrows(dependency_count,-2)
```

```
dependency_count=7×2 table
       Node        Dependency_count
    ___________    ________________

    'Service6'            5
```

```
    'Service7'          3
    'Service4'          2
    'Service5'          2
    'Service3'          1
    'Service2'          1
    'Service1'          0
```

Find All Dependencies for Specific Service

Find all the services that the service `Service6` depends on in the graph `network_graph` using the `nearest` function.

```
disp('Service6 depends on the following services:');
```

```
Service6 depends on the following services:
```

```
nearest(network_graph,'Service6',Inf,'Direction','outgoing')
```

```
ans = 5×1 cell array
    {'Service4'}
    {'Service5'}
    {'Service3'}
    {'Service2'}
    {'Service1'}
```

Close Database Connection

```
close(neo4jconn)
```

See Also

`neo4j` | `searchNode` | `searchRelation` | `nearest`

Related Examples

- “Find Friends of Friends in Social Neighborhood” on page 10-32

More About

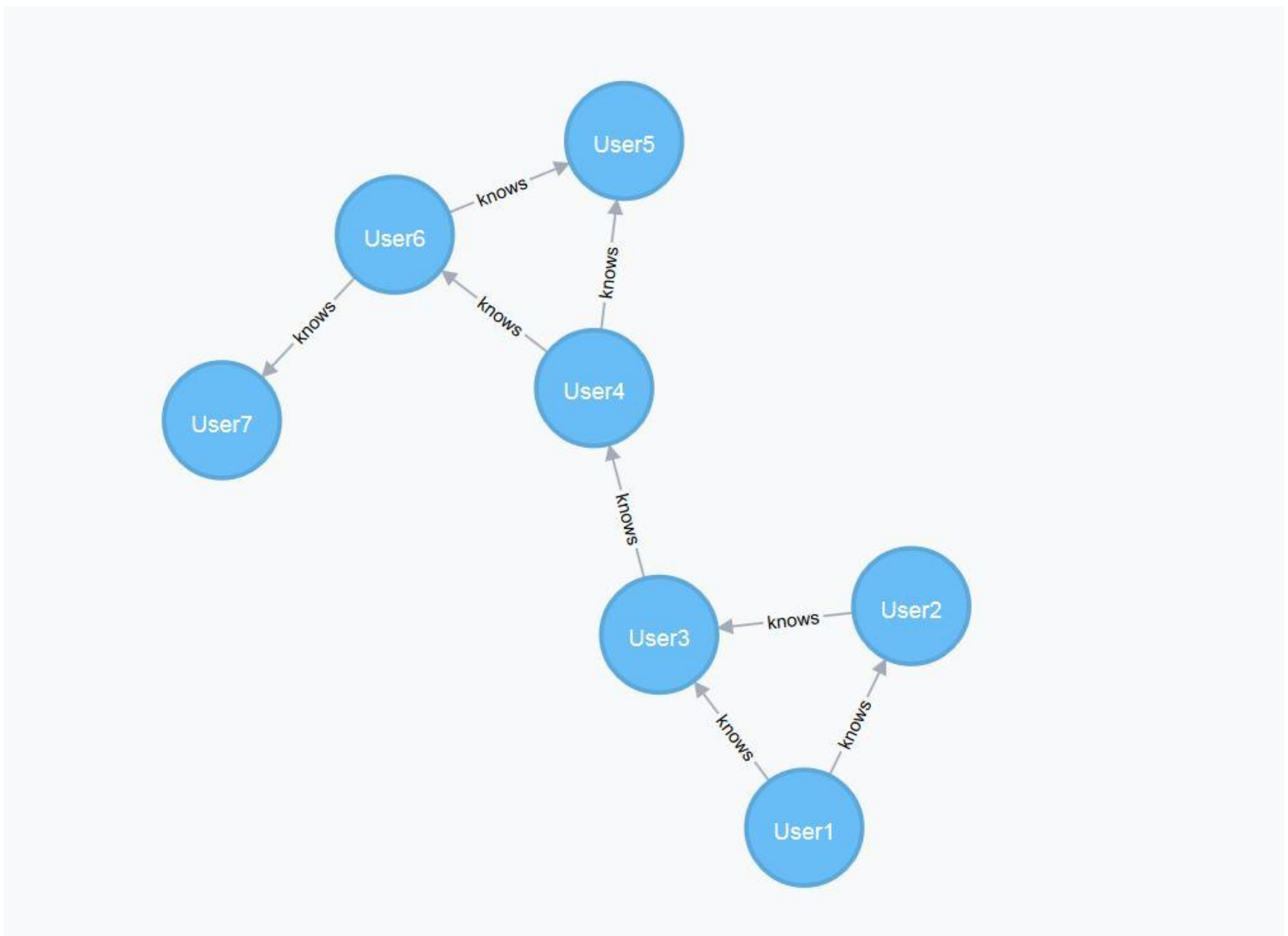
- “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6
- “Directed and Undirected Graphs”

Find Shortest Path Between People in Social Neighborhood

This example shows how to search a social neighborhood to find the shortest path between people, using the MATLAB® interface to Neo4j®. Assume that you have graph data that is stored on a Neo4j database which represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has type `knows`.

To find the shortest path between `User1` and `User7`, use the MATLAB interface to Neo4j and the `digraph` object. For details about the MATLAB interface to Neo4j, see “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6.

The local machine hosts the Neo4j database with port number `7474`, user name `neo4j`, and password `matlab`. For a visual representation of the data in the database, see this figure.



Connect to Neo4j Database

Create a Neo4j connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search Entire Graph

Find all the `Person` nodes and all the relationships associated with each `Person` node using `searchGraph`.

```
social_graphdata = searchGraph(neo4jconn,{'Person'})
```

```
social_graphdata = struct with fields:
        Nodes: [7×3 table]
    Relations: [8×5 table]
```

Convert Graph Data to Directed Graph

Using the table `social_graphdata.Nodes`, access the `name` property for each node that appears in the `NodeData` variable of the table.

Assign the table `social_graphdata.Nodes` to `nodestable`.

```
nodestable = social_graphdata.Nodes
```

```
nodestable=7×3 table
         NodeLabels      NodeData                NodeObject
         __________    ____________    ____________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    4     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    5     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    9     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

Assign the row names for each row in the table `nodestable` to `rownames`.

```
rownames = nodestable.Properties.RowNames
```

```
rownames = 7×1 cell array
    {'0'}
    {'1'}
    {'2'}
    {'3'}
    {'4'}
```

```
    {'5'}
    {'9'}
```

Access the `NodeData` variable from `nodestable` for each row. `nodedata` contains an array of structures.

```
nodedata = [nodestable.NodeData{rownames}]
```

```
nodedata = 1×7 struct array with fields:
    name
```

To retrieve the `name` field from each structure, index into the array. `nodenames` is a cell array of character vectors that contains node names.

```
nodenames = {nodedata(:).name}
```

```
nodenames = 1×7 cell array
    {'User1'}    {'User3'}    {'User2'}    {'User4'}    {'User5'}    {'User6'}    {'User7'}
```

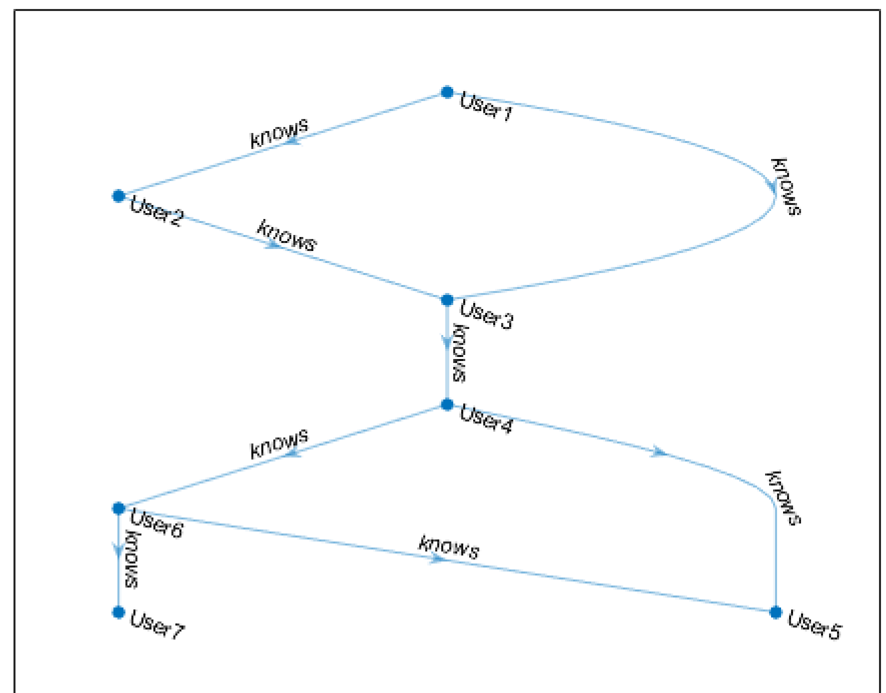
Create the `digraph` object `social_graph` using the `neo4jStruct2Digraph` function with the graph data stored in `social_graphdata` and the node names stored in `nodenames`.

```
social_graph = neo4jStruct2Digraph(social_graphdata,'NodeNames',nodenames)
```

```
social_graph = 
  digraph with properties:

    Edges: [8×3 table]
    Nodes: [7×3 table]
```

To see a visual representation of the graph, create a figure that displays `social_graph`.

```
plot(social_graph,'EdgeLabel',social_graph.Edges.RelationType)
```



Find Shortest Path

Find the shortest path between `User1` and `User7` using `shortestpath`.

```
[user1_to_user7,distance] = shortestpath(social_graph,'User1','User7')
```

```
user1_to_user7 = 1×5 cell array
    {'User1'}    {'User3'}    {'User4'}    {'User6'}    {'User7'}

distance = 4
```

Close Database Connection

```
close(neo4jconn)
```

See Also

`neo4j` | `searchNode` | `searchRelation` | `shortestpath`

Related Examples

- “Find Friends of Friends in Social Neighborhood” on page 10-32

More About

- “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6

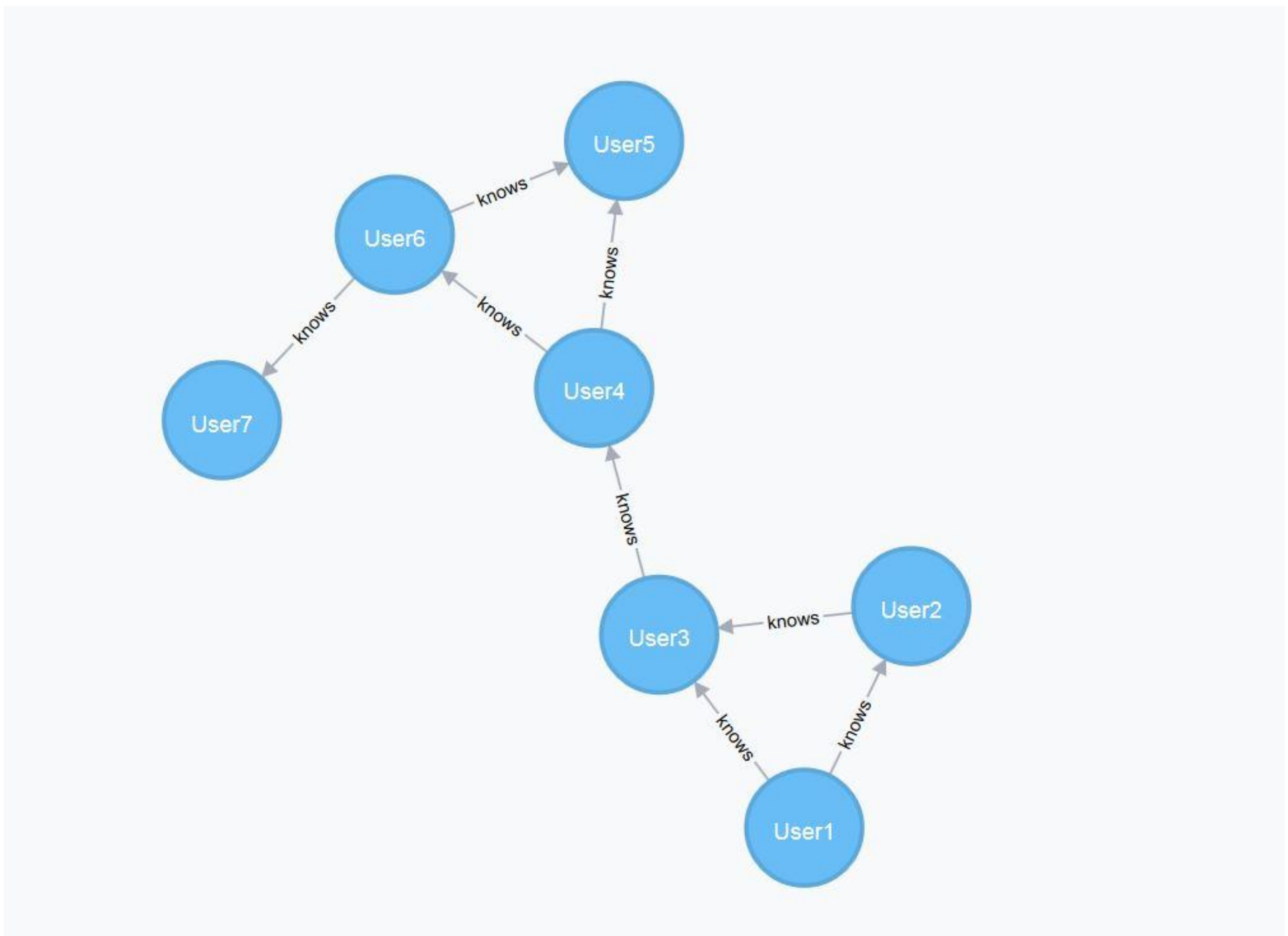
- "Directed and Undirected Graphs"

Find Friends of Friends in Social Neighborhood

This example shows how to search a social neighborhood to find the second-degree friends of a person, using the MATLAB® interface to Neo4j®. Assume that you have graph data that is stored on a Neo4j database which represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has type `knows`.

To find the second-degree friends of `User1`, use the MATLAB interface to Neo4j and the `digraph` object. For details about the MATLAB interface to Neo4j, see “Graph Database Workflow for Neo4j Database Interfaces” on page 10-6.

The local machine hosts the Neo4j database with port number `7474`, user name `neo4j`, and password `matlab`. For a visual representation of the data in the database, see this figure.



Connect to Neo4j Database

Create a Neo4j connection object `neo4jconn` using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message

ans =

     []
```

Search for One Person in Database

Find the node that has the node label `Person` with the property name `User1`.

```
user1 = searchNode(neo4jconn,'Person','PropertyKey','name', ...
    'PropertyValue','User1')

user1 =
  Neo4jNode with properties:

        NodeID: 0
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

Search for All Second-Degree Friends of Person

Find outgoing relationships for `User1`. To limit the search to relationships with a distance of two or less, specify `2` as the value of the name-value pair argument `'Distance'`.

```
user1_relation = searchRelation(neo4jconn,user1,'out','Distance',2)

user1_relation = struct with fields:
       Origin: 0
        Nodes: [4×3 table]
    Relations: [4×5 table]
```

Convert Graph Data to Directed Graph

Using the table `user1_relation.Nodes`, access the `name` property for each node that appears in the `NodeData` variable of the table.

Assign the table `user1_relation.Nodes` to `nodestable`.

```
nodestable = user1_relation.Nodes

nodestable=4×3 table
         NodeLabels      NodeData                   NodeObject
         __________    ____________    ____________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

```
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

Assign the row names for each row in the table `nodestable` to `rownames`.

```
rownames = nodestable.Properties.RowNames
```

```
rownames = 4×1 cell array
    {'0'}
    {'1'}
    {'2'}
    {'3'}
```

Access the `NodeData` variable from `nodestable` for each row. `nodedata` contains an array of structures.

```
nodedata = [nodestable.NodeData{rownames}]
```

```
nodedata = 1×4 struct array with fields:
    name
```

To retrieve the `name` field from each structure, index into the array. `nodenames` is a cell array of character vectors that contains node names.

```
nodenames = {nodedata(:).name}
```

```
nodenames = 1×4 cell array
    {'User1'}    {'User3'}    {'User2'}    {'User4'}
```

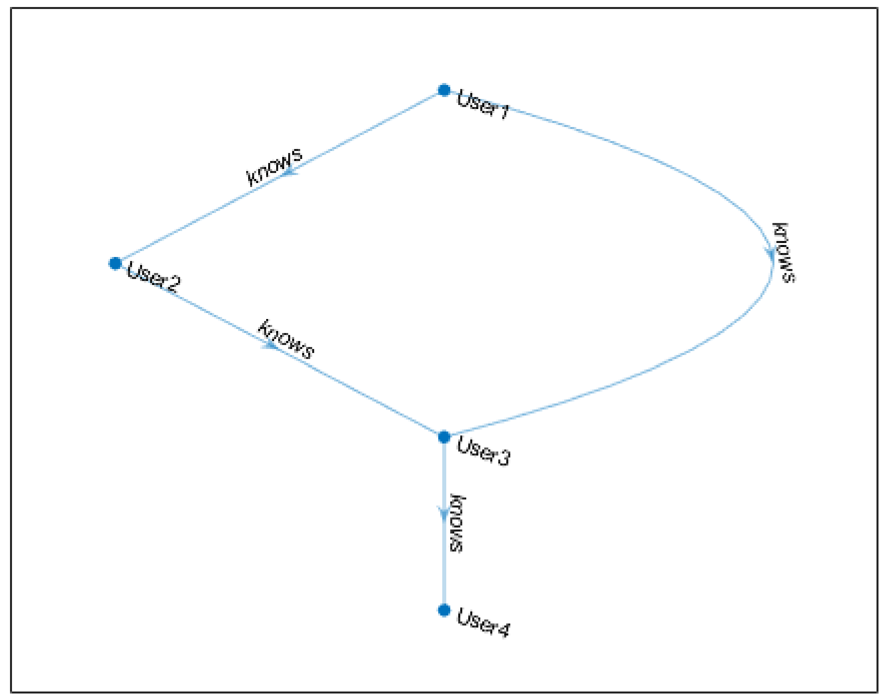
Create the `digraph` object `user1_graph` using the `neo4jStruct2Digraph` function with the relationship data stored in `user1_relation` and the node names stored in `nodenames`.

```
user1_graph = neo4jStruct2Digraph(user1_relation,'NodeNames',nodenames)
```

```
user1_graph = 
  digraph with properties:

    Edges: [4×3 table]
    Nodes: [4×3 table]
```

To see a visual representation of the graph, create a figure that displays `user1_graph`.

```
plot(user1_graph,'EdgeLabel',user1_graph.Edges.RelationType)
```



Find Friends of Person

Retrieve a list of all the first-degree friends of `User1`. The `user1_friend` variable is a cell array of character vectors that contains the names of first-degree friends.

```
disp('Friends of User1 are:')
```

```
Friends of User1 are:
```

```
user1_friend = successors(user1_graph,'User1')
```

```
user1_friend = 2×1 cell array
    {'User3'}
    {'User2'}
```

Find Second-Degree Friends

To find the second-degree friends of `User1`, run `successors` again by looping through the list of the first-degree friends. `user1_friends_friend` is a cell array of character vectors that contains the names of second-degree friends.

```
user1_friends_friend = {};
for i = 1:length(user1_friend)
    user1_friends_friend = [user1_friends_friend; ...
        successors(user1_graph,user1_friend{i})];
end
disp('Friends of User1''s friends are:')
```

```
Friends of User1's friends are:
```

```
user1_friends_friend = unique(user1_friends_friend)
```

```
user1_friends_friend = 2×1 cell array
    {'User3'}
    {'User4'}
```

Remove Duplicate Friends

Remove duplicates from the second-degree friends list that are already in the first-degree friends list using `setdiff`.

```
finalResult = setdiff(user1_friends_friend,user1_friend);
```

```
disp('User1''s second-degree friends are:')
```

```
User1's second-degree friends are:
```

```
for i = 1:length(finalResult)
    disp(finalResult{i})
end
```

```
User4
```

`finalResult` is a cell array of character vectors that contains the names of second-degree friends. This list removes the names of the first-degree friends.

Close Database Connection

```
close(neo4jconn)
```

See Also

`neo4j` | `searchNode` | `searchRelation` | `successors` | `unique` | `setdiff`

Related Examples

- "Find Shortest Path Between People in Social Neighborhood" on page 10-27

More About

- "Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
- "Directed and Undirected Graphs"

Database Toolbox Interface for Neo4j Bolt Protocol Installation

To use the Database Toolbox Interface for Neo4j Bolt Protocol, you must first install it. Ensure that the interface supports your Neo4j database version.

Supported Neo4j Versions

The Database Toolbox Interface for Neo4j Bolt Protocol supports the Neo4j database version 4.0.0 and later.

Installation

To install the Database Toolbox Interface for Neo4j Bolt Protocol, follow these steps:

1. In the **Environment** section of the MATLAB toolstrip, select **Add-Ons** > **Get Add-Ons**.
2. In the Add-On Explorer, search for the Database Toolbox Interface for Neo4j Bolt Protocol.
3. Install the Database Toolbox Interface for Neo4j Bolt Protocol.
4. Restart MATLAB.

The installer downloads and installs the Neo4j Java driver. Then, the installer adds the driver to the static Java class path as part of the installation.

For details about installing add-ons, see "Get and Manage Add-Ons". For other information, see "Add-Ons".

See Also

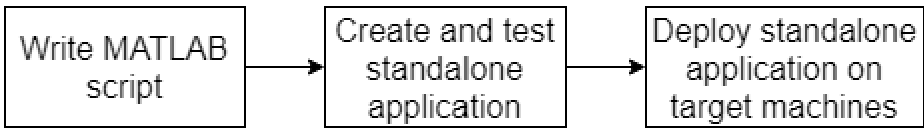
`neo4j` | `createNode` | `createRelation` | `storeDigraph` | `searchGraph` | `addNodeLabel` | `setNodeProperty` | `setRelationProperty`

More About

- "Find Friends of Friends in Social Neighborhood" on page 10-32
- "Update Friend Information in Social Neighborhood" on page 10-11
- "Search Graph Database" on page 10-9
- "Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

Deploy Graph Database Application with MATLAB Compiler

This example shows how to write a script to analyze data stored in a graph database, and deploy the script as a standalone application. Write code that connects to the Neo4j® database, imports data from the database into MATLAB®, analyzes the data, and closes the database connection. Then, you can deploy the code by compiling it as a standalone application by using the Application Compiler (MATLAB Compiler) app and running the application on other machines.



Overall, the example follows the steps described in “Create Standalone Application from MATLAB Function” (MATLAB Compiler) and updates the steps for a standalone database application.

Ensure that you have administrator privileges on the other machines to run the standalone application.

Create Function in MATLAB

Write a MATLAB script named `findShortestPathBetweenPeople.m` and save it in a file location of your choice. The script contains the `findShortestPathBetweenPeople` function, which returns the distance between two people in a graph network. The function performs these actions:

- Connects to a Neo4j database running on the local machine
- Imports graph data and converts it to a directed graph
- Performs the shortest path analysis
- Closes the database connection

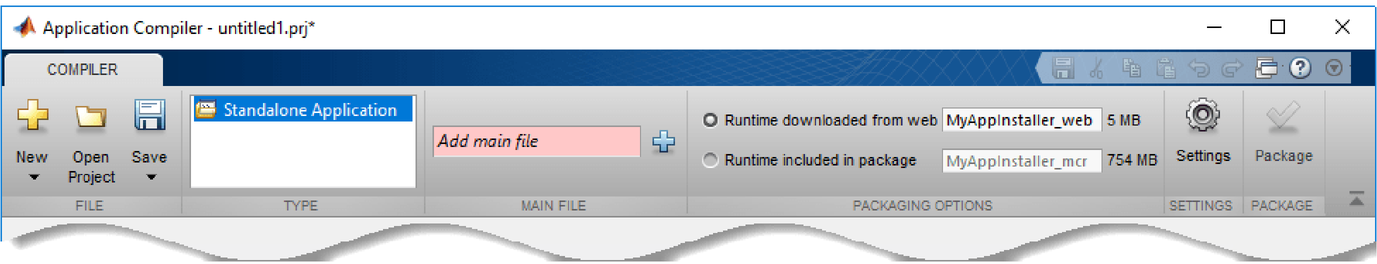
```
type findShortestPathBetweenPeople.m
```

```
function distance = findShortestPathBetweenPeople(userA,userB)

%  FINDSHORTESTPATHBETWEENPEOPLE The findShortestPathBetweenPeople function
%  connects to a Neo4j® database, imports data from the database into
%  MATLAB®, finds the shortest path between two people, and closes the
%  database connection.

%%
% Create a Neo4j connection object |neo4jconn| using the URL
% |http://localhost:7474/db/data|, user name |neo4j|, and password
% |matlab|.

url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);

%%
% Find all the |Person| nodes and all the relationships associated with
% each |Person| node using |searchGraph|.
```

```
social_graphdata = searchGraph(neo4jconn,{'Person'});

%%
% Using the table |social_graphdata.Nodes|, access the |name| property for
% each node that appears in the |NodeData| variable of the table.
%
% Assign the table |social_graphdata.Nodes| to |nodestable|.

nodestable = social_graphdata.Nodes;

%%
% Assign the row names for each row in the table |nodestable| to
% |rownames|.

rownames = nodestable.Properties.RowNames;

%%
% Access the |NodeData| variable from |nodestable| for each row. |nodedata|
% contains an array of structures.

nodedata = [nodestable.NodeData{rownames}];

%%
% To retrieve the |name| field from each structure, index into the array.
% |nodenames| is a cell array of character vectors that contains node names.

nodenames = {nodedata(:).name};

%%
% Create the |digraph| object |social_graph| using the
% |neo4jStruct2Digraph| function with the graph data stored in
% |social_graphdata| and the node names stored in |nodenames|.

social_graph = neo4jStruct2Digraph(social_graphdata,'NodeNames',nodenames);

%%
% Find the shortest path between |UserA| and |UserB| using |shortestpath|.

[~,distance] = shortestpath(social_graph,userA,userB);

%%
% Close the database connection.
close(neo4jconn)
```

Create Standalone Application Using Application Compiler App

On the **MATLAB Apps** tab, on the far right of the **Apps** section, click the arrow to open the apps gallery. Under **Application Deployment**, click **Application Compiler**.



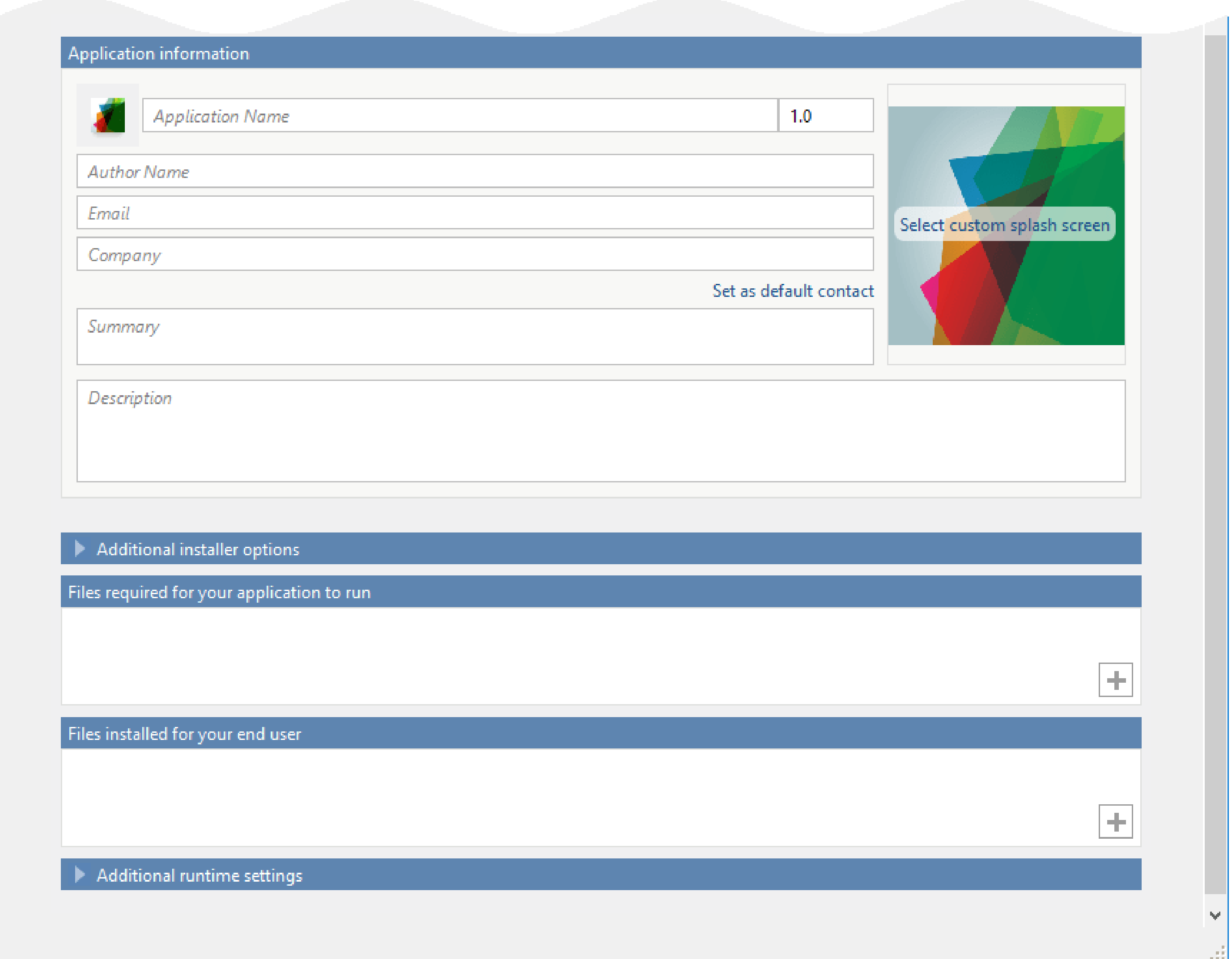
In the **MATLAB Compiler** project window, specify the main file of the MATLAB application that you want to deploy.

1. In the **Main File** section of the toolstrip, click .
2. In the **Add Files** dialog box, browse to the file location that contains your saved script. Select `findShortestPathBetweenPeople.m` and click **Open**. The Application Compiler app adds the `findShortestPathBetweenPeople` function to the list of main files.

Decide whether to include the MATLAB Runtime installer in the generated application by selecting one of the two options in the **Packaging Options** section:

- **Runtime downloaded from web** — Generates an installer that downloads the MATLAB Runtime and installs it along with the deployed MATLAB application
- **Runtime included in package** — Generates an installer that includes the MATLAB Runtime installer

Customize the packaged application and its appearance by entering the following options:



- **Application information** — Editable information about the deployed application. You can also customize the appearance of the standalone application by changing the application icon and splash screen. The generated installer uses this information to populate the installed application metadata.
- **Additional installer options** — Options for editing the default installation path for the generated installer and selecting a custom logo.
- **Files required for your application to run** — Additional files required by the generated application to run. The software includes these files in the generated application installer.
- **Files installed for your end user** — Files that are installed with your application. These files include the generated `readme.txt` file and the generated executable for the target platform.
- **Additional runtime settings** — Platform-specific options for controlling the generated executable.

For details about these options, see "Customize an Application" (MATLAB Compiler).

To generate the packaged application, click **Package** in the **Package** section on the toolstrip. In the Save Project dialog box, specify the location in which to save the project.

In the **Package** dialog box, verify that **Open output folder when process completes** is selected.

When the deployment process is complete, examine the generated output.

- `for_redistribution` — Folder containing the file that installs the application and the MATLAB Runtime.
- `for_testing` — Folder containing all the artifacts created by `mcc` (such as binary, header, and source files for a specific target). Use these files to test the installation.
- `for_redistribution_files_only` — Folder containing the files required for redistributing the application. Distribute these files to users who have MATLAB or MATLAB Runtime installed on their machines.
- `PackagingLog.txt` — Log file generated by MATLAB Compiler™.

Install and Run Standalone Application

To install the standalone application, in the `for_redistribution` folder, double-click the `MyAppInstaller_web` executable.

If you want to connect to the Internet using a proxy server, click **Connection Settings**. Enter the proxy server settings in the provided dialog box. Click **OK**.

To complete the installation, follow the instructions in the installation wizard.

To run your standalone application:

1. Open a terminal window.
2. Navigate to the folder in which you installed the application.
3. Run the application.

Test Standalone Application on Target Machine

Choose one target machine to test the MATLAB generated standalone application.

Copy the files in the `for_testing` folder to the target machine.

To test your standalone application:

1. Open a terminal window.
2. Navigate to the `for_testing` folder.
3. Run the application.

Deploy Standalone Application on Target Machines

Copy the `for_redistribution_files_only` folder to a file location on all target machines where MATLAB or MATLAB Runtime is installed and the Neo4j database server is running.

Run the MATLAB generated standalone application on all target machines by using the executable in the `for_redistribution_files_only` folder.

See Also

`neo4j` | `searchGraph` | `neo4jStruct2Digraph` | `close`

More About

- “Create Functions in Files”
- “Create Standalone Application from MATLAB Function” (MATLAB Compiler)
- “Customize an Application” (MATLAB Compiler)

11

MongoDB C++ Interface Topics

Import and Analyze Data from MongoDB Using MongoDB C++ Interface

This example shows how to import employee data from a collection in MongoDB® into the MATLAB® workspace using the MongoDB C++ interface. The example then shows how to conduct a simple data analysis based on the imported data.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [14×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 14 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Specify the `employees` collection for document retrieval. Retrieve all documents in the collection by using the MongoDB C++ interface connection. `documents` is a structure array.

```
collection = "employees";
documents = find(conn,collection);
```

Using all documents, determine the maximum salary of all employees. `salaries` contains an array of doubles for the salaries.

```
salaries = [];
for i = 1:length(documents)
```

```
    salaries = [salaries documents{i}.salary];
end
max(salaries)
```

```
ans = int32
    29000
```

Close the MongoDB connection.

```
close(conn)
```

See Also

`mongoc` | `isopen` | `find` | `close` | `max`

External Websites

- MongoDB Manual

Import Filtered Data from MongoDB Using MongoDB C++ Interface

This example shows how to import flight data from a MongoDB® collection into the MATLAB® workspace using the MongoDB C++ interface. The example then shows how to use a MongoDB query with filter criteria and a field list, and how to perform a simple data analysis based on the filtered flight data.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [14×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 14 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Specify the `airlinesmall` collection. Define the MongoDB query to filter the flight data for the years 1998 through 1999. Specify the fields to retrieve from the collection.

```
collection = "airlinesmall";
mongoquery = "{""Year"":{""$gte"":1998,""$lt"":2000}}";
fields = strcat("{""Year"":1.0,""Month"":1.0,""DayofMonth"":1.0,""DayOfWeek"":1.0,", ...
    """DepTime"":1.0,""ArrTime"":1.0}");
```

Retrieve flight data using the MongoDB connection. `documents` is a structure array with fields that correspond to the specified fields.

```
documents = find(conn,collection,Query=mongoquery,Projection=fields)
```

```
documents=10911×1 struct array with fields:
    _id
    Year
    Month
    DayofMonth
    DayOfWeek
    DepTime
    ArrTime
```

Determine the unique years in the data.

```
years = [documents(:).Year];
unique(years)
```

```
ans = 1×2 int32 row vector

   1998   1999
```

Close the MongoDB connection.

```
close(conn)
```

See Also

`mongoc` | `isopen` | `find` | `close` | `strcat` | `unique`

External Websites

- MongoDB Manual

Import Large Data from MongoDB Using MongoDB C++ Interface

This example shows how to import a large set of flight data from a MongoDB® collection into the MATLAB® workspace using the MongoDB C++ interface. To avoid out-of-memory issues when retrieving many documents, use a loop to import large data in batches.

Create MongoDB C++ Interface Connection

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [14×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 14 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Determine Number of Documents to Import

Find the total number of documents, specified as `totaldocs`, in the `airlinesmall` collection for the years 1997 through 2010. Use a MongoDB query to filter the flight data for the specified years.

```
collection = "airlinesmall";
mongoquery = "{""Year"":{""$gte"":1997,""$lte"":2010}}";
totaldocs = count(conn,collection,Query=mongoquery);
```

Retrieve Large Data in Batches

Estimate the batch size to be 15,000 documents. Define the MATLAB workspace variable for storing the retrieved data.

```
batchsize = 15000;
flightdata = [];
```

You can change the batch size depending on the performance and memory capacity of your system.

Use a `while` loop to retrieve flight data from the collection. The variable `flightdata` accumulates each batch of retrieved data.

```
% Track number of documents read
index = 0;

while index < totaldocs

    % Retrieve documents in a batch
    localdata = find(conn,collection,Query=mongoquery, ...
        Skip=index,Limit=batchsize);

    % Store retrieved documents locally
    flightdata = [flightdata; localdata];

    % Move to the next batch
    index = index + batchsize;

end
```

Display information about the `flightdata` variable. The retrieved data is a structure array that contains 75,603 structures. Each structure contains 30 fields of flight data.

```
whos flightdata
```

```
  Name                    Size                    Bytes  Class     Attributes

  flightdata          75603x1                248848692  struct
```

Close MongoDB C++ Interface Connection

```
close(conn)
```

See Also

`mongoc` | `isopen` | `count` | `find` | `close`

External Websites

- MongoDB Manual

Export MATLAB Data into MongoDB Using MongoDB C++ Interface

This example shows how to export table and structure data from the MATLAB® workspace into new MongoDB® collections using the MongoDB C++ interface. The example then shows how to count the number of documents in the collections, remove documents from the collections, and drop the collections.

The example uses the data set `tsunamis.xlsx`, which contains tsunami data. You can find this file in the `toolbox/matlab/demos` folder.

Create MongoDB C++ Interface Connection

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Create Collection and Export Data into MongoDB

Load the data set using the `readtable` function. Convert tsunami data to a structure using the `table2struct` function. The MATLAB workspace contains the `tsunamidata` structure.

```
data = readtable("tsunamis.xlsx");
tsunamidata = table2struct(data);
```

Create a collection to store the tsunami data using the MongoDB connection.

```
tsunamicoll = "tsunamis";
createCollection(conn,tsunamicoll)
```

Export structure data into the `tsunamis` collection. `n` contains the number of documents inserted.

```
n = insert(conn,tsunamicoll,tsunamidata)
```

```
n = int64
    162
```

Count Documents in Collection

Count the number of documents in the new collection.

```
ntsunamis = count(conn,tsunamicoll)
```

```
ntsunamis = int64
    162
```

Remove Documents and Drop Collection

Remove all documents from the collection. `ntsunamis` contains the number of documents removed from the collection.

```
ntsunamis = remove(conn,tsunamicoll,"{}")
```

```
ntsunamis = int64
    162
```

Drop the collection from the `mongotest` database.

```
dropCollection(conn,tsunamicoll)
```

Close MongoDB C++ Interface Connection

```
close(conn)
```

See Also

`mongoc` | `isopen` | `count` | `createCollection` | `dropCollection` | `insert` | `remove` | `close` | `readtable`

External Websites

- MongoDB Manual

Import and Export MATLAB Objects Using MongoDB and MongoDB C++ Interface

This example shows how to export objects from the MATLAB workspace into MongoDB using the MongoDB C++ interface. The export serializes the objects in MongoDB. Then, the example shows how to import objects back into the MATLAB workspace. The import deserializes the objects and recreates them in MATLAB for method execution. After the export and import, the example shows how to drop the collection.

In this example, the objects belong to the `TensileData` class. This class is a sample class in MATLAB. The data used to create the objects is sample data. For details, see “Representing Structured Data with Classes”. To run the code in this example, you define the class in the current folder.

The sample data represents tensile stress and strain measurements that you can use to calculate the elastic modulus of various materials. In simple terms, stress is the force applied to a material, and strain is the resulting deformation. The ratio of stress to strain defines a characteristic of the material.

Create Objects

Create the `TensileData` objects `tdcs` for carbon steel materials and `tdss` for stainless steel materials.

```
tdcs = TensileData('carbon steel',1, ...
    [2e4 4e4 6e4 8e4],[.12 .20 .31 .40]);
tdss = TensileData('stainless steel',1, ...
    [2e4 4e4 6e4 8e4],[.06 .10 .16 .20]);
```

Connect to MongoDB C++ Interface

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = 

  connection with properties:

              Database: "mongotest"
              UserName: ""
                Server: "dbtb01"
                  Port: 27017
       CollectionNames: [13×1 string]
```

`conn` is the `mongo` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.

- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Create Collection in MongoDB

Create the `TensileData` collection using the MongoDB connection.

```
collection = "TensileData";
createCollection(conn,collection)
```

Export Objects into MongoDB

Export the `TensileData` objects into the collection. The `insert` function serializes the `TensileData` objects into a JSON-style structure. `ntdcs` and `ntdss` contain the number of objects exported into the collection.

```
ntdcs = insert(conn,collection,tdcs);
ntdss = insert(conn,collection,tdss);
```

Import Objects into MATLAB Workspace

Import the `TensileData` objects into the MATLAB workspace. The `find` function deserializes the `TensileData` objects into the `documents` structure array.

```
documents = find(conn,collection);
```

Recreate the objects in the MATLAB workspace.

```
tdcs = TensileData(documents(1).Material,documents(1).SampleNumber, ...
    documents(1).Stress,documents(1).Strain);
tdss = TensileData(documents(2).Material,documents(2).SampleNumber, ...
    documents(2).Stress,documents(2).Strain);
```

You can execute methods of the objects after they appear in the MATLAB workspace. For example, calculate the elastic modulus.

Remove Documents and Drop Collection

Remove all documents from the collection. `n` contains the number of documents removed from the collection.

```
n = remove(conn,collection,"{}")
```

```
n =

     2
```

Drop the collection.

```
dropCollection(conn,collection)
```

Close MongoDB C++ Interface Connection

```
close(conn)
```

See Also

mongoc | isopen | find | createCollection | dropCollection | insert | remove | close

External Websites

- MongoDB Manual

12

Functions

close

Namespace: `database.odbc`

Close and invalidate database and driver resource utilizer

Syntax

`close(object)`

Description

`close(object)` closes and invalidates the database and driver resource utilizer `object` to free up database and driver resources.

Examples

Close connection Object

Connect to a Microsoft® SQL Server® database and verify the database connection. Then, import data from the database into MATLAB®. Determine the highest unit cost among the retrieved products in the table. Close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select all data from `productTable` and sort it by the product number. `data` is a table containing the imported data that results from executing the SQL `SELECT` statement.

```
selectquery = 'SELECT * FROM productTable ORDER BY productNumber';
data = select(conn,selectquery);
```

Display the first three rows of data.

```
data(1:3,:)
```

```
ans =
```

```
  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans =

    24
```

Close the database connection.

```
close(conn)
```

Close `DatabaseDatastore` Object

Create a database connection using a JDBC driver. To create this connection, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function. Then, create a `DatabaseDatastore` object and close it.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query retrieves all data from the `airlinesmall` table.

```
sqlquery = "select * from airlinesmall";

dbds = databaseDatastore(conn,sqlquery);
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Input Arguments

`object` — Database and driver resource utilizer
`connection` object | `DatabaseDatastore` object

Database and driver resource utilizer, specified as one of the objects described in this table.

Object Argument Name	Object Name	Object Description	Object Creation Function
`conn`	`connection`	Create a connection between an installed database and MATLAB. For details, see "Connect to Database" on page 2-129.	`database`
`dbds`	`DatabaseDatastore`	Create a connection to a type of datastore for working with large data.	`databaseDatastore`

- `connection` objects and `DatabaseDatastore` objects remain open until you close them using the `close` function. Always close these objects when you finish using them.
- Executing `close` with a `DatabaseDatastore` object releases the MATLAB resources associated with the `connection` object.

Note When you close the MATLAB session, MATLAB closes open `DatabaseDatastore` objects and connections. However, the database might not free up the connections. Consult your database administrator about the remaining connections.

Version History

Introduced before R2006a

See Also

`database` | `databaseDatastore` | `fetch`

Topics

"Import Data from Database Table Using sqlread Function" on page 5-58
"Import Large Data Using DatabaseDatastore Object" on page 5-23
"Insert Data into Database Table" on page 5-61
"Configure Driver and Data Source" on page 2-14
"Connect to Database" on page 2-129

commit

Namespace: `database.odbc`

Make database changes permanent

Syntax

`commit(conn)`

Description

`commit(conn)` makes permanent changes made to the database connection `conn` since the last `commit` or `rollback` function was run. To run this function, the `AutoCommit` flag for `conn` must be `off`.

Examples

Example 1 — Check the Status of the Autocommit Flag

Check that the status of the `AutoCommit` flag for connection `conn` is `off`.

```
conn.AutoCommit
ans =
    'off'
```

Example 2 — Commit Data to a Database

1. Insert `exdata` into the columns `DEPTNO`, `DNAME`, and `LOC` in the table `DEPT`, for the data source `conn`.

   ```
   datainsert(conn,'DEPT',...
   {'DEPTNO';'DNAME';'LOC'},exdata)
   ```
2. Commit this data.

   ```
   commit(conn)
   ```

Tips

For ODBC connections, you can use the `commit` function with the native ODBC interface. For details, see `database`.

Version History

Introduced before R2006a

See Also

`database` | `exec` | `datainsert` | `get` | `rollback` | `update`

Topics

"Import Data from Database Table Using sqlread Function" on page 5-58
"Insert Data into Database Table" on page 5-61
"Roll Back Data After Updating Record" on page 5-9

commit

Make changes to SQLite database file permanent

Syntax

```
commit(conn)
```

Description

`commit(conn)` makes changes to the SQLite database connection permanent using the MATLAB interface to SQLite. This function makes permanent any changes made after the last `commit` or `rollback` function has been run. To use the `commit` function, you must set the `AutoCommit` property of the `sqlite` object to `off`.

Examples

Commit Data to SQLite Database

Use the MATLAB® interface to SQLite to insert product data from MATLAB into a new table in an SQLite database. Then, commit the changes to the database.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Allow manual committing of changes to the database by setting the `AutoCommit` property to `off`.

```
conn.AutoCommit = "off";
```

Create a MATLAB table that contains data for two products. The data is stored in the `productTable` and `suppliers` tables.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new table named `toyTable`.

```
tablename = "toyTable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________
```

```
        30              5e+05           1000            25          "Rubik's Cube"
        40              6e+05           2000            30          "Doll House"
```

Commit the changes to the database.

```
commit(conn)
```

Delete the new table to maintain the dataset.

```
sqlquery = "DROP TABLE toyTable";
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

Version History

Introduced in R2022a

See Also

Objects
`sqlite`

Functions
`sqlread` | `sqlwrite` | `close`

Topics
“Insert Data into SQLite Database Table” on page 5-36
“Create Table and Add Column in SQLite Database” on page 5-38
“Delete Data from SQLite Database” on page 5-39
“Roll Back Data in SQLite Database” on page 5-41

configureODBCDataSource

Open ODBC Data Source Administrator dialog box

Syntax

```
configureODBCDataSource
```

Description

`configureODBCDataSource` opens the ODBC Data Source Administrator dialog box on Windows systems.

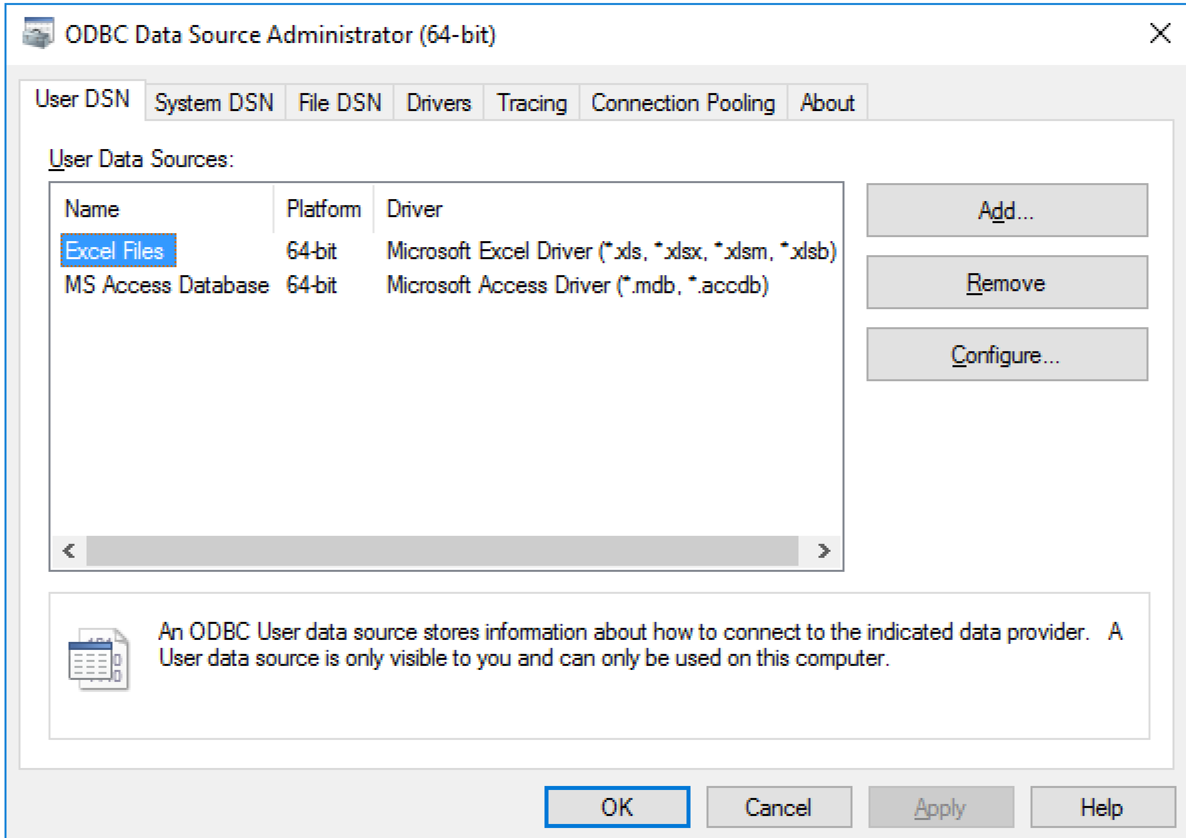
Examples

Open ODBC Data Source Administrator Dialog Box

Use the `configureODBCDataSource` function to open the ODBC Data Source Administrator dialog box on Windows systems.

```
configureODBCDataSource
```

The ODBC Data Source Administrator dialog box opens.



For configuring ODBC data sources, see “Configure Driver and Data Source” on page 2-14.

Tips

- Database Toolbox no longer supports connecting to a database using a 32-bit driver. For Microsoft Access, use the 64-bit version. Or, to connect to the 32-bit version of Microsoft Access, see https://www.mathworks.com/matlabcentral/answers/235949-how-to-connect-to-32-bit-microsoft-access-database-from-64-bit-matlab. For details about working with the 64-bit version of Windows, see Using Previous MATLAB Releases.

Alternative Functionality

App

You can open the ODBC Data Source Administrator dialog box using the Database Explorer app. In the **Data Source** section of the Database Explorer app, select **Configure Data Source** > **Configure ODBC data source**.

Version History

Introduced in R2017b

See Also

Apps
Database Explorer

Functions
`database`

Topics
“Configure Driver and Data Source” on page 2-14

configureJDBCDataSource

(To be removed) Configure JDBC data source

Note The `configureJDBCDataSource` function will be removed in a future release. Use the `databaseConnectionOptions` function instead. For details, see “Compatibility Considerations”.

Syntax

```
configureJDBCDataSource
opts = configureJDBCDataSource('Vendor',vendor)
opts = configureJDBCDataSource('DataSource',datasource)
```

Description

`configureJDBCDataSource` opens the JDBC Data Source Configuration dialog box.

`opts = configureJDBCDataSource('Vendor',vendor)` creates a new JDBC data source for the specified database vendor.

`opts = configureJDBCDataSource('DataSource',datasource)` edits an existing JDBC data source.

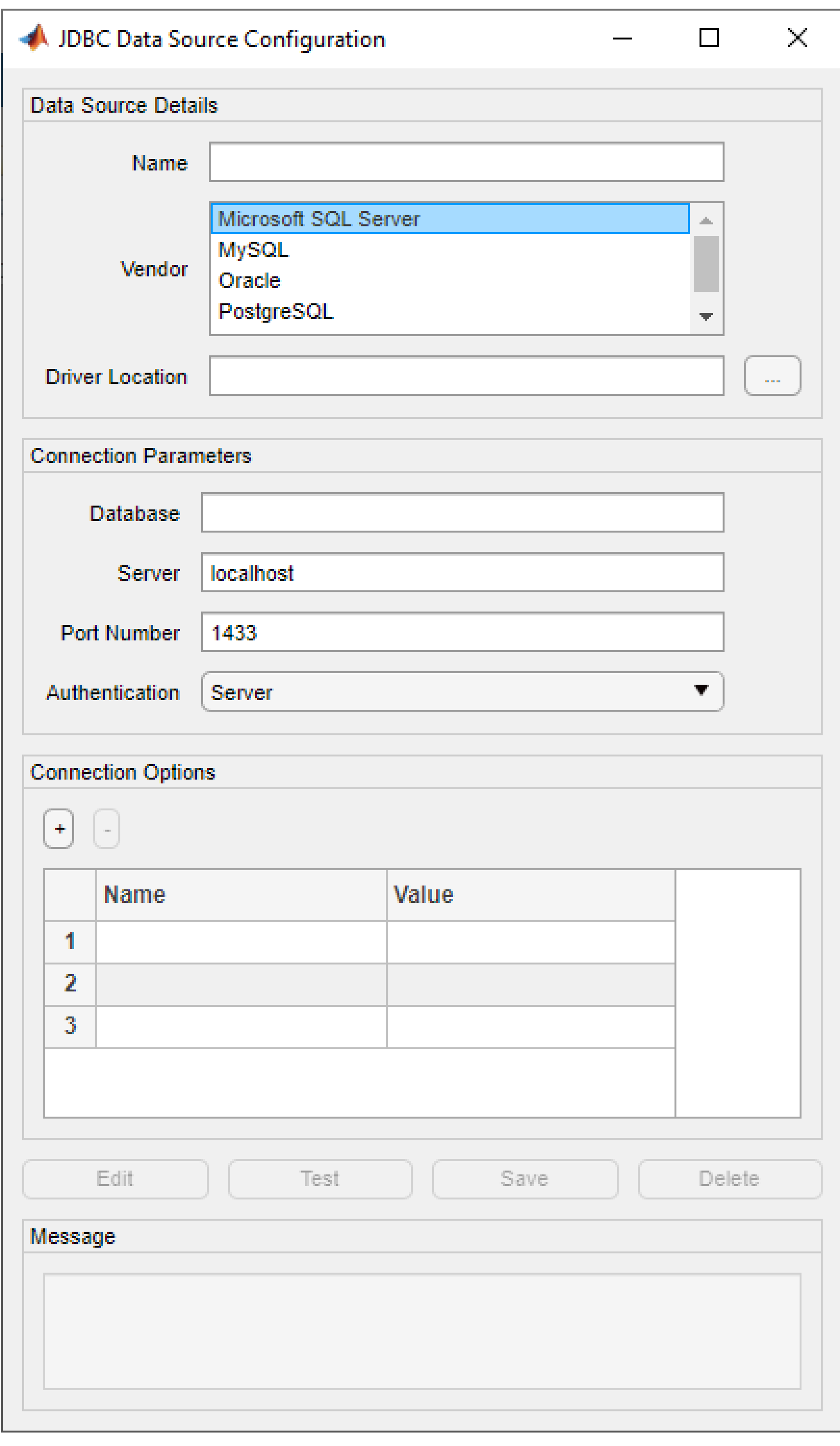
Examples

Open JDBC Data Source Configuration Dialog Box

Use the `configureJDBCDataSource` function to open the JDBC Data Source Configuration dialog box.

```
configureJDBCDataSource
```

The JDBC Data Source Configuration dialog box opens.



For information about configuring JDBC data sources, see "Configure Driver and Data Source" on page 2-14.

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft SQL Server database.

Create an SQL Server data source.

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server')
```

```
opts = 

  JDBCConnectionOptions with properties:

                      Vendor: 'Microsoft SQL Server'
              DataSourceName: ''

                DatabaseName: ''
                      Server: 'localhost'
                  PortNumber: 1433
                    AuthType: 'Server'

          JDBCDriverLocation: ''
```

`opts` is a `JDBCConnectionOptions` object with these properties:

- `Vendor` — Database vendor name
- `DataSourceName` — Name of the data source
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthType` — Authentication type
- `JDBCDriverLocation` — Full path of the JDBC driver file

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, database server `dbtb04`, port number `54317`, full path to the JDBC driver file, and Windows® authentication.

```
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows')
```

```
opts = 

  JDBCConnectionOptions with properties:

                      Vendor: 'Microsoft SQL Server'
              DataSourceName: 'SQLServerDataSource'

                DatabaseName: ''
                      Server: 'dbtb04'
                  PortNumber: 54317
                    AuthType: 'Windows'

          JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

The `setConnectionOptions` function sets the `DataSourceName`, `Server`, `PortNumber`, `AuthType`, and `JDBCDriverLocation` properties in the `JDBCConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Save the configured data source.

```
saveAsJDBCDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Input Arguments

vendor — Database vendor
'Microsoft SQL Server' | 'MySQL' | 'Oracle' | 'PostgreSQL' | 'Other'

Database vendor, specified as one of these values:

- 'Microsoft SQL Server' — Microsoft SQL Server database
- 'MySQL' — MySQL database
- 'Oracle' — Oracle database
- 'PostgreSQL' — PostgreSQL database
- 'Other' — Other database

You can specify these values as either a character vector or string scalar.

datasource — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing configured JDBC data source.

Example: "myJDBCDataSource"

Data Types: char | string

Output Arguments

opts — JDBC connection options
JDBCConnectionOptions object

JDBC connection options, returned as a `JDBCConnectionOptions` object.

Alternative Functionality

App

You can open the JDBC Data Source Configuration dialog box using the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source > Configure JDBC data source**.

Version History

Introduced in R2019a

R2020b: `configureJDBCDataSource` function will be removed

Not recommended starting in R2020b

The `configureJDBCDataSource` function will be removed in a future release. Use the `databaseConnectionOptions` function instead. Some differences between the workflows might require updates to your code.

Update Code

Use the `databaseConnectionOptions` function to create an `SQLConnectionOptions` object.

In prior releases, you configured a JDBC data source using the `configureJDBCDataSource` function and the `JDBCConnectionOptions` object. For example:

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server');
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows');
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsJDBCDataSource(opts)
```

Now you can set JDBC connection options using the `databaseConnectionOptions` function, and save the data source using the `SQLConnectionOptions` object instead.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthType',"Windows");
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsDataSource(opts)
```

Also, you can open the JDBC Data Source Configuration dialog box by using the Database Explorer app.

See Also

Apps
Database Explorer

Objects
`JDBCConnectionOptions`

Functions
`setConnectionOptions` | `addConnectionOptions` | `rmConnectionOptions` | `testConnection` | `saveAsJDBCDataSource` | `deleteJDBCDataSource` | `database` | `databaseConnectionOptions`

Topics
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

JDBCConnectionOptions

(To be removed) Define JDBC connection options for database

Note The `JDBCConnectionOptions` object will be removed in a future release. Use the `SQLConnectionOptions` object instead. For details, see “Compatibility Considerations”.

Description

The `JDBCConnectionOptions` object enables you to configure a JDBC data source and set JDBC connection options.

Creation

Create a `JDBCConnectionOptions` object with the `configureJDBCDataSource` function.

Properties

All Databases

`JDBCDriverLocation` — JDBC driver location
character vector | string scalar

JDBC driver location, specified as a character vector or string scalar. Specify the full path to the JDBC driver file, including the name of the file.

Example: `"C:\drivers\sqljdbc4.jar"`

Data Types: `char` | `string`

`Vendor` — Database vendor
character vector

This property is read-only.

Database vendor, specified as a character vector.

Example: `'MySQL'`

Data Types: `char`

`DataSourceName` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar.

Example: `"mydatasource"`

Data Types: `char` | `string`

Common Properties for Microsoft SQL Server, MySQL, Oracle, and PostgreSQL Databases

`Server` — Database server name or address
`'localhost'` (default) | character vector | string scalar

Database server name or address, specified as a character vector or string scalar.

Data Types: `char` | `string`

`PortNumber` — Server port number where the server is listening
numeric scalar

Server port number where the server is listening, specified as a numeric scalar. The default value is based on the database vendor:

- Microsoft SQL Server — 1433
- MySQL — 3306
- Oracle — 1521
- PostgreSQL — 5432

Data Types: `double`

`DatabaseName` — Database name
character vector | string scalar

Database name on the server, specified as a character vector or string scalar.

Example: `"mydatabase"`

Data Types: `char` | `string`

Microsoft SQL Server Database Only

`AuthType` — Authentication type
`'Server'` (default) | `'Windows'`

Authentication type, specified as one of these values:

- `'Server'` — Microsoft SQL Server authentication
- `'Windows'` — Windows authentication

You can specify these values as either a character vector or string scalar.

Oracle Database Only

`DriverType` — Driver type
`'thin'` (default) | `'oci'`

Driver type, specified as one of these values:

- `'thin'` — Thin driver
- `'oci'` — Windows authentication

  You can specify these values as either a character vector or string scalar.

Other Databases

`Driver` — JDBC driver name
character vector | string scalar

JDBC driver name, specified as a character vector or string scalar that refers to the Java driver that implements the `java.sql.Driver` interface.

For details about the JDBC driver name, consult your database driver documentation.

Data Types: `char` | `string`

URL — Database connection URL
character vector | string scalar

Database connection URL, specified as a character vector or string scalar for the vendor-specific URL. This URL is typically constructed using connection properties such as the server name, port number, and database name.

For details about the database connection URL, consult your database driver documentation.

Data Types: `char` | `string`

Object Functions

setConnectionOptions	(To be removed) Set JDBC connection options
addConnectionOptions	(To be removed) Add JDBC driver-specific connection options
rmConnectionOptions	(To be removed) Remove JDBC driver-specific connection options
testConnection	(To be removed) Test JDBC data source connection
saveAsJDBCDataSource	(To be removed) Save JDBC data source

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft SQL Server database.

Create an SQL Server data source.

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: ''

              DatabaseName: ''
                    Server: 'localhost'
                PortNumber: 1433
                  AuthType: 'Server'

        JDBCDriverLocation: ''
```

`opts` is a `JDBCConnectionOptions` object with these properties:

- `Vendor` — Database vendor name
- `DataSourceName` — Name of the data source
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthType` — Authentication type
- `JDBCDriverLocation` — Full path of the JDBC driver file

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, database server `dbtb04`, port number `54317`, full path to the JDBC driver file, and Windows® authentication.

```
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

The `setConnectionOptions` function sets the `DataSourceName`, `Server`, `PortNumber`, `AuthType`, and `JDBCDriverLocation` properties in the `JDBCConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Save the configured data source.

```
saveAsJDBCDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Version History

Introduced in R2019b

R2020b: `JDBCConnectionOptions` object will be removed

Not recommended starting in R2020b

The `JDBCConnectionOptions` object will be removed in a future release. Use the `SQLConnectionOptions` object instead. Some differences between the workflows might require updates to your code.

Update Code

Use the `SQLConnectionOptions` object to set JDBC connection options.

In prior releases, you configured a JDBC data source using the `JDBCConnectionOptions` object. For example:

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server');
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows');
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsJDBCDataSource(opts)
```

Now you can set JDBC connection options and save the data source using the `SQLConnectionOptions` object instead.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthType',"Windows");
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsDataSource(opts)
```

See Also

Objects

`SQLConnectionOptions`

Functions

`configureJDBCDataSource` | `deleteJDBCDataSource`

Topics

“Modify and Delete Data Sources” on page 4-17

"Configure Driver and Data Source" on page 2-14

addConnectionOptions

Namespace: `database.options`

(To be removed) Add JDBC driver-specific connection options

Note The `addConnectionOptions` function will be removed in a future release. Use the `setoptions` function instead. For details, see “Compatibility Considerations”.

Syntax

```
opts = addConnectionOptions(opts,
Option1,OptionValue1,...,OptionN,OptionValueN)
```

Description

`opts = addConnectionOptions(opts,
Option1,OptionValue1,...,OptionN,OptionValueN)` adds JDBC driver-specific connection options using the `JDBCConnectionOptions` object `opts`.

Examples

Add Driver-Specific Connection Option

Create a JDBC data source for a Microsoft SQL Server database, configure the data source by setting JDBC connection options, set an additional JDBC driver-specific option, and save the data source.

Create an SQL Server data source.

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: ''

              DatabaseName: ''
                    Server: 'localhost'
                PortNumber: 1433
                  AuthType: 'Server'

        JDBCDriverLocation: ''
```

`opts` is a `JDBCConnectionOptions` object with these properties:

- `Vendor` — Database vendor name

- `DataSourceName` — Name of the data source
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthType` — Authentication type
- `JDBCDriverLocation` — Full path of the JDBC driver file

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, database server `dbtb04`, port number `54317`, full path to the JDBC driver file, and Windows® authentication.

```
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

The `setConnectionOptions` function sets the `DataSourceName`, `Server`, `PortNumber`, `AuthType`, and `JDBCDriverLocation` properties in the `JDBCConnectionOptions` object.

Add a JDBC driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. `opts` contains a new section of properties for the additional JDBC connection option.

```
opts = addConnectionOptions(opts,'loginTimeout',20)
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

```
  Additional JDBC Connection Options:

              loginTimeout: '20'
```

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Save the configured data source.

```
saveAsJDBCDataSource(opts)
```

Input Arguments

`opts` — JDBC connection options
`JDBCConnectionOptions` object

JDBC connection options, specified as a `JDBCConnectionOptions` object.

`Option1,OptionValue1,...,OptionN,OptionValueN` — JDBC driver-specific options
name-value pair arguments

JDBC driver-specific options, specified as one or more name-value pair arguments. `Option` is a character vector or string scalar that specifies the name of a JDBC driver-specific connection option. `OptionValue` specifies the value of the connection option. `OptionValue` can be a character vector, string scalar, logical scalar, or numeric scalar. You can specify any connection option allowed by your JDBC driver. Consult your JDBC driver documentation for the available connection options.

Note You can specify a JDBC driver-specific connection option in two ways: using this input argument or using the database connection URL. If you specify the same option with different values in both the input argument and URL, the JDBC driver implementation defines which value takes precedence. For maximum portability, specify a JDBC driver-specific connection option in only one of these ways.

Example: `'useSSL',true` specifies that the database connection uses SSL authentication.

Output Arguments

`opts` — JDBC connection options
`JDBCConnectionOptions` object

JDBC connection options, returned as a `JDBCConnectionOptions` object.

Alternative Functionality

App

You can add JDBC driver-specific connection options by using the JDBC Data Source Configuration dialog box in the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure JDBC data source**.

Version History

Introduced in R2019b

R2020b: `addConnectionOptions` function will be removed

Not recommended starting in R2020b

The `addConnectionOptions` function will be removed in a future release. Use the `setoptions` function instead. Some differences between the workflows might require updates to your code.

Update Code

Use the `setoptions` function with the `SQLConnectionOptions` object to set JDBC driver-specific connection options.

In prior releases, you configured a JDBC data source using the `JDBCConnectionOptions` object, and added options using the `addConnectionOptions` function. For example:

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server');
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows');
opts = addConnectionOptions(opts,'loginTimeout',20);
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsJDBCDataSource(opts)
```

Now you can set JDBC driver-specific connection options using the `setoptions` function with the `SQLConnectionOptions` object instead.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthType',"Windows", ...
    'loginTimeout',20);
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsDataSource(opts)
```

See Also

Objects
JDBCConnectionOptions

Functions
configureJDBCDataSource | saveAsJDBCDataSource | setConnectionOptions | testConnection | rmConnectionOptions | deleteJDBCDataSource | setoptions

Topics
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

deleteJDBCDataSource

(To be removed) Delete JDBC data source

Note The `deleteJDBCDataSource` function will be removed in a future release. Use the `deleteDataSource` function instead.

Syntax

```
deleteJDBCDataSource(datasource)
```

Description

`deleteJDBCDataSource(datasource)` deletes the specified JDBC data source.

Examples

Delete JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft SQL Server database. Then, delete the configured data source.

Create an SQL Server data source.

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: ''

              DatabaseName: ''
                    Server: 'localhost'
                PortNumber: 1433
                  AuthType: 'Server'

        JDBCDriverLocation: ''
```

`opts` is a `JDBCConnectionOptions` object with these properties:

- `Vendor` — Database vendor name
- `DataSourceName` — Name of the data source
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

- `AuthType` — Authentication type
- `JDBCDriverLocation` — Full path of the JDBC driver file

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, database server `dbtb04`, port number `54317`, full path to the JDBC driver file, and Windows® authentication.

```
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows')
```

```
opts = 
  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

The `setConnectionOptions` function sets the `DataSourceName`, `Server`, `PortNumber`, `AuthType`, and `JDBCDriverLocation` properties in the `JDBCConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Save the configured data source.

```
saveAsJDBCDataSource(opts)
```

Delete the configured data source.

```
datasource = opts.DataSourceName;
deleteJDBCDataSource(datasource)
```

Input Arguments

datasource — Data source name

character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing configured JDBC data source.

Example: `"myJDBCDataSource"`

Data Types: `char` | `string`

Alternative Functionality

App

You can delete a JDBC data source by using the JDBC Data Source Configuration dialog box in the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure JDBC data source**.

Version History

Introduced in R2019b

See Also

Objects
`JDBCConnectionOptions`

Functions
`configureJDBCDataSource` | `saveAsJDBCDataSource` | `deleteDataSource`

Topics
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

rmConnectionOptions

Namespace: `database.options`

(To be removed) Remove JDBC driver-specific connection options

---

Note The `rmConnectionOptions` function will be removed in a future release. Use the `rmoptions` function instead. For details, see "Compatibility Considerations".

Syntax

```
opts = rmConnectionOptions(opts,option)
```

Description

`opts = rmConnectionOptions(opts,option)` removes a JDBC driver-specific connection option using the `JDBCConnectionOptions` object `opts`.

Examples

Remove Driver-Specific Connection Option

Create a JDBC data source for a Microsoft SQL Server database, configure the data source by setting JDBC connection options, and set and remove an additional JDBC driver-specific option. Then, test and save the data source.

Create an SQL Server data source.

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: ''

              DatabaseName: ''
                    Server: 'localhost'
                PortNumber: 1433
                  AuthType: 'Server'

         JDBCDriverLocation: ''
```

`opts` is a `JDBCConnectionOptions` object with these properties:

- `Vendor` — Database vendor name
- `DataSourceName` — Name of the data source

- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthType` — Authentication type
- `JDBCDriverLocation` — Full path of the JDBC driver file

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, database server `dbtb04`, port number `54317`, full path to the JDBC driver file, and Windows® authentication.

```
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

The `setConnectionOptions` function sets the `DataSourceName`, `Server`, `PortNumber`, `AuthType`, and `JDBCDriverLocation` properties in the `JDBCConnectionOptions` object.

Add a JDBC driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. `opts` contains a new section of properties for the additional JDBC connection option.

```
opts = addConnectionOptions(opts,'loginTimeout',20)
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'

  Additional JDBC Connection Options:
```

```
                loginTimeout: '20'
```

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates that the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Remove the JDBC driver-specific option. The `opts` object no longer contains the properties section for the additional JDBC connection options.

```
opts = rmConnectionOptions(opts,'loginTimeout')
```

```
opts = 

  JDBCConnectionOptions with properties:

                      Vendor: 'Microsoft SQL Server'
              DataSourceName: 'SQLServerDataSource'

                DatabaseName: ''
                      Server: 'dbtb04'
                  PortNumber: 54317
                    AuthType: 'Windows'

          JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

Test the database connection again.

```
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Save the configured data source.

```
saveAsJDBCDataSource(opts)
```

Input Arguments

opts — JDBC connection options
`JDBCConnectionOptions` object

JDBC connection options, specified as a `JDBCConnectionOptions` object.

option — JDBC driver-specific option
character vector | string scalar | cell array of character vectors | string array

JDBC driver-specific option, specified as a character vector, string scalar, cell array of character vectors, or string array. Specify the name of one or more JDBC driver-specific connection options that you added using the `addConnectionOptions` function.

Example: `"loginTimeout"`

Data Types: `char` | `string` | `cell`

Output Arguments

`opts` — JDBC connection options
`JDBCConnectionOptions` object

JDBC connection options, returned as a `JDBCConnectionOptions` object.

Alternative Functionality

App

You can remove JDBC driver-specific connection options by using the JDBC Data Source Configuration dialog box in the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure JDBC data source**.

Version History

Introduced in R2019b

R2020b: `rmConnectionOptions` function will be removed

Not recommended starting in R2020b

The `rmConnectionOptions` function will be removed in a future release. Use the `rmoptions` function instead. Some differences between the workflows might require updates to your code.

Update Code

Use the `rmoptions` function with the `SQLConnectionOptions` object to remove JDBC driver-specific connection options.

In prior releases, you configured a JDBC data source using the `JDBCConnectionOptions` object, and removed options using the `rmConnectionOptions` function. For example:

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server');
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows');
opts = addConnectionOptions(opts,'loginTimeout',20);
username = "";
password = "";
status = testConnection(opts,username,password);
opts = rmConnectionOptions(opts,'loginTimeout');
status = testConnection(opts,username,password);
saveAsJDBCDataSource(opts)
```

Now you can set JDBC driver-specific connection options with the `SQLConnectionOptions` object instead, and then remove options using the `rmoptions` function.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthType',"Windows", ...
    'loginTimeout',20);
username = "";
password = "";
status = testConnection(opts,username,password);
opts = rmoptions(opts,'loginTimeout');
status = testConnection(opts,username,password);
saveAsDataSource(opts)
```

See Also

Objects
`JDBCConnectionOptions`

Functions
`configureJDBCDataSource` | `saveAsJDBCDataSource` | `addConnectionOptions` | `setConnectionOptions` | `testConnection` | `deleteJDBCDataSource` | `rmoptions`

Topics
“Modify and Delete Data Sources” on page 4-17
“Configure Driver and Data Source” on page 2-14

saveAsJDBCDataSource

Namespace: `database.options`

(To be removed) Save JDBC data source

> **Note** The `saveAsJDBCDataSource` function will be removed in a future release. Use the `saveAsDataSource` function instead. For details, see “Compatibility Considerations”.

Syntax

`saveAsJDBCDataSource(opts)`

Description

`saveAsJDBCDataSource(opts)` saves the JDBC data source specified by the `JDBCConnectionOptions` object `opts`.

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft SQL Server database.

Create an SQL Server data source.

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: ''

              DatabaseName: ''
                    Server: 'localhost'
                PortNumber: 1433
                  AuthType: 'Server'

        JDBCDriverLocation: ''
```

`opts` is a `JDBCConnectionOptions` object with these properties:

- `Vendor` — Database vendor name
- `DataSourceName` — Name of the data source
- `DatabaseName` — Name of the database
- `Server` — Name of the database server

- `PortNumber` — Port number
- `AuthType` — Authentication type
- `JDBCDriverLocation` — Full path of the JDBC driver file

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, database server `dbtb04`, port number `54317`, full path to the JDBC driver file, and Windows® authentication.

```
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

The `setConnectionOptions` function sets the `DataSourceName`, `Server`, `PortNumber`, `AuthType`, and `JDBCDriverLocation` properties in the `JDBCConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Save the configured data source.

```
saveAsJDBCDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Input Arguments

opts — JDBC connection options
`JDBCConnectionOptions` object

JDBC connection options, specified as a `JDBCConnectionOptions` object.

Alternative Functionality

App

You can save a JDBC data source by using the JDBC Data Source Configuration dialog box in the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure JDBC data source**.

Version History

Introduced in R2019b

R2020b: saveAsJDBCDataSource function will be removed

Not recommended starting in R2020b

The `saveAsJDBCDataSource` function will be removed in a future release. Use the `saveAsDataSource` function instead. Some differences between the workflows might require updates to your code.

Update Code

Use the `saveAsDataSource` function with the `SQLConnectionOptions` object to save the JDBC data source.

In prior releases, you configured and saved a JDBC data source using the `JDBCConnectionOptions` object and the `saveAsJDBCDataSource` function. For example:

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server');
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows');
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsJDBCDataSource(opts)
```

Now you can set JDBC connection options and save the data source using the `SQLConnectionOptions` object and the `saveAsDataSource` function instead.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthType',"Windows");
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsDataSource(opts)
```

See Also

Objects
`JDBCConnectionOptions`

Functions
`configureJDBCDataSource` | `addConnectionOptions` | `setConnectionOptions` | `rmConnectionOptions` | `testConnection` | `deleteJDBCDataSource` | `saveAsDataSource`

Topics
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

setConnectionOptions

Namespace: `database.options`

(To be removed) Set JDBC connection options

Note The `setConnectionOptions` function will be removed in a future release. Use the `setoptions` function instead. For details, see "Compatibility Considerations".

Syntax

```
opts = setConnectionOptions(opts,
Option1,OptionValue1,...,OptionN,OptionValueN)
```

Description

`opts = setConnectionOptions(opts, Option1,OptionValue1,...,OptionN,OptionValueN)` sets JDBC connection options using the `JDBCConnectionOptions` object `opts`.

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft SQL Server database.

Create an SQL Server data source.

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server')
```

```
opts = 

  JDBCConnectionOptions with properties:

                  Vendor: 'Microsoft SQL Server'
          DataSourceName: ''

            DatabaseName: ''
                  Server: 'localhost'
              PortNumber: 1433
                AuthType: 'Server'

      JDBCDriverLocation: ''
```

`opts` is a `JDBCConnectionOptions` object with these properties:

- `Vendor` — Database vendor name
- `DataSourceName` — Name of the data source
- `DatabaseName` — Name of the database

- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthType` — Authentication type
- `JDBCDriverLocation` — Full path of the JDBC driver file

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, database server `dbtb04`, port number `54317`, full path to the JDBC driver file, and Windows® authentication.

```
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

The `setConnectionOptions` function sets the `DataSourceName`, `Server`, `PortNumber`, `AuthType`, and `JDBCDriverLocation` properties in the `JDBCConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Save the configured data source.

```
saveAsJDBCDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Input Arguments

opts — JDBC connection options

`JDBCConnectionOptions` object

JDBC connection options, specified as a `JDBCConnectionOptions` object.

`Option1,OptionValue1,...,OptionN,OptionValueN` — JDBC connection options to set
name-value pair arguments

JDBC connection options to set, specified as one or more name-value pair arguments. `Option` is a character vector or string scalar that specifies the name of a JDBC connection option. `OptionValue` specifies the value of the JDBC connection option. `OptionValue` can be a character vector, string scalar, logical scalar, or numeric scalar. You can specify any JDBC connection option that is a property of the `JDBCConnectionOptions` object.

Example: `'DataSourceName','myDataSource','Vendor','MySQL','Server','localhost','PortNumber',3306` configures a JDBC data source named `myDataSource` for a MySQL database located on the local server with the port number `3306`.

Output Arguments

`opts` — JDBC connection options
`JDBCConnectionOptions` object

JDBC connection options, returned as a `JDBCConnectionOptions` object.

Alternative Functionality

App

You can set JDBC connection options by using the JDBC Data Source Configuration dialog box in the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source > Configure JDBC data source**.

Version History

Introduced in R2019b

R2020b: `setConnectionOptions` function will be removed

Not recommended starting in R2020b

The `setConnectionOptions` function will be removed in a future release. Use the `setoptions` function instead. Some differences between the workflows might require updates to your code.

Update Code

Use the `setoptions` function with the `SQLConnectionOptions` object to set the JDBC connection options.

In prior releases, you configured a JDBC data source using the `setConnectionOptions` function and the `JDBCConnectionOptions` object. For example:

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server');
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows');
username = "";
```

```
password = "";
status = testConnection(opts,username,password);
saveAsJDBCDataSource(opts)
```

Now you can set JDBC connection options using the `setoptions` function, and save the data source using the `SQLConnectionOptions` object instead.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthType',"Windows");
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsDataSource(opts)
```

See Also

Objects
`JDBCConnectionOptions`

Functions
`configureJDBCDataSource` | `saveAsJDBCDataSource` | `addConnectionOptions` | `rmConnectionOptions` | `testConnection` | `deleteJDBCDataSource` | `setoptions`

Topics
“Modify and Delete Data Sources” on page 4-17
“Configure Driver and Data Source” on page 2-14

testConnection

Namespace: `database.options`

(To be removed) Test JDBC data source connection

Note The `testConnection` function will be removed in a future release. Use the `testConnection` function of the `SQLConnectionOptions` object instead. For details, see “Compatibility Considerations”.

Syntax

```
status = testConnection(opts,username,password)
[status,message] = testConnection(opts,username,password)
```

Description

`status = testConnection(opts,username,password)` tests the JDBC data source connection specified by the `JDBCConnectionOptions` object `opts`, a user name, and a password.

`[status,message] = testConnection(opts,username,password)` also returns the error message associated with testing the database connection.

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft SQL Server database.

Create an SQL Server data source.

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: ''

              DatabaseName: ''
                    Server: 'localhost'
                PortNumber: 1433
                  AuthType: 'Server'

        JDBCDriverLocation: ''
```

`opts` is a `JDBCConnectionOptions` object with these properties:

- `Vendor` — Database vendor name

- `DataSourceName` — Name of the data source
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthType` — Authentication type
- `JDBCDriverLocation` — Full path of the JDBC driver file

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, database server `dbtb04`, port number `54317`, full path to the JDBC driver file, and Windows® authentication.

```
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows')
```

```
opts = 

  JDBCConnectionOptions with properties:

                    Vendor: 'Microsoft SQL Server'
            DataSourceName: 'SQLServerDataSource'

              DatabaseName: ''
                    Server: 'dbtb04'
                PortNumber: 54317
                  AuthType: 'Windows'

        JDBCDriverLocation: 'C:\Drivers\sqljdbc4.jar'
```

The `setConnectionOptions` function sets the `DataSourceName`, `Server`, `PortNumber`, `AuthType`, and `JDBCDriverLocation` properties in the `JDBCConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical

   1
```

Save the configured data source.

```
saveAsJDBCDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Input Arguments

`opts` — JDBC connection options
`JDBCConnectionOptions` object

JDBC connection options, specified as a `JDBCConnectionOptions` object.

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

Output Arguments

`status` — Connection status
logical

Connection status, returned as a logical `true` if the connection test passes or a logical `false` if the connection test fails.

`message` — Error message
character vector

Error message, returned as a character vector. If the connection test passes, then the error message is an empty character vector. Otherwise, the error message contains text from the resulting failure in database connection.

Alternative Functionality

App

You can test a JDBC data source connection by using the JDBC Data Source Configuration dialog box in the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select **Configure Data Source** > **Configure JDBC data source**.

Version History

Introduced in R2019b

R2020b: `testConnection` function will be removed
Not recommended starting in R2020b

The `testConnection` function will be removed in a future release. Use the `testConnection` function of the `SQLConnectionOptions` object instead. Some differences between the workflows might require updates to your code.

Update Code

Use the `testConnection` function with the `SQLConnectionOptions` object to test the specified JDBC connection options.

In prior releases, you configured a JDBC data source using the `JDBCConnectionOptions` object. For example:

```
opts = configureJDBCDataSource('Vendor','Microsoft SQL Server');
opts = setConnectionOptions(opts, ...
    'DataSourceName','SQLServerDataSource', ...
    'Server','dbtb04','PortNumber',54317, ...
    'JDBCDriverLocation','C:\Drivers\sqljdbc4.jar', ...
    'AuthType','Windows');
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsJDBCDataSource(opts)
```

Now you can set JDBC connection options and save the data source using the `SQLConnectionOptions` object instead.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor);
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\sqljdbc4.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthType',"Windows");
username = "";
password = "";
status = testConnection(opts,username,password);
saveAsDataSource(opts)
```

See Also

Objects
`JDBCConnectionOptions`

Functions
`configureJDBCDataSource` | `saveAsJDBCDataSource` | `addConnectionOptions` | `setConnectionOptions` | `rmConnectionOptions` | `deleteJDBCDataSource` | `testConnection`

Topics
“Modify and Delete Data Sources” on page 4-17
“Configure Driver and Data Source” on page 2-14

SQLConnectionOptions

Define JDBC database connection options

Description

Create connection options for a JDBC database connection.

After you create an `SQLConnectionOptions` object, set the connection options, test the connection, and save the data source, you can create a JDBC database connection using the saved data source. The connection options include the options required to make a database connection. You can also define additional connection options for a specific database driver.

Creation

Create an `SQLConnectionOptions` object using the `databaseConnectionOptions` function.

Properties

All Databases

`DataSourceName` — Data source name
string scalar

Data source name, specified as a string scalar. You can use the data source name in the `database` function to create a JDBC database connection.

Example: `"MSSQLServer"`

Data Types: `string`

`Vendor` — Database vendor
string scalar

This property is read-only.

Database vendor, specified as a string scalar. Set this property using the `vendor` input argument in the `databaseConnectionOptions` function.

Example: `"Microsoft SQL Server"`

Data Types: `string`

`JDBCDriverLocation` — JDBC driver location
string scalar

JDBC driver location, specified as a string scalar. Specify the full path to the JDBC driver file, including the name of the file.

Example: `"C:\drivers\sqljdbc4.jar"`

Data Types: `string`

Common Properties for Microsoft SQL Server, MySQL, Oracle, and PostgreSQL Databases

`DatabaseName` — Database name

string scalar

Database name on the server, specified as a string scalar.

Example: `"mydatabase"`

Data Types: `string`

`Server` — Database server name or address

`"localhost"` (default) | string scalar

Database server name or address, specified as a string scalar.

Data Types: `string`

`PortNumber` — Server port number where the server is listening

numeric scalar

Server port number where the server is listening, specified as a numeric scalar. The default value is based on the database vendor:

- Microsoft SQL Server — 1433
- MySQL — 3306
- Oracle — 1521
- PostgreSQL — 5432

Data Types: `double`

Microsoft SQL Server Database Only

`AuthenticationType` — Authentication type

`"Server"` (default) | `"Windows"`

Authentication type, specified as one of these values:

- `"Server"` — Microsoft SQL Server authentication
- `"Windows"` — Windows authentication

Specify the value as a string scalar.

Oracle Database Only

`DriverType` — Driver type

`"thin"` (default) | `"oci"`

Driver type, specified as one of these values:

- `"thin"` — Thin driver
- `"oci"` — Windows authentication or OCI driver

Specify the value as a string scalar.

Other Databases

`Driver` — JDBC driver name
string scalar

JDBC driver name, specified as a string scalar that refers to the Java driver that implements the `java.sql.Driver` interface.

For details about the JDBC driver name, consult your database driver documentation.

Example: `org.sqlite.JDBC`

Data Types: `string`

URL — Database connection URL
string scalar

Database connection URL, specified as a string scalar for the vendor-specific URL. This URL is typically constructed using connection properties such as the server name, port number, and database name.

For details about the database connection URL, consult your database driver documentation.

Example: `jdbc:sqlite:C:\Databases\sqlite.db`

Data Types: `string`

Object Functions

setoptions	Set JDBC or ODBC connection options
rmoptions	Remove JDBC or ODBC connection options
reset	Reset JDBC or ODBC connection options to defaults
testConnection	Test JDBC or ODBC database connection
saveAsDataSource	Save JDBC or ODBC data source

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft® SQL Server® database.

Create an SQL Server data source for a JDBC database connection.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: ""
              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 1433
```

```
          AuthenticationType: "Server"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and Windows® authentication.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthenticationType',"Windows")
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "SQLServerDataSource"
                      Vendor: "Microsoft SQL Server"

          JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
                DatabaseName: "toystore_doc"
                      Server: "dbtb04"
                  PortNumber: 54317
          AuthenticationType: "Windows"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Version History

Introduced in R2020b

See Also

`databaseConnectionOptions` | `deleteDataSource`

Topics

"Create JDBC Data Source and Set Options Programmatically" on page 2-17
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

SQLConnectionOptions

Define ODBC database connection options

Description

Create connection options for an ODBC database connection.

After you create an `SQLConnectionOptions` object, set the connection options, test the connection, and save the data source, you can create an ODBC database connection by using the saved data source. The connection options include the options required to make a database connection. You can also define additional connection options for a specific database driver.

Creation

Create an `SQLConnectionOptions` object using the `databaseConnectionOptions` function.

Properties

All Databases

`DataSourceName` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. You can use the data source name in the `database` function to create an ODBC database connection.

Example: `"MSSQLServer"`

Data Types: `char` | `string`

`Vendor` — Database vendor
character vector | string scalar

Database vendor, specified as a character vector or string scalar. Set this property using the `vendor` input argument in the `databaseConnectionOptions` function.

Example: `"Microsoft SQL Server"`

Data Types: `char` | `string`

`ODBCDriver` — ODBC driver location
character vector | string scalar

ODBC driver location, specified as a character vector or string scalar. Specify `ODBCDriver` as one of the following:

- On the Windows platform, use the name of the driver.
- On the macOS platform, use the absolute path of the driver.

Example: "MariaDB ODBC 3.1 Driver" or "/Applications/MATLAB_R2024a.app/bin/maci64/libmaodbc.dylib"

Data Types: char | string

Common Properties for Microsoft SQL Server, MySQL, Oracle, and PostreSQL Databases

DatabaseName — Database name
character vector | string scalar

Database name on the server, specified as a character vector or string scalar.

Example: "mydatabase"

Data Types: char | string

Server — Database server name or address
"localhost" (default) | character vector | string scalar

Database server name or address, specified as a character vector or string scalar.

Example: "dbtb09"

Data Types: char | string

PortNumber — Server port number where the server is listening
numeric scalar

Server port number where the server is listening, specified as a numeric scalar. The default value is based on the database vendor:

- Microsoft SQL Server — 1433
- MySQL — 3306
- Oracle — 1521
- PostgreSQL — 5432

Data Types: double

Microsoft SQL Server Only

AuthenticationType — Authentication type
"Server" (default) | "Windows"

Authentication type, specified as one of these values:

- "Server" — Microsoft SQL Server authentication
- "Windows" — Windows authentication

Specify the value as a character vector or string scalar.

Oracle Database Only

DriverType — Driver type
"thin" (default) | "oci"

Driver type, specified as one of these values:

- `"thin"` — Thin driver
- `"oci"` — Windows authentication or OCI driver

Specify the value as a character vector or string scalar.

macOS Databases Only

`DriverManager` — Driver Manager
`"unixODBC"` | `"iodbc"`

Driver manager for macOS platform, specified as `"unixODBC"` or `"iODBC"`.

Object Functions

setoptions	Set JDBC or ODBC connection options
rmoptions	Remove JDBC or ODBC connection options
reset	Reset JDBC or ODBC connection options to defaults
testConnection	Test JDBC or ODBC database connection
saveAsDataSource	Save JDBC or ODBC data source

Examples

Create ODBC Data Source

Create a data source that connects to a MySQL server on the Windows or macOS platform.

On the Windows platform, use the `databaseConnectionOptions` function to create a data source that connects to a MySQL server.

```
opts = databaseConnectionOptions('odbc','mysql')
```

```
opts = 

SQLConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "MySQL"

                DatabaseName: ""
                      Server: "localhost"
                  PortNumber: 3306
                  ODBCDriver: "MariaDB ODBC 3.1 Driver"
```

Configure the data source by setting the ODBC connection options.

```
opts = opts.setoptions('DataSourceName','mysql_odbc','DatabaseName','toy_store',"Server","dbtb09'
opts.saveAsDataSource();
```

Alternatively, use the `databaseConnectionOptions` function on the macOS platform to create a data source that connects to a MySQL server.

```
opts = databaseConnectionOptions("odbc","MySQL")
```

```
opts = 
```

```
SQLConnectionOptions with properties:

              DataSourceName: "mysql-server-test"
                      Vendor: "MySQL"

                DatabaseName: "toy_store"
                      Server: "dbtb09"
                  PortNumber: 3306
                  ODBCDriver: "/Applications/MATLAB_R2024a.app/bin/maci64/libmaodbc.dylib"
               DriverManager: "unixODBC"
```

Configure the data source by setting the ODBC connection options.

```
opts = setoptions(opts,"DataSourceName","mysql-server-test", ...
    "DatabaseName","toy_store","Server","dbtb01")
```

Version History

Introduced in R2024a

See Also

`databaseConnectionOptions` | `deleteDataSource`

Topics

“Modify and Delete Data Sources” on page 4-17
“Configure Driver and Data Source” on page 2-14

databaseConnectionOptions

Create database connection options

Syntax

```
opts = databaseConnectionOptions(drivertype,vendor)
opts = databaseConnectionOptions(datasource)
```

Description

`opts = databaseConnectionOptions(drivertype,vendor)` creates an `SQLConnectionOptions` object `opts` using the specified driver type and database vendor. The `SQLConnectionOptions` object contains the database connection options.

`opts = databaseConnectionOptions(datasource)` enables you to edit an existing data source using its name.

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft® SQL Server® database.

Create an SQL Server data source for a JDBC database connection.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor)
```

```
opts =
  SQLConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "Microsoft SQL Server"

          JDBCDriverLocation: ""
                DatabaseName: ""
                      Server: "localhost"
                  PortNumber: 1433
          AuthenticationType: "Server"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server

- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and Windows® authentication.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthenticationType',"Windows")
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Windows"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Edit Existing JDBC Data Source

Edit an existing JDBC data source for a Microsoft® SQL Server® database. Set an additional JDBC driver-specific option, and save the data source.

Retrieve the existing SQL Server data source `SQLServerDataSource`.

```
datasource = "SQLServerDataSource";
opts = databaseConnectionOptions(datasource)

opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "SQLServerDataSource"
                      Vendor: "Microsoft SQL Server"

          JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
                DatabaseName: "toystore_doc"
                      Server: "dbtb04"
                  PortNumber: 54317
          AuthenticationType: "Windows"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Add a JDBC driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. `opts` contains a new section of properties for the additional JDBC connection option.

```
opts = setoptions(opts,'loginTimeout',"20")

opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "SQLServerDataSource"
                      Vendor: "Microsoft SQL Server"

          JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
                DatabaseName: "toystore_doc"
                      Server: "dbtb04"
                  PortNumber: 54317
          AuthenticationType: "Windows"

    Additional Connection Options:

                loginTimeout: "20"
```

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the updated data source.

```
saveAsDataSource(opts)
```

Create ODBC Data Source

Create a data source that connects to a MySQL server on the Windows or macOS platform.

On the Windows platform, use the `databaseConnectionOptions` function to create a data source that connects to a MySQL server.

```
opts = databaseConnectionOptions('odbc','mysql')
```

```
opts = 



SQLConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "MySQL"

                DatabaseName: ""
                      Server: "localhost"
                  PortNumber: 3306
                  ODBCDriver: "MariaDB ODBC 3.1 Driver"
```

Configure the data source by setting the ODBC connection options.

```
opts = opts.setoptions('DataSourceName','mysql_odbc','DatabaseName',"toy_store","Server","dbtb09"
opts.saveAsDataSource();
```

Alternatively, use the `databaseConnectionOptions` function on the macOS platform to create a data source that connects to a MySQL server.

```
opts = databaseConnectionOptions("odbc","MySQL")
```

```
opts = 

  SQLConnectionOptions with properties:

              DataSourceName: "mysql-server-test"
                      Vendor: "MySQL"

                DatabaseName: "toy_store"
                      Server: "dbtb09"
                  PortNumber: 3306
                  ODBCDriver: "/Applications/MATLAB_R2024a.app/bin/maci64/libmaodbc.dylib"
               DriverManager: "unixODBC"
```

Configure the data source by setting the ODBC connection options.

```
opts = setoptions(opts,"DataSourceName","mysql-server-test", ...
    "DatabaseName","toy_store","Server","dbtb01")
```

Create ODBC Data Source for Other Vendors

Create a data source that connects to other servers on the Windows or macOS platform by using the community version of Databricks.

On the Windows platform, use the `databaseConnectionOptions` function with the vendor input argument set to `"other"` to create a data source.

```
opts = databaseConnectionOptions("odbc","other")
```

```
opts = 

  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Other"

                ODBCDriver: ""
```

Configure the data source by setting the ODBC connection options.

```
opts = setoptions(opts,"DataSourceName","databricks-server","ODBCDriver","Simba Spark ODBC Drive
"Host","community.cloud.databricks.com","Port","443","AuthMech","3","ThriftTransport","2", ...
"ssl","1","httpPath","sql/protocolv1/o/5263663312480005/0119-142946-quslz33e", ...
"SparkServerType","3","ServiceDiscoveryMode","No Service Discovery")
```

```
opts = 

  SQLConnectionOptions with properties:

            DataSourceName: "databricks-server"
                    Vendor: "Other"

                ODBCDriver: "Simba Spark ODBC Driver"

    Additional Connection Options:

                  AuthMech: "3"
                      Host: "community.cloud.databricks.com"
                      Port: "443"
      ServiceDiscoveryMode: "No Service Discovery"
           SparkServerType: "3"
           ThriftTransport: "2"
                  httpPath: "sql/protocolv1/o/5263663312480005/0119-142946-quslz33e"
                       ssl: "1"
```

Alternatively, on the macOS platform, use the `databaseConnectionOptions` function with the vendor input argument set to `"other"` to create a data source.

```
opts = databaseConnectionOptions("odbc","other")
```

```
opts = 

  SQLConnectionOptions with properties:
```

```
              DataSourceName: ""
                      Vendor: "Other"

                  ODBCDriver: ""
               DriverManager: "unixODBC"
```

Configure the data source by setting the ODBC connection options.

```
opts = setoptions(opts,"DataSourceName","databricks-server","ODBCDriver","/Library/simba/spark/li
"Host","community.cloud.databricks.com","Port","443","AuthMech","3","ThriftTransport","2", "ssl",
"httpPath","sql/protocolv1/o/5263663312480005/0119-142946-quslz33e","SparkServerType","3","Servic
```

```
opts = 

  SQLConnectionOptions with properties:

              DataSourceName: "databricks-server"
                      Vendor: "Other"

                  ODBCDriver: "/Library/simba/spark/lib/libsparkodbc_sb64-universal.dylib"
               DriverManager: "unixODBC"

    Additional Connection Options:

                    AuthMech: "3"
                        Host: "community.cloud.databricks.com"
                        Port: "443"
        ServiceDiscoveryMode: "No Service Discovery"
             SparkServerType: "3"
             ThriftTransport: "2"
                    httpPath: "sql/protocolv1/o/5263663312480005/0119-142946-quslz33e"
                         ssl: "1"
```

Input Arguments

drivertype — Driver type
"jdbc" | "odbc" | "native"

Driver type, specified as one of these values:

- `"jdbc"` — JDBC driver
- `"odbc"` — ODBC driver
- `"native"` — Native interface

You can specify the value as either a character vector or string scalar.

vendor — Database vendor
"Microsoft SQL Server" | "MySQL" | "Oracle" | "PostgreSQL" | "Other" | ...

Database vendor, specified as one of these values:

- For JDBC drivers or ODBC drivers
  - `"Microsoft SQL Server"` — Microsoft SQL Server database

    - `"MySQL"` — MySQL database
    - `"Oracle"` — Oracle database
    - `"PostgreSQL"` — PostgreSQL database
    - `"Other"` — Other database
- For native interfaces
    - `"MySQL"` — MySQL native interface
    - `"PostgreSQL"` — PostgreSQL native interface
    - `"Cassandra"` — Apache Cassandra database C++ interface

If the `drivertype` input argument is `"jdbc"`, then the `vendor` argument must be one of the values for JDBC drivers. If the `drivertype` input argument is `"native"`, then the `vendor` argument must be one of the values for native interfaces.

You can specify the value as either a character vector or a string scalar.

`datasource` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing data source.

Example: `"myDataSource"`

Data Types: `char` | `string`

Output Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, returned as one of the following objects:

- `SQLConnectionOptions` — JDBC database connection options
- `SQLConnectionOptions` — ODBC database connection options
- `SQLConnectionOptions` — MySQL native interface connection options
- `SQLConnectionOptions` — PostgreSQL native interface connection options
- `CassandraConnectionOptions` — Apache Cassandra database connection options

Alternative Functionality

App

You can open the JDBC Data Source Configuration, MySQL Data Source Configuration, or PostgreSQL Data Source Configuration dialog boxes using the Database Explorer app. In the **Data Source** section of the **Database Explorer** tab, select one of these accordingly:

- **Configure Data Source** > **Configure JDBC data source**
- **Configure Data Source** > **Configure native data source** > **MySQL**
- **Configure Data Source** > **Configure native data source** > **PostgreSQL**

Version History

Introduced in R2020b

R2024a: Addition of ODBC as a database connection option
Behavior changed in R2024a

`databaseConnectionOptions` supports ODBC database connections.

See Also

Apps
Database Explorer

Objects
`SQLConnectionOptions`

Functions
`listDataSources` | `setoptions` | `saveAsDataSource` | `testConnection` | `database` | `deleteDataSource`

Topics
"Create JDBC Data Source and Set Options Programmatically" on page 2-17
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

deleteDataSource

Delete data source

Syntax

```
deleteDataSource(datasource)
```

Description

`deleteDataSource(datasource)` deletes the specified data source.

Examples

Delete Existing JDBC Data Source

Delete an existing JDBC data source for a Microsoft® SQL Server® database.

List the configured data sources on the system. The JDBC data source `SQLServerDataSource` is an existing data source on the system.

```
listDataSources
```

```
ans=3×3 table
            Name             DriverType            Vendor
    _____________________    __________    ______________________

    "MSSQLServerAuth"          "ODBC"      <missing>
    "MSSQLServerJDBCAuth"      "JDBC"      "Microsoft SQL Server"
    "SQLServerDataSource"      "JDBC"      "Microsoft SQL Server"
```

Delete the SQL Server data source `SQLServerDataSource`.

```
datasource = "SQLServerDataSource";
deleteDataSource(datasource)
```

List the configured data sources again. The list of existing data sources does not contain the `SQLServerDataSource` data source.

```
listDataSources
```

```
ans=2×3 table
            Name             DriverType            Vendor
    _____________________    __________    ______________________

    "MSSQLServerAuth"          "ODBC"      <missing>
    "MSSQLServerJDBCAuth"      "JDBC"      "Microsoft SQL Server"
```

Input Arguments

`datasource` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing data source.

Example: `"myDataSource"`

Data Types: `char` | `string`

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `setoptions` | `rmoptions` | `reset` | `saveAsDataSource` | `database` | `testConnection` | `listDataSources`

Topics
"Create JDBC Data Source and Set Options Programmatically" on page 2-17
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

reset

Namespace: `database.options.jdbc.sqlserver`

Reset JDBC or ODBC connection options to defaults

Syntax

`opts = reset(opts)`

Description

`opts = reset(opts)` resets all JDBC or ODBC connection options to their default values for all properties, where `opts` is one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

The `reset` function also removes any additional driver-specific properties from these objects.

Examples

Reset Connection Options to Default Values

Create, configure, and test a JDBC data source for a Microsoft® SQL Server® database. Reset the JDBC connection options to their default values. Then configure, test, and save the data source with different JDBC connection options.

Create an SQL Server data source for a JDBC database connection.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: ""
              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 1433
        AuthenticationType: "Server"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name

- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and Windows® authentication.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthenticationType',"Windows")
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Windows"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Reset the JDBC connection options to their default values. The properties of the `SQLConnectionOptions` object contain the default values.

```
opts = reset(opts)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: ""
```

```
              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 1433
        AuthenticationType: "Server"
```

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and Windows® authentication. Also, set driver-specific connection options to specify a timeout value for establishing the database connection, and to disable SSL encryption.

```
opts = setoptions(opts, ...
    "DataSourceName","SQLServerDataSource", ...
    "JDBCDriverLocation", ...
    "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    "DatabaseName","toystore_doc", ...
    "Server","dbtb04","PortNumber",54317, ...
    "AuthenticationType","Windows","loginTimeout","20", ...
    "encrypt","false")
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Windows"

    Additional Connection Options:

                   encrypt: "false"
              loginTimeout: "20"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object. The driver-specific connection options appear below the other connection options.

Test the database connection again.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

Input Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

Output Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, returned as one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

Version History

Introduced in R2020b

R2024a: Reset ODBC connection options
Behavior changed in R2024a

Reset connection options to their default values for ODBC database connections.

See Also

Objects
`SQLConnectionOptions` | `SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `setoptions` | `rmoptions` | `saveAsDataSource` | `database` | `deleteDataSource` | `testConnection`

Topics
“Create JDBC Data Source and Set Options Programmatically” on page 2-17
“Modify and Delete Data Sources” on page 4-17
“Configure Driver and Data Source” on page 2-14

rmoptions

Namespace: `database.options.jdbc.sqlserver`

Remove JDBC or ODBC connection options

Syntax

```
opts = rmoptions(opts,option)
```

Description

`opts = rmoptions(opts,option)` removes JDBC or ODBC connection options, where `opts` is one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

Examples

Remove Driver-Specific Connection Option

Edit an existing JDBC data source for a Microsoft® SQL Server® database. Set an additional JDBC driver-specific option, and test the database connection. Then, remove the additional JDBC driver-specific option, and test and save the data source.

Retrieve the existing SQL Server data source `SQLServerDataSource`.

```
datasource = "SQLServerDataSource";
opts = databaseConnectionOptions(datasource)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Windows"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database

- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Add a JDBC driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. `opts` contains a new property for the additional JDBC connection option.

```
opts = setoptions(opts,'loginTimeout',"20")
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "SQLServerDataSource"
                      Vendor: "Microsoft SQL Server"

          JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
                DatabaseName: "toystore_doc"
                      Server: "dbtb04"
                  PortNumber: 54317
          AuthenticationType: "Windows"

    Additional Connection Options:

                loginTimeout: "20"
```

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Remove the JDBC driver-specific option for specifying a timeout value. The `opts` object no longer contains the `loginTimeout` property.

```
opts = rmoptions(opts,'loginTimeout')
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "SQLServerDataSource"
                      Vendor: "Microsoft SQL Server"

          JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
                DatabaseName: "toystore_doc"
                      Server: "dbtb04"
                  PortNumber: 54317
          AuthenticationType: "Windows"
```

Test the database connection again.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the data source.

```
saveAsDataSource(opts)
```

Input Arguments

opts — Database connection options
SQLConnectionOptions object

Database connection options, specified as one of the following:

- SQLConnectionOptions object for JDBC connections.
- SQLConnectionOptions object for ODBC connections.

option — Connection option
character vector | string scalar | cell array of character vectors | string array

Connection option for your JDBC or ODBC connection, specified as a character vector, string scalar, cell array of character vectors, or string array. Specify the name of one or more connection options or driver-specific connection options.

Example: ["DatabaseName" "Server" "PortNumber"]

Example: "loginTimeout"

Data Types: char | string | cell

Output Arguments

opts — Database connection options
SQLConnectionOptions object

Database connection options, returned as one of the following:

- SQLConnectionOptions object for JDBC connections.
- SQLConnectionOptions object for ODBC connections.

Version History

Introduced in R2020b

R2024a: Remove ODBC connection options
Behavior changed in R2024a

Remove connection options for ODBC database connections.

See Also

Objects
`SQLConnectionOptions` | `SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `setoptions` | `saveAsDataSource` | `database` | `deleteDataSource` | `testConnection` | `reset`

Topics
"Create JDBC Data Source and Set Options Programmatically" on page 2-17
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

saveAsDataSource

Namespace: `database.options.jdbc.sqlserver`

Save JDBC or ODBC data source

Syntax

`saveAsDataSource(opts)`

Description

`saveAsDataSource(opts)` saves the JDBC or ODBC data source, where `opts` is one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft® SQL Server® database.

Create an SQL Server data source for a JDBC database connection.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: ""
              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 1433
        AuthenticationType: "Server"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server

- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and Windows® authentication.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthenticationType',"Windows")
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Windows"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Input Arguments

opts — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as one of the following:

- `SQLConnectionOptions` object for JDBC connections.

- `SQLConnectionOptions` object for ODBC connections.

Version History

Introduced in R2020b

R2024a: Save ODBC data source

Behavior changed in R2024a

Save data sources for ODBC database connections.

See Also

Objects

`SQLConnectionOptions` | `SQLConnectionOptions`

Functions

`databaseConnectionOptions` | `setoptions` | `rmoptions` | `database` | `deleteDataSource` | `testConnection` | `reset`

Topics

"Create JDBC Data Source and Set Options Programmatically" on page 2-17
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

setoptions

Namespace: `database.options.jdbc.sqlserver`

Set JDBC or ODBC connection options

Syntax

`opts = setoptions(opts,Option1,OptionValue1,...,OptionN,OptionValueN)`

Description

`opts = setoptions(opts,Option1,OptionValue1,...,OptionN,OptionValueN)` sets JDBC or ODBC connection options, where `opts` is one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft® SQL Server® database.

Create an SQL Server data source for a JDBC database connection.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: ""
              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 1433
        AuthenticationType: "Server"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server

- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and Windows® authentication.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthenticationType',"Windows")
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Windows"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Edit Existing JDBC Data Source

Edit an existing JDBC data source for a Microsoft® SQL Server® database. Set an additional JDBC driver-specific option, and save the data source.

Retrieve the existing SQL Server data source `SQLServerDataSource`.

```
datasource = "SQLServerDataSource";
opts = databaseConnectionOptions(datasource)

opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "SQLServerDataSource"
                      Vendor: "Microsoft SQL Server"

          JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
                DatabaseName: "toystore_doc"
                      Server: "dbtb04"
                  PortNumber: 54317
          AuthenticationType: "Windows"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Add a JDBC driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. `opts` contains a new section of properties for the additional JDBC connection option.

```
opts = setoptions(opts,'loginTimeout',"20")

opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "SQLServerDataSource"
                      Vendor: "Microsoft SQL Server"

          JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
                DatabaseName: "toystore_doc"
                      Server: "dbtb04"
                  PortNumber: 54317
          AuthenticationType: "Windows"

    Additional Connection Options:

                loginTimeout: "20"
```

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the updated data source.

```
saveAsDataSource(opts)
```

Create ODBC Data Source

Create a data source that connects to a MySQL server on the Windows or macOS platform.

On the Windows platform, use the `databaseConnectionOptions` function to create a data source that connects to a MySQL server.

```
opts = databaseConnectionOptions('odbc','mysql')
```

```
opts = 

SQLConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "MySQL"

                DatabaseName: ""
                      Server: "localhost"
                  PortNumber: 3306
                  ODBCDriver: "MariaDB ODBC 3.1 Driver"
```

Configure the data source by setting the ODBC connection options.

```
opts = opts.setoptions('DataSourceName','mysql_odbc','DatabaseName',"toy_store","Server","dbtb09'
opts.saveAsDataSource();
```

Alternatively, use the `databaseConnectionOptions` function on the macOS platform to create a data source that connects to a MySQL server.

```
opts = databaseConnectionOptions("odbc","MySQL")
```

```
opts = 

SQLConnectionOptions with properties:

              DataSourceName: "mysql-server-test"
                      Vendor: "MySQL"

                DatabaseName: "toy_store"
                      Server: "dbtb09"
                  PortNumber: 3306
                  ODBCDriver: "/Applications/MATLAB_R2024a.app/bin/maci64/libmaodbc.dylib"
               DriverManager: "unixODBC"
```

Configure the data source by setting the ODBC connection options.

```
opts = setoptions(opts,"DataSourceName","mysql-server-test", ...
    "DatabaseName","toy_store","Server","dbtb01")
```

Input Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

`Option1,OptionValue1,...,OptionN,OptionValueN` — JDBC or ODBC connection options to set
name-value arguments

JDBC or ODBC connection options to set, specified as one or more name-value arguments. `Option` is a character vector or string scalar that specifies the name of a connection option. `OptionValue` is the value of the connection option, specified as a character vector, string scalar, logical scalar, or numeric scalar. You can specify any connection option that is a property of the following objects:

- `SQLConnectionOptions` for JDBC connections.
- `SQLConnectionOptions` for ODBC connections.

Example: `"DataSourceName","myDataSource","Server","localhost","PortNumber",3306` configures a JDBC data source named `myDataSource` that is located on the local server with the port number `3306`. `"DataSourceName","mysql-server-test","DatabaseName","toy_store","Server","dbtb01"` configures an ODBC data source named `mysql-server-test` that is located on a server named `dbtb01`.

Output Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, returned as one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

Version History

Introduced in R2020b

R2024a: Set ODBC connection options
Behavior changed in R2024a

Set connection options for ODBC database connections.

See Also

Apps
Database Explorer

Objects
`SQLConnectionOptions` | `SQLConnectionOptions`

Functions
`deleteDataSource` | `databaseConnectionOptions` | `rmoptions` | `saveAsDataSource` | `testConnection` | `database` | `reset`

Topics
"Create JDBC Data Source and Set Options Programmatically" on page 2-17
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

testConnection

Namespace: `database.options.jdbc.sqlserver`

Test JDBC or ODBC database connection

Syntax

```
status = testConnection(opts,username,password)
[status,message] = testConnection(opts,username,password)
```

Description

`status = testConnection(opts,username,password)` tests the JDBC or ODBC database connection, a user name, and a password, where `opts` is one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

`[status,message] = testConnection(opts,username,password)` also returns the error message associated with testing the database connection.

Examples

Create JDBC Data Source

Create, configure, test, and save a JDBC data source for a Microsoft® SQL Server® database.

Create an SQL Server data source for a JDBC database connection.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: ""
              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 1433
        AuthenticationType: "Server"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name

- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and Windows® authentication.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthenticationType',"Windows")
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Windows"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `database` function or the Database Explorer app.

Retrieve Message for JDBC Database Connection Test

Create and configure a JDBC data source to a Microsoft® SQL Server® database. Test the database connection to the JDBC data source and retrieve the error message.

Create an SQL Server data source for a JDBC database connection.

```
vendor = "Microsoft SQL Server";
opts = databaseConnectionOptions("jdbc",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: ""
              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 1433
        AuthenticationType: "Server"
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `JDBCDriverLocation` — Full path of the JDBC driver file
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number
- `AuthenticationType` — Authentication type

Configure the data source by setting the JDBC connection options for the data source `SQLServerDataSource`, full path to the JDBC driver file, database name `toystore_doc`, database server `dbtb04`, port number `54317`, and SQL Server authentication.

```
opts = setoptions(opts, ...
    'DataSourceName',"SQLServerDataSource", ...
    'JDBCDriverLocation',"C:\Drivers\mssql-jdbc-7.0.0.jre8.jar", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb04", ...
    'PortNumber',54317,'AuthenticationType',"Server")
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "SQLServerDataSource"
                    Vendor: "Microsoft SQL Server"

        JDBCDriverLocation: "C:\Drivers\mssql-jdbc-7.0.0.jre8.jar"
              DatabaseName: "toystore_doc"
                    Server: "dbtb04"
                PortNumber: 54317
        AuthenticationType: "Server"
```

The `setoptions` function sets the `DataSourceName`, `JDBCDriverLocation`, `DatabaseName`, `Server`, `PortNumber`, and `AuthenticationType` properties in the `SQLConnectionOptions` object.

Test the database connection using an incorrect user name and password. The `testConnection` function returns the logical `0`, which indicates the database connection fails. Retrieve and display the error message for the failed connection.

```
username = "wronguser";
password = "wrongpassword";
[status,message] = testConnection(opts,username,password)
```

```
status = logical
   0


message =
'JDBC Driver Error: Login failed for user 'wronguser'. ClientConnectionId:dfe57aed-973f-4c5f-838b
```

Input Arguments

opts — Database connection options
SQLConnectionOptions object

Database connection options, specified as one of the following:

- `SQLConnectionOptions` object for JDBC connections.
- `SQLConnectionOptions` object for ODBC connections.

username — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

password — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

Output Arguments

status — Connection status
logical

Connection status, returned as a logical `true` if the connection test passes or `false` if the connection test fails.

message — Error message
character vector

Error message, returned as a character vector. If the connection test passes, then the error message is an empty character vector. Otherwise, the error message contains text from the failed database connection.

Version History

Introduced in R2020b

R2024a: Test ODBC database connection

Behavior changed in R2024a

Test connections for ODBC database connections.

See Also

Objects

`SQLConnectionOptions` | `SQLConnectionOptions`

Functions

`databaseConnectionOptions` | `setoptions` | `rmoptions` | `saveAsDataSource` | `database` | `deleteDataSource` | `reset`

Topics

"Create JDBC Data Source and Set Options Programmatically" on page 2-17
"Modify and Delete Data Sources" on page 4-17
"Configure Driver and Data Source" on page 2-14

connection

Relational database ODBC connection

Description

Create a database connection using an ODBC driver. For details about ODBC drivers and the alternative JDBC drivers, see "Choose Between ODBC and JDBC Drivers" on page 2-12.

You can use the `connection` object to connect to various databases using different drivers that you install and administer. For details, see "Connect to Database" on page 2-129.

Creation

Create a `connection` object using the `odbc` or `database` function.

Properties

Connection Properties

`DataSource` — Data source name
`''` (default) | character vector

This property is read-only.

Data source name for ODBC connection, specified as a character vector. `DataSource` is the name you provide for your data source when you create a data source using the Microsoft ODBC Administrator.

The data source name is an empty character vector when the connection is invalid.

Example: `'MS SQL Server'`

Data Types: `char`

`UserName` — User name
`''` (default) | character vector

This property is read-only.

User name required to access the database, specified as a character vector. If no user name is required, specify an empty value `''`.

Example: `'username'`

Data Types: `char`

`Message` — Database connection status message
`''` (default) | character vector

This property is read-only.

Database connection status message, specified as a character vector. The status message is empty when the database connection is successful. Otherwise, this property contains an error message.

Example: `'ODBC Driver Error: [Micro ...'`

Data Types: `char`

Type — Database connection type
`'ODBC Connection Object'`

This property is read-only.

Database connection type, specified as the value `'ODBC Connection Object'` that means a database connection created using an ODBC driver.

Data Types: `char`

Database Properties

`AutoCommit` — Flag to autocommit transactions
`'on'` (default) | `'off'`

Flag to autocommit transactions, specified as one of these values:

- `'on'` — Database transactions are automatically committed to the database.
- `'off'` — Database transactions must be committed to the database manually.

Example: `'AutoCommit','off'`

`ReadOnly` — Read-only database data
`'off'` (default) | `'on'`

Read-only database data, specified as one of these values:

- `'on'` — Database data is read-only.
- `'off'` — Database data is writable.

Data Types: `char`

`LoginTimeout` — Login timeout
`0` (default) | positive numeric scalar

This property is read-only.

Login timeout, specified as a positive numeric scalar. The login timeout specifies the number of seconds that the driver waits while trying to connect to a database before throwing an error.

When no login timeout for the connection attempt is specified, the value is `0`.

When login timeout is not supported by the database, the value is `-1`.

Data Types: `double`

`MaxDatabaseConnections` — Maximum database connections
`-1` (default) | positive numeric scalar

This property is read-only.

Maximum database connections, specified as a positive, numeric scalar.

The value is `0` when there is no upper limit to the maximum number of database connections.

When the maximum number of database connections is not supported by the database, the value is `-1`.

Data Types: `double`

Catalog and Schema Information

`DefaultCatalog` — Default catalog name
`''` (default) | character vector

This property is read-only.

Default catalog name, specified as a character vector.

When a database does not specify a default catalog, the value is an empty character vector `''`.

Example: `'catalog'`

Data Types: `char`

`Catalogs` — Catalog names
`{}` (default) | cell array of character vectors

This property is read-only.

Catalog names, specified as a cell array of character vectors.

When a database does not contain catalogs, the value is an empty cell array `{}`.

Example: `{'catalog1', 'catalog2'}`

Data Types: `cell`

`Schemas` — Schema names
`{}` (default) | cell array of character vectors

This property is read-only.

Schema names, specified as a cell array of character vectors.

When a database does not contain schemas, the value is an empty cell array `{}`.

Example: `{'schema1', 'schema2', 'schema3'}`

Data Types: `cell`

Database and Driver Information

`DatabaseProductName` — Database product name
`''` (default) | character vector

This property is read-only.

Database product name, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'Microsoft SQL Server'`

Data Types: `char`

`DatabaseProductVersion` — Database product version
`''` (default) | character vector

This property is read-only.

Database product version, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'11.00.2100'`

Data Types: `char`

`DriverName` — Driver name
`''` (default) | character vector

This property is read-only.

Driver name of an ODBC driver, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'sqlncli11.dll'`

Data Types: `char`

`DriverVersion` — Driver version
`''` (default) | character vector

This property is read-only.

Driver version of an ODBC driver, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'11.00.5058'`

Data Types: `char`

Object Functions

close	Close and invalidate database and driver resource utilizer
commit	Make database changes permanent
execute	Execute SQL statement using relational database connection
fetch	Import data into MATLAB workspace from execution of SQL statement
isopen	Determine if database connection is open
rollback	Undo database changes
executeSQLScript	Execute SQL script on database
select	Execute SQL SELECT statement and import data into MATLAB
sqlfind	Find information about all table types in database
sqlinnerjoin	Inner join between two database tables
sqlouterjoin	Outer join between two database tables
sqlread	Import data into MATLAB from database table
sqlwrite	Insert MATLAB data into database table

sqlupdate	Update rows in database table
update	Replace data in database table with MATLAB data

Examples

Connect to MySQL Using ODBC Driver

First, create an ODBC connection to the MySQL database. Then, import data from the database into MATLAB and perform simple data analysis. Close the database connection. The code assumes that you are connecting to a MySQL database version 5.5.46 using the MySQL ODBC 5.3 ANSI Driver.

Connect to the database using the data source name, user name, and password.

```
datasource = 'dsname';
username = 'username';
password = 'pwd';

conn = database(datasource,username,password)
```

```
conn = 

  connection with properties:

                  DataSource: 'MySQLdb'
                    UserName: 'username'
                     Message: ''
                        Type: 'ODBC Connection Object'
  Database Properties:

                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 0
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'catalog'
                    Catalogs: {'catalog1', 'catalog2'}
                     Schemas: {}

  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '5.5.46-0+deb7u1'
                  DriverName: 'myodbc5a.dll'
               DriverVersion: '05.03.0004'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `select` function. Display the data.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery)
```

```
ans =

    productnumber    quantity    price         inventorydate
    _____________    ________    _____    _______________________

     1               1700        14.5     '2014-09-23 09:38:34.0'
     2               1200         9.3     '2014-07-08 22:50:45.0'
     3                356        17.2     '2014-05-14 07:14:28.0'
     ...
```

Determine the highest product quantity from the table.

```
max(data.Quantity)
```

```
ans =

        9000
```

Close the database connection `conn`.

```
close(conn)
```

Alternative Functionality

You can connect to an SQLite database file by creating the `sqlite` object. This connection uses the MATLAB interface to SQLite that does not require installing or administering a database or driver. For details, see "Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5.

Version History

Introduced before R2006a

See Also

`select` | `fetch` | `close`

Topics

"Configure Driver and Data Source" on page 2-14
"MySQL ODBC for Windows" on page 2-47
"Connect to Database" on page 2-129
"Import Data from Database Table Using sqlread Function" on page 5-58
"Insert Data into Database Table" on page 5-61
"Database Connection Error Messages" on page 3-7

connection

Relational database JDBC connection

Description

Create a database connection using a JDBC driver. For details about JDBC drivers and the alternative ODBC drivers, see “Choose Between ODBC and JDBC Drivers” on page 2-12.

You can use the `connection` object to connect to various databases using different drivers that you install and administer. For details, see “Connect to Database” on page 2-129.

Creation

Create a `connection` object using the `database` function.

Properties

Connection Properties

`DataSource` — Data source name
`''` (default) | character vector

This property is read-only.

Database name for JDBC connection, specified as a character vector. `DataSource` is the name of your database. The name differs for different database systems. For example, `DataSource` is the SID or the service name when you are connecting to an Oracle database. Or, `DataSource` is the catalog name when you are connecting to a MySQL database. For details about your database name, contact your database administrator or refer to your database documentation.

The data source name is an empty character vector when the connection is invalid.

Example: `'MS SQL Server'`

Data Types: `char`

`UserName` — User name
`''` (default) | character vector

This property is read-only.

User name required to access the database, specified as a character vector. If no user name is required, specify an empty value `''`.

Example: `'username'`

Data Types: `char`

`Message` — Database connection status message
`''` (default) | character vector

This property is read-only.

Database connection status message, specified as a character vector. The status message is empty when the database connection is successful. Otherwise, this property contains an error message.

Example: `'JDBC Driver Error: [Micro ...'`

Data Types: `char`

Type — Database connection type
`'JDBC Connection Object'`

This property is read-only.

Database connection type, specified as the value `'JDBC Connection Object'` that means a database connection created using a JDBC driver.

Data Types: `char`

JDBC Connection Properties

`Driver` — JDBC driver
`''` (default) | character vector

This property is read-only.

JDBC driver, specified as a character vector when connecting to a database using a JDBC driver URL. This property depends on the `URL` property.

Example: `'com.mysql.jdbc.jdbc2.opti ...'`

Data Types: `char`

URL — Database connection URL
`''` (default) | character vector

This property is read-only.

Database connection URL, specified as a character vector for a vendor-specific string. This property depends on the `Driver` property.

Example: `'jdbc:mysql://sname:1234/ ...'`

Data Types: `char`

Database Properties

`AutoCommit` — Flag to autocommit transactions
`'on'` (default) | `'off'`

Flag to autocommit transactions, specified as one of these values:

- `'on'` — Database transactions are automatically committed to the database.
- `'off'` — Database transactions must be committed to the database manually.

Example: `'AutoCommit','off'`

`ReadOnly` — Read-only database data
`'off'` (default) | `'on'`

Read-only database data, specified as one of these values:

- `'on'` — Database data is read-only.
- `'off'` — Database data is writable.

Data Types: `char`

`LoginTimeout` — Login timeout
`0` (default) | positive numeric scalar

This property is read-only.

Login timeout, specified as a positive numeric scalar. The login timeout specifies the number of seconds that the driver waits while trying to connect to a database before throwing an error.

When no login timeout for the connection attempt is specified, the value is `0`.

When login timeout is not supported by the database, the value is `-1`.

Data Types: `double`

`MaxDatabaseConnections` — Maximum database connections
`-1` (default) | positive numeric scalar

This property is read-only.

Maximum database connections, specified as a positive, numeric scalar.

The value is `0` when there is no upper limit to the maximum number of database connections.

When the maximum number of database connections is not supported by the database, the value is `-1`.

Data Types: `double`

Catalog and Schema Information

`DefaultCatalog` — Default catalog name
`''` (default) | character vector

This property is read-only.

Default catalog name, specified as a character vector.

When a database does not specify a default catalog, the value is an empty character vector `''`.

Example: `'catalog'`

Data Types: `char`

`Catalogs` — Catalog names
`{}` (default) | cell array of character vectors

This property is read-only.

Catalog names, specified as a cell array of character vectors.

When a database does not contain catalogs, the value is an empty cell array `{}`.

Example: `{'catalog1', 'catalog2'}`

Data Types: `cell`

`Schemas` — Schema names
`{}` (default) | cell array of character vectors

This property is read-only.

Schema names, specified as a cell array of character vectors.

When a database does not contain schemas, the value is an empty cell array `{}`.

Example: `{'schema1', 'schema2', 'schema3'}`

Data Types: `cell`

Database and Driver Information

`DatabaseProductName` — Database product name
`''` (default) | character vector

This property is read-only.

Database product name, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'Microsoft SQL Server'`

Data Types: `char`

`DatabaseProductVersion` — Database product version
`''` (default) | character vector

This property is read-only.

Database product version, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'11.00.2100'`

Data Types: `char`

`DriverName` — Driver name
`''` (default) | character vector

This property is read-only.

Driver name of a JDBC driver, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'sqlncli11.dll'`

Data Types: `char`

`DriverVersion` — Driver version
`''` (default) | character vector

This property is read-only.

Driver version of a JDBC driver, specified as a character vector.

When the database connection is invalid, the value is an empty character vector `''`.

Example: `'11.00.5058'`

Data Types: `char`

Object Functions

close	Close and invalidate database and driver resource utilizer
commit	Make database changes permanent
execute	Execute SQL statement using relational database connection
fetch	Import data into MATLAB workspace from execution of SQL statement
isopen	Determine if database connection is open
rollback	Undo database changes
executeSQLScript	Execute SQL script on database
select	Execute SQL SELECT statement and import data into MATLAB
sqlfind	Find information about all table types in database
sqlinnerjoin	Inner join between two database tables
sqlouterjoin	Outer join between two database tables
sqlread	Import data into MATLAB from database table
sqlwrite	Insert MATLAB data into database table
sqlupdate	Update rows in database table
update	Replace data in database table with MATLAB data
runstoredprocedure	Call stored procedure with and without input and output arguments

Examples

Connect to Oracle Using JDBC Driver

Create a JDBC connection to an Oracle database. To create this connection, you must configure a JDBC data source. For more information, see the `databaseConnectionOptions` function. Then, import data from the database into MATLAB, perform simple data analysis, and close the database connection.

This example assumes that you are connecting to an Oracle Database 12c Enterprise Edition Release 12.1.0.2.0 using the Oracle JDBC Driver 12.1.0.1.0.

Connect to the database using a JDBC data source name, user name, and password.

```
datasource = 'dsname';
username = 'username';
password = 'pwd';

conn = database(datasource,username,password)
```

```
conn = 

  connection with properties:

                DataSource: 'dsname'
                  UserName: 'username'
                    Driver: 'oracle.jdbc.pool.OracleDa ...'
                       URL: 'jdbc:oracle:thin:@(DESCRI ...'
```

```
                   Message: ''
                      Type: 'JDBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: ''
                  Catalogs: {}
                   Schemas: {'schema1', 'schema2', 'schema3' ... and 39 more}

  Database and Driver Information:

         DatabaseProductName: 'Oracle'
      DatabaseProductVersion: 'Oracle Database 12c Enter ...'
                  DriverName: 'Oracle JDBC driver'
               DriverVersion: '12.1.0.1.0'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `select` function. Display the data.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery)
```

```
ans =

    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _______________________

     1               1700        14.5     '2014-09-23 09:38:34.0'
     2               1200         9.3     '2014-07-08 22:50:45.0'
     3                356        17.2     '2014-05-14 07:14:28.0'
     ...
```

Determine the highest product quantity in the table.

```
max(data.Quantity)
```

```
ans =

        9000
```

Close the database connection.

```
close(conn)
```

Alternative Functionality

You can connect to an SQLite database file by creating the `sqlite` object. This connection uses the MATLAB interface to SQLite that does not require installing or administering a database or driver.

For details, see "Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5.

Version History

Introduced before R2006a

See Also

`select` | `fetch` | `close`

Topics

"Configure Driver and Data Source" on page 2-14
"Oracle JDBC for Windows" on page 2-41
"Connect to Database" on page 2-129
"Import Data from Database Table Using sqlread Function" on page 5-58
"Insert Data into Database Table" on page 5-61
"Database Connection Error Messages" on page 3-7

cursor

(Not recommended) Database cursor

Note The `cursor` object is not recommended. Use the `fetch` function instead. For details, see "Compatibility Considerations".

The scrollable cursor functionality has no replacement.

Description

After connecting to a relational database using either ODBC or JDBC drivers, you can perform actions using the database connection. To import data into MATLAB from a database and perform database operations, you must create a `cursor` object. Database Toolbox uses this object to retrieve rows from database tables and execute SQL statements.

There are two types of database cursors, basic and scrollable. Basic cursors let you import data in an SQL query in a sequential way. However, scrollable cursors enable data import from a specified offset in the data set.

To import data quickly using a SQL `SELECT` statement, use the `select` function. To import data with full functionality, use the `exec` and `fetch` functions. For differences, see "Data Import Using Database Explorer App or Command Line" on page 2-133.

A `cursor` object stays open until you close it using the `close` function.

Creation

Create a `cursor` object using the `exec` function.

Properties

ODBC and JDBC Driver Properties

`Data` — SQL query results
cell array (default) | table | structure | numeric | dataset

SQL query results, specified as a cell array, table, structure, numeric, or dataset array. After running the `exec` function, this property is blank. The `fetch` function populates this property with imported data from the executed SQL query.

To set the data return format, use the `setdbprefs` function.

Note The dataset array value will be removed in a future release. Use table instead.

Example: `[15×5 table]`

Data Types: `double` | `struct` | `table` | `cell`

`RowLimit` — Number of rows to import
`0` (default) | positive numeric scalar

This property is read-only.

Number of rows to import at a time, specified as a positive numeric scalar.

Data Types: `double`

`SQLQuery` — SQL query
character vector

This property is read-only.

SQL query, specified as a character vector. To change the SQL query, create a `cursor` object and specify the SQL query in the input argument `sqlquery` of the `exec` function.

For information about the SQL query language, see the SQL Tutorial.

Example: `'SELECT * FROM productTable'`

Data Types: `char`

`Message` — Error message
`''` (default) | character vector

This property is read-only.

Error message, specified as a character vector. An empty character vector specifies that the `exec` or `fetch` functions executed successfully. If this property is empty after running `exec`, then the SQL statement executed successfully. If this property is empty after running `fetch`, then the data import completed successfully. Otherwise, the property populates with the returned error message.

To throw error messages to the Command Window, use the `setdbprefs` function. Enter this code:

```
setdbprefs('ErrorHandling','report');
sqlquery = 'SELECT * FROM invalidtablename';
curs = exec(conn,sqlquery)
```

To store error messages in the `Message` property instead, enter this code:

```
setdbprefs('ErrorHandling','store');
sqlquery = 'SELECT * FROM invalidtablename';
curs = exec(conn,sqlquery)
```

Example: `'Table 'schame.InvalidTableName' doesn't exist'`

Data Types: `char`

Type — Database cursor type
`'ODBCCursor Object'` | `'Database Cursor Object'`

This property is read-only.

Database cursor type, specified as one of these values.

Value	Database Cursor Type
'ODBCCursor Object'	cursor object created using an ODBC database connection
'Database Cursor Object'	cursor object created using a JDBC database connection

Statement — Statement
C statement object | Java statement object

This property is read-only.

Statement, specified as a C statement object or Java statement object.

Example: [1×1 com.mysql.jdbc.StatementImpl]

Scrollable — Scrollable cursor
0 (default) | 1

This property is read-only.

Scrollable cursor, specified as a logical value. The value 0 identifies the cursor object as basic. The value 1 identifies the cursor object as scrollable.

Note This property is hidden.

Data Types: logical

Position — Cursor position
0 (default) | numeric scalar

This property is read-only.

Cursor position of a scrollable cursor in the data set, specified as a numeric scalar. Only scrollable cursors have this property. The cursor position behaves differently depending on the database driver used to establish the database connection.

Data Types: double

JDBC Driver Properties

DatabaseObject — JDBC connection
connection object

This property is read-only.

JDBC connection, specified as a connection object created by connecting to a database using the JDBC driver.

Example: [1×1 database.jdbc.connection]

ResultSet — Result set
Java result set object

This property is read-only.

Result set, specified as a Java result set object.

Example: `[1×1 com.mysql.jdbc.JDBC4ResultSet]`

`Cursor` — Database cursor
Java object

This property is read-only.

Database cursor, specified as an internal Java object that represents the `cursor` object.

Example: `[1×1 com.mathworks.toolbox.database.sqlExec]`

`Fetch` — Imported data
Java object

This property is read-only.

Imported data, specified as an internal Java object that represents the imported data.

Example: `[1×1 com.mathworks.toolbox.database.fetchTheData]`

Object Functions

close	(Not recommended) Close cursor
fetch	(Not recommended) Import data into MATLAB workspace from database cursor
get	(To be removed) Retrieve object properties
isopen	(Not recommended) Determine if database cursor is open

Examples

Select Data Using Native ODBC Driver

Use a native ODBC connection to import product data from a Microsoft SQL Server database into MATLAB. Then, determine the highest unit cost among products.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select all data from the table `productTable` using the `connection` object. Assign the SQL `SELECT` statement to the variable `sqlquery`. The `cursor` object contains the executed SQL query.

```
sqlquery = 'SELECT * FROM productTable';
curs = exec(conn,sqlquery)
```

```
curs =

   cursor with properties:

         Data: 0
     RowLimit: 0
     SQLQuery: 'SELECT * FROM productTable'
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

For an ODBC connection, the `Type` property contains `ODBCCursor Object`. For JDBC connections, the `Type` property contains `Database Cursor Object`.

Import data from the table into MATLAB.

```
curs = fetch(curs);
data = curs.Data;
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans =

    24
```

After you finish working with the `cursor` object, close it. Close the database connection.

```
close(curs)
close(conn)
```

Version History

Introduced before R2006a

R2018b: `cursor` object is not recommended

Not recommended starting in R2018b

The `cursor` object is not recommended. Use the `fetch` function instead. Some differences between the workflows might require updates to your code.

There are no plans to remove the `cursor` object at this time.

Update Code

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

See Also

close | database | fetch | setdbprefs

close

Namespace: `database.odbc`

(Not recommended) Close cursor

Note The `close` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see “Compatibility Considerations”.

Syntax

`close(curs)`

Description

`close(curs)` closes and invalidates the database cursor and driver resource utilizer to free up database and driver resources.

Examples

Close `cursor` Object

Connect to a Microsoft SQL Server database and verify the database connection. Then, import data from the database into MATLAB. Determine the highest unit cost among the retrieved products in the table. Close the database cursor and database connection.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select all data from the table `productTable` by using the `connection` object, and sort the data by product number. Assign the SQL `SELECT` statement to the variable `sqlquery`. The `cursor` object contains the executed SQL query.

```
sqlquery = 'SELECT * FROM productTable ORDER BY productNumber';
curs = exec(conn,sqlquery);
```

Import the data from the executed SQL query and display the first three rows.

```
curs = fetch(curs);
curs.Data(1:3,:)

ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    1                4.0035e+05     1001              14          'Building Blocks'
    2                4.0031e+05     1002               9          'Painting Set'
    3                  4.01e+05     1009              17          'Slinky'
```

Determine the highest unit cost in the table.

```
data = curs.Data;
max(data.unitCost)

ans =

    24
```

After you finish working with the `cursor` object, close it.

```
close(curs)
```

After you close the `cursor` object, MATLAB deletes the object. Use the `clear` function to remove the `curs` variable from the MATLAB workspace.

```
curs
clear curs

curs =

  handle to deleted cursor
```

Close the database connection.

```
close(conn)
```

Input Arguments

`curs` — Database cursor

`cursor` object

Database cursor, specified as a `cursor` object created using the `exec` function.

Version History

Introduced before R2006a

R2018b: `close` function is not recommended

Not recommended starting in R2018b

The `close` function is not recommended. Use the `fetch` function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the `close` function at this time.

Update Code

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the `close` function.

See Also

`database` | `close` | `fetch`

External Websites

SQL Tutorial

fetch

Namespace: `database.odbc`

(Not recommended) Import data into MATLAB workspace from database cursor

---

Note The `fetch` function with the `cursor` object is not recommended. Use the `fetch` function with the `connection` object or the `select` function instead. For details, see "Compatibility Considerations".

The scrollable cursor functionality has no replacement.

Syntax

```
curs = fetch(curs)
curs = fetch(curs,rowlimit)
curs = fetch( ___ ,Name,Value)
```

Description

`curs = fetch(curs)` imports all rows of data from an executed SQL query into the `Data` property of the `cursor` object. Use the `cursor` object to investigate imported data and its structure.

Caution: Leaving `cursor` and `connection` objects open or overwriting open objects can result in unexpected behavior. After you finish working with these objects, you must close them using `close`.

`curs = fetch(curs,rowlimit)` imports the maximum number of rows of data, as specified in `rowlimit`, from an executed SQL query.

`curs = fetch( ___ ,Name,Value)` specifies options using one or more name-value pair arguments in addition to the input arguments in previous syntaxes. For example, `curs = fetch(curs,'AbsolutePosition',5);` imports data using an absolute position offset in a scrollable cursor, whereas `curs = fetch(curs,'RelativePosition',10);` imports data using a relative position offset.

Examples

Import All Data Using `cursor` Object

Import product data from a Microsoft SQL Server database into MATLAB by using the `cursor` object. Then, determine the highest unit cost among products in the table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message

ans =

     []
```

Execute the SQL query using the `exec` function and the database connection. Then, import all the data from `productTable`.

```
sqlquery = 'SELECT * FROM productTable';
curs = exec(conn,sqlquery);
curs = fetch(curs)

curs =

  cursor with properties:

         Data: [15×5 table]
     RowLimit: 0
     SQLQuery: 'SELECT * FROM productTable'
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

For an ODBC connection, the `Type` property contains `ODBCCursor Object`. For JDBC connections, this property contains `Database Cursor Object`.

Display the data in the `cursor` object property `Data`.

```
curs.Data

ans =

  15×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

     9               1.2597e+05     1003              13          'Victorian Doll'
     8               2.1257e+05     1001               5          'Train Set'
     7               3.8912e+05     1007              16          'Engine Kit'
     2               4.0031e+05     1002               9          'Painting Set'
     4               4.0034e+05     1008              21          'Space Cruiser'
     1               4.0035e+05     1001              14          'Building Blocks'
     5               4.0046e+05     1005               3          'Tin Soldier'
     6               4.0088e+05     1004               8          'Sail Boat'
     3                 4.01e+05     1009              17          'Slinky'
    10               8.8865e+05     1006              24          'Teddy Bear'
    11               4.0814e+05     1004              11          'Convertible'
    12               2.1046e+05     1010              22          'Hugsy'
    13               4.7082e+05     1012              17          'Pancakes'
    14                5.101e+05     1011              19          'Shawl'
    15               8.9975e+05     1011              20          'Snacks'
```

Determine the highest unit cost in the table.

```
data = curs.Data;
max(data.unitCost)
```

```
ans =

    24
```

After you finish working with the `cursor` object, close it. Close the database connection.

```
close(curs)
close(conn)
```

Input Arguments

`curs` — Database cursor
`cursor` object

Database cursor, specified as a `cursor` object created using the `exec` function.

`rowlimit` — Row limit
numeric scalar

Row limit, specified as a positive numeric scalar that indicates the maximum number of rows of data to import from the database.

If `rowlimit` is `0`, `fetch` returns all the rows of data.

Data Types: `double`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `curs = fetch(curs,'RelativePosition',10);`

`AbsolutePosition` — Absolute position offset
numeric scalar

Absolute position offset, specified as the comma-separated pair consisting of `'AbsolutePosition'` and a numeric scalar that indicates the absolute position offset value. When you specify an absolute position offset value, `fetch` imports data starting from the cursor position equal to this value, regardless of the current cursor location. The scalar can be a positive number to signify fetching data from the start of the data set, or a negative number to signify fetching data from the end of the data set. This name-value pair argument is available only when you create a scrollable `cursor` object using `exec`.

Example: `'AbsolutePosition',5`

Data Types: `double`

`RelativePosition` — Relative position offset
numeric scalar

Relative position offset, specified as the comma-separated pair consisting of `'RelativePosition'` and a numeric scalar that indicates the relative position offset value. When you specify a relative position offset value, `fetch` adds the current cursor position value to the relative position offset value. Then, `fetch` imports data starting from the resulting value. The scalar can be a positive number to signify importing data after the current cursor position in the data set, or a negative number to signify importing data before the current cursor position in the data set. This name-value pair argument is available only when you create a scrollable `cursor` object using `exec`.

Example: `'RelativePosition',10`

Data Types: `double`

Output Arguments

`curs` — Database cursor
`cursor` object

Database cursor, returned as a `cursor` object populated with imported data in the `Data` property. You can specify the output data format in the `Data` property by using the `setdbprefs` function.

Tips

- If you have a native ODBC connection that you established using `database`, then running `fetch` on the `cursor` object updates the input `cursor` object itself. Depending on whether you provide an output argument, the same object gets copied over to the output. Therefore, only one `cursor` object exists in memory for any of these usages:

```
% First use
curs = fetch(curs)
% Second use
fetch(curs)
% Third use
curs2 = fetch(curs)
```

Version History

Introduced before R2006a

R2018b: `fetch` function with the `cursor` object is not recommended

Not recommended starting in R2018b

The `fetch` function with the `cursor` object is not recommended. Use the `fetch` function with the `connection` object instead. Some differences between the workflows might require updates to your code.

There are no plans to remove the `fetch` function at this time.

Update Code

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
```

```
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

You can also import data in one step using the `select` function.

```
data = select(conn,selectquery);
```

The scrollable cursor functionality has no replacement.

See Also

`fetch` | `close` | `database` | `setdbprefs` | `exec`

External Websites

SQL Tutorial

isopen

Namespace: `database.odbc`

(Not recommended) Determine if database cursor is open

Note The `isopen` function is not recommended. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see "Compatibility Considerations".

Syntax

`i = isopen(curs)`

Description

`i = isopen(curs)` returns `1` if the database cursor is open and `0` if the database cursor is closed or invalid.

Examples

Determine If Database Cursor Is Open

Connect to a Microsoft SQL Server database and verify the database cursor. Then, import data from the database into MATLAB. Determine the highest unit cost among the retrieved products in the table. Close the database cursor and database connection.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a `cursor` object by executing an SQL query in the database. Select all the data from the table `productTable` by using the `connection` object, and then sort the data by the product number.

```
sqlquery = 'SELECT * FROM productTable ORDER BY productNumber';
curs = exec(conn,sqlquery);
```

Determine if the database cursor is open. The `isopen` function returns the numeric scalar `1`, which means the database cursor is open.

```
i = isopen(curs)
```

```
i =

     1
```

Import data from the executed SQL query and display the first three rows.

```
curs = fetch(curs);
curs.Data(1:3,:)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    1                4.0035e+05     1001              14          'Building Blocks'
    2                4.0031e+05     1002               9          'Painting Set'
    3                  4.01e+05     1009              17          'Slinky'
```

Determine the highest unit cost in the table.

```
data = curs.Data;
max(data.unitCost)
```

```
ans =

    24
```

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Determine if the database cursor is closed. The `isopen` function returns the numeric scalar `0`, which means the database cursor is closed. If the `cursor` object is invalid, the `isopen` function returns the same result.

```
i = isopen(curs)
```

```
i =

     0
```

Close the database connection.

```
close(conn)
```

Input Arguments

`curs` — Database cursor
`cursor` object

Database cursor, specified as a `cursor` object created using the `exec` function.

Version History

Introduced in R2015b

R2018b: isopen function is not recommended

Not recommended starting in R2018b

The isopen function is not recommended. Use the fetch function to import data. Some differences between the workflows might require updates to your code.

There are no plans to remove the isopen function at this time.

Update Code

Use the fetch function with the connection object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the cursor object, determine if the cursor object is open, and import data. For example:

```
curs = exec(conn,sqlquery);
i = isopen(curs);
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the fetch function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the isopen function.

See Also

database | fetch | close

External Websites

SQL Tutorial

odbc

Create ODBC database connection

Syntax

```
conn = odbc(datasource,username,password)
conn = odbc(datasource,username,password,Name,Value)
conn = odbc(dsnless)
conn = odbc(dsnless,DriverManager=dm)
```

Description

`conn = odbc(datasource,username,password)` creates a database connection to an ODBC data source with a user name and password. The database connection `conn` is returned as an ODBC `connection` object.

`conn = odbc(datasource,username,password,Name,Value)` specifies options using one or more name-value arguments. For example, `'LoginTimeout',5` creates an ODBC connection with a login timeout of 5 seconds.

`conn = odbc(dsnless)` creates a connection to a database using a DSN-less connection string. (DSN is a data source name.)

`conn = odbc(dsnless,DriverManager=dm)` creates a connection to an ODBC data source using a DSN-less connection string. You can set `DriverManager` to `"unixODBC"` or `"iODBC"` for use on macOS platforms.

Examples

Connect to MySQL Using ODBC Database Connection

Connect to a MySQL® database using an ODBC database connection. Then, import data from the database into MATLAB®, perform a simple data analysis, and close the database connection.

This example assumes that you are connecting to a MySQL Version 5.7.22 database using the MySQL ODBC 5.3 Driver.

Create a database connection to a MySQL database. Specify the user name and password.

```
datasource = "MySQL ODBC";
conn = odbc(datasource,"root","matlab")
```

```
conn = 
  connection with properties:

                  DataSource: 'MySQL ODBC'
                    UserName: 'root'
                     Message: ''
                        Type: 'ODBC Connection Object'
  Database Properties:
```

```
                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 0
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toystore_doc'
                    Catalogs: {'information_schema', 'detsdb', 'mysql' ... and 4 more}
                     Schemas: {}

  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '5.7.22'
                  DriverName: 'myodbc5a.dll'
               DriverVersion: '05.03.0014'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `fetch` function. Display the first three rows of data.

```
query = "SELECT * FROM inventoryTable";
data = fetch(conn,query);
head(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price          inventoryDate
    _____________    ________    _____    _______________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
```

Determine the highest product quantity in the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection.

```
close(conn)
```

Connect to MySQL Using ODBC Database Connection with Additional Options

Connect to a MySQL® database using an ODBC data source and a timeout value. Then, import data from the database into MATLAB®, perform a simple data analysis, and close the database connection.

This example assumes that you are connecting to a MySQL Version 5.7.22 database using the MySQL ODBC 5.3 Driver.

Create a database connection to a MySQL database using an ODBC data source. Specify the user name and password. Also, specify a timeout value of 5 seconds for connecting to the database.

```
datasource = "MySQL ODBC";
username = "root";
password = "matlab";
conn = odbc(datasource,username,password,'LoginTimeout',5)
```

```
conn = 
  connection with properties:

                  DataSource: 'MySQL ODBC'
                    UserName: 'root'
                     Message: ''
                        Type: 'ODBC Connection Object'
  Database Properties:

                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 5
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toystore_doc'
                    Catalogs: {'information_schema', 'detsdb', 'mysql' ... and 4 more}
                     Schemas: {}

  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '5.7.22'
                  DriverName: 'myodbc5a.dll'
               DriverVersion: '05.03.0014'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `fetch` function. Display the first three rows of data.

```
query = "SELECT * FROM inventoryTable";
data = fetch(conn,query);
head(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
```

Determine the highest product quantity in the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection.

```
close(conn)
```

Connect to MySQL Using DSN-Less Connection

Connect to a MySQL® database using a DSN-less database connection. Then, import data from the database into MATLAB®, perform a simple data analysis, and close the database connection.

This example assumes that you are connecting to a MySQL Version 5.7.22 database using the MySQL ODBC 5.3 Driver.

Create a database connection to a MySQL database. Specify the connection string.

```
dsnless = strcat("Driver={MySQL ODBC 5.3 Ansi Driver}; Server=dbtb01;", ...
   "Database=toystore_doc; UID=root; PWD=matlab");
conn = odbc(dsnless)
```

```
conn =
  connection with properties:

                DataSource: ''
                  UserName: ''
                   Message: ''
                      Type: 'ODBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: 'toystore_doc'
                  Catalogs: {'information_schema', 'detsdb', 'mysql' ... and 4 more}
                   Schemas: {}
```

```
  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '5.7.22'
                  DriverName: 'myodbc5a.dll'
               DriverVersion: '05.03.0014'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `fetch` function. Display the first three rows of data.

```
query = "SELECT * FROM inventoryTable";
data = fetch(conn,query);
head(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price          inventoryDate
    _____________    ________    _____    _______________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
```

Determine the highest product quantity in the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection.

```
close(conn)
```

MySQL ODBC for macOS DSN-Less Connection

This example requires the download and installation of the MySQL ODBC driver from MySQL Community Downloads. Verify the iODBC driver manager is installed in the path `/usr/local/iODBC`. If you need to install the iODBC driver manager, you can download it from iodbc.org.

Connect to the database using the DSN-less connection string and the iODBC driver manager.

```
dsnless = "Driver=/usr/local/mysql-connector-odbc-8.0.30-macos12-x86-64bit/lib/libmyodbc8w.so;Se
conn = odbc(dsnless,DriverManager="iODBC")
```

```
conn =
```

```
connection with properties:

                  DataSource: ''
                    UserName: ''
                     Message: ''
                        Type: 'ODBC Connection Object'
  Database Properties:

                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 0
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toy_store'
                    Catalogs: {'information_schema', 'mysql', 'performance_schema' ... and 3 more
                     Schemas: {}

  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '8.0.3-rc-log'
                  DriverName: 'libmyodbc8w.so'
               DriverVersion: '08.00.0031'
```

Input Arguments

`datasource` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing data source.

Example: `"myDataSource"`

Data Types: `char` | `string`

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

`dsnless` — DSN-less connection
character vector | string scalar

DSN-less connection string, specified as a character vector or string scalar. The connection string is specific to each database and usually contains connection parameters such as the database server name, port number, and database name. For details about the connection parameters of your database, see the database documentation.

This table shows some sample DSN-less connection strings for the Windows and Linux platforms. To use these samples, substitute your values for the corresponding connection parameters in the strings. The values might vary based on your database configuration.

Database	DSN-Less Connection String
Microsoft SQL Server	Windows — `"Driver={SQL Server Native Client 11.0}; Server=localhost\toy_store; Port=1433; Database=toy_store; UID=user; PWD=password"` Linux — `"Driver={ODBC Driver 17 for SQL Server}; Server=localhost,1433; Database=toy_store; UID=user; PWD=password"` macOS — `"Driver=/usr/local/Cellar/msodbcsql18/18.1.2.1/lib/libmsodbcsql.18.dylib;Server=localhost,1433;UID=username;PWD=password;Database=toy_store"`
MySQL	Windows — `"Driver={MySQL ODBC 5.3 Ansi Driver}; Server=localhost; Database=toy_store; UID=user; PWD=password"` Linux — `"Driver={MySQL ODBC 5.3}; Server=localhost; Database=toy_store; UID=user; PWD=password"` macOS — `"Driver=/usr/local/mysql-connector-odbc-8.0.30-macos12-x86-64bit/lib/libmyodbc8w.so;Server=dbtb04;Port=3306;UID=username;PWD=password;Database=toy_store"`

Database	DSN-Less Connection String
PostgreSQL	Windows — `"Driver={PostgreSQL ANSI(x64)}; Server=localhost; Database=toy_store; UID=user; PWD=password"` Linux — `"Driver={PostgreSQL ANSI};Servername=localhost;Database=toy_store;UID=user;PWD=password"` macOS — `"Driver=/usr/local/psqlodbcw.so;Server=localhost;Port=5432;UID=username;PWD=password;Database=toy_store"`

Data Types: `char` | `string`

`dm` — Driver manager for macOS platform
`"unixODBC"` (default) | `"iODBC"`

Driver manager for macOS platform, specified as `"unixODBC"` or `"iODBC"`. For more information, see Configuring an ODBC Driver on Windows, macOS, and LINUX. The ODBC driver manager manages communication between apps and ODBC drivers. All drivers that ship with MATLAB depend on `unixODBC`. If using your own driver, refer to your driver manual to determine which driver manager to use.

Example: `dm = "unixODBC"; odbc(dsnless,DriverManager=dm)`

Name-Value Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `conn = odbc(datasource,username,password,'AutoCommit','off','ReadOnly','off')` creates a database connection to an ODBC data source with a user name and password, and specifies that database transactions must be committed to the database manually and the database data is writeable.

`AutoCommit` — Flag to autocommit transactions
`'on'` (default) | `'off'`

Flag to autocommit transactions, specified as one of these values:

- `'on'` — Database transactions are automatically committed to the database.
- `'off'` — Database transactions must be committed to the database manually.

Example: `'AutoCommit','off'`

`LoginTimeout` — Login timeout
`0` (default) | positive numeric scalar

Login timeout, specified as a name-value argument consisting of a `LoginTimeout` and a positive numeric scalar. The login timeout specifies the number of seconds that the driver waits while trying to connect to a database before throwing an error.

To specify no login timeout for the connection attempt, set the value to `0`.

When the database does not support a login timeout, the function sets this value to `–1`.

Example: `LoginTimeout=5`

Data Types: `double`

`ReadOnly` — Read-only database data
`'off'` (default) | `'on'`

Read-only database data, specified as one of these values:

- `'on'` — Database data is read-only.
- `'off'` — Database data is writable.

Example: `'ReadOnly','on'`

Limitations

The Linux and macOS platforms do not support the following:

- `select` function
- ODBC database connection using the Database Explorer app
- MySQL ODBC driver 8.0 and higher

Version History

Introduced in R2021a

R2023b: ODBC Support for macOS

Connect to database servers on a Mac using the shipped driver from MathWorks® or a downloaded driver.

See Also

`database` | `configureODBCDataSource` | `close` | `sqlread` | `fetch` | `isopen` | `update` | `sqlwrite`

Topics

"Setup Requirements for Database Connection" on page 2-11
"Connection Options" on page 2-8
"Configure Driver and Data Source" on page 2-14
"Microsoft SQL Server ODBC for Windows" on page 2-23
"Connect to Database" on page 2-129
"Import Data from Database Table Using sqlread Function" on page 5-58
"Insert Data into Database Table" on page 5-61
"Retrieve Database Metadata" on page 5-64

"Database Connection Error Messages" on page 3-7

database

Connect to database

Syntax

```
conn = database(datasource,username,password)
conn = database(databasename,username,password,
Param1,ParamValue1,...,ParamN,ParamValueN)
conn = database( ___ ,Name,Value)
conn = database(databasename,username,password,driver,url)
```

Description

`conn = database(datasource,username,password)` creates a database connection to a data source with a user name and password. The database connection is a `connection` object. The data source specifies whether the database connection uses an ODBC or JDBC driver.

`conn = database(databasename,username,password,
Param1,ParamValue1,...,ParamN,ParamValueN)` creates a JDBC database connection to a database name with a user name, password, and JDBC driver parameters as specified by multiple name-value arguments.

`conn = database( ___ ,Name,Value)` specifies options using one or more name-value pair arguments in addition to any of the input argument combinations in previous syntaxes. For example, `conn = database(datasource,username,password,'LoginTimeout',5);` creates an ODBC or JDBC connection, as specified by the `datasource` input argument, with a login timeout of 5 seconds.

`conn = database(databasename,username,password,driver,url)` creates a JDBC database connection specified by the JDBC driver name and database connection URL.

Examples

Connect to MySQL Using ODBC Driver

Connect to a MySQL® database. Then, import data from the database into MATLAB®. Perform simple data analysis, and then close the database connection.

To create a database connection using an ODBC driver, you must configure an ODBC data source.

This example assumes that you are connecting to a MySQL Version 5.7.22 database using the MySQL Driver 5.3.

Create a database connection to the ODBC data source `MySQL ODBC`. Specify the user name and password.

```
datasource = "MySQL ODBC";
username = "username";
```

```
password = "password";
conn = database(datasource,username,password)

conn =
  connection with properties:

                  DataSource: 'MySQL ODBC'
                    UserName: 'username'
                     Message: ''
                        Type: 'ODBC Connection Object'
  Database Properties:

                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 0
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toystore_doc'
                    Catalogs: {'information_schema', 'detsdb', 'mysql' ... and 4 more}
                     Schemas: {}

  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '5.7.22'
                  DriverName: 'myodbc5a.dll'
               DriverVersion: '05.03.0014'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` -- Information about the database configuration
- `Catalog and Schema Information` -- Names of catalogs and schemas in the database
- `Database and Driver Information` -- Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB® using the `sqlread` function. Display the first eight rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data)

ans=8×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
          4            2580        21     {'2013-06-08 14:24:33'}
          5            9000         3     {'2012-09-14 15:00:25'}
          6            4540         8     {'2013-12-25 19:45:00'}
          7            6034        16     {'2014-08-06 08:38:00'}
```

```
          8            8350         5     {'2011-06-18 11:45:35'}
```

Determine the highest product quantity in the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection.

```
close(conn)
```

Connect to PostgreSQL Using JDBC Driver URL

Connect to the PostgreSQL database. Then, import data from the database into MATLAB, perform simple data analysis, and then close the database connection. This example assumes that you are connecting to a PostgreSQL 9.4.5 database using the JDBC PostgreSQL Native Driver 8.4.

Connect to the database using the database name, user name, and password. Use the JDBC driver `org.postgresql.Driver` to make the connection.

Use the URL defined by the driver vendor including your server name `host`, port number, and database name.

```
databasename = "dbname";
username = "username";
password = "pwd";
driver = "org.postgresql.Driver";
url = "jdbc:postgresql://host:port/dbname";

conn = database(databasename,username,password,driver,url)
```

```
conn = 

  connection with properties:

                DataSource: 'dbname'
                  UserName: 'username'
                    Driver: 'org.postgresql.Driver'
                       URL: 'jdbc:postgresql://host: ...'
                   Message: ''
                      Type: 'JDBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 8192

  Catalog and Schema Information:

            DefaultCatalog: 'catalog'
                  Catalogs: {'catalog'}
                   Schemas: {'schema1', 'schema2', 'schema3' ... and 1 more}

  Database and Driver Information:

       DatabaseProductName: 'PostgreSQL'
    DatabaseProductVersion: '9.4.5'
                DriverName: 'PostgreSQL Native Driver'
             DriverVersion: 'PostgreSQL 8.4 JDBC4 (bui ...'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `select` function. Display the data.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery)
```

```
ans =

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _______________________

     1               1700        14.5     '2014-09-23 09:38:34.0'
     2               1200         9.3     '2014-07-08 22:50:45.0'
     3                356        17.2     '2014-05-14 07:14:28.0'
     ...
```

Determine the highest quantity in the table.

```
max(data.quantity)
```

```
ans =

    9000
```

Close the database connection.

```
close(conn)
```

Connect to MySQL Using ODBC Driver with Additional Options

Connect to the MySQL® database using an ODBC driver. Then, import data from the database into MATLAB®, perform simple data analysis, and then close the database connection. The example assumes that you are connecting to the MySQL database version 5.7.22 and MySQL ODBC 5.3 ANSI driver.

Create a database connection to a MySQL database and a login timeout of 5 seconds. Specify the user name and password.

```
databasename = "toystore_doc";
username = "username";
password = "password";
conn = database(databasename,username,password,'Vendor','MySQL', ...
    'Server','dbtb01','PortNumber',3306,'LoginTimeout',5)
```

```
conn =
  connection with properties:

                  DataSource: 'toystore_doc'
                    UserName: 'username'
```

```
                     Driver: 'com.mysql.cj.jdbc.Driver'
                        URL: 'jdbc:mysql://dbtb01:3306/ ...'
                    Message: ''
                       Type: 'JDBC Connection Object'
  Database Properties:

                 AutoCommit: 'on'
                   ReadOnly: 'off'
               LoginTimeout: 5
     MaxDatabaseConnections: 0

  Catalog and Schema Information:

             DefaultCatalog: 'toystore_doc'
                   Catalogs: {'detsdb', 'information_schema', 'mysql' ... and 4 more}
                    Schemas: {}

  Database and Driver Information:

        DatabaseProductName: 'MySQL'
     DatabaseProductVersion: '5.7.22'
                 DriverName: 'MySQL Connector/J'
              DriverVersion: 'mysql-connector-java-8.0. ...'
```

`conn` has an empty `Message` property, which indicates a successful connection.

The property sections of the `conn` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `select` function. Display the first three rows of data.

```
selectquery = "SELECT * FROM inventoryTable";
data = select(conn,selectquery);
head(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price          inventoryDate
    _____________    ________    _____    _______________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
```

Determine the highest quantity in the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection.

```
close(conn)
```

Input Arguments

`datasource` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing data source.

Example: `"myDataSource"`

Data Types: `char` | `string`

`databasename` — JDBC database name
character vector | string scalar

JDBC database name, specified as a character vector or string scalar. Specify the name of your database to create a database connection using a JDBC driver.

The name differs for different database systems. For example, `databasename` is the SID or the service name when you are connecting to an Oracle database. Or, `databasename` is the catalog name when you are connecting to a MySQL database.

For details about your database name, contact your database administrator or refer to your database documentation.

Data Types: `char` | `string`

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

`Param1,ParamValue1,...,ParamN,ParamValueN` — JDBC driver parameters
name-value pair arguments

JDBC driver parameters, specified as multiple name-value pair arguments. A `Param` argument is a character vector or string scalar that specifies the name of a JDBC driver parameter. A `ParamValue` argument is a character vector, string scalar, or numeric scalar that specifies the value of the JDBC driver parameter.

Param Valid Values	Param Value Description	ParamValue Valid Values
"Vendor"	Database vendor	• 'MySQL' • 'Oracle' • 'Microsoft SQL Server' • 'PostgreSQL' If you are connecting to a database system not listed here, use the driver and url syntax.
"Server"	Database server name or address	• character vector • string scalar • 'localhost' (default)
"PortNumber"	Server port number where the server is listening	Numeric scalar
"AuthType"	Authentication type (required only for Microsoft SQL Server)	• 'Server' — Microsoft SQL Server authentication • 'Windows' — Windows authentication
"DriverType"	Driver type (required only for Oracle)	• 'thin' — Thin driver • 'oci' — Windows authentication

Tip: When creating a JDBC connection using the JDBC driver parameters, you can omit the following:

- 'Server' parameter when connecting to a database locally
- 'PortNumber' parameter when connecting to a database server listening on the default port (except for Oracle connections)

Example: `'Vendor','Microsoft SQL Server','Server','dbtb04','AuthType','Windows','PortNumber',54317` connects to a Microsoft SQL Server database using a JDBC driver on a machine named `dbtb04` with Windows authentication and using port number `54317`.

Example: `'Vendor','MySQL','Server','remotehost'` connects to a MySQL database using a JDBC driver on a machine named `remotehost`.

`driver` — JDBC driver name
character vector | string scalar

JDBC driver name, specified as a character vector or string scalar that refers to the name of the Java driver that implements the `java.sql.Driver` interface. For details, see JDBC driver name and database connection URL on page 12-137.

Data Types: `char` | `string`

`url` — Database connection URL
character vector | string scalar

Database connection URL, specified as a character vector or string scalar for the vendor-specific URL. This URL is typically constructed using connection properties such as server name, port number, and database name. For details, see JDBC driver name and database connection URL on page 12-137. If you do not know the driver name or the URL, you can use name-value pair arguments to specify individual connection properties.

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `'LoginTimeOut',5,'ErrorHandling','report'` specifies waiting for 5 seconds to connect to a database before throwing an error and displaying any error messages at the command line.

`AutoCommit` — Flag to autocommit transactions
`'on'` (default) | `'off'`

Flag to autocommit transactions, specified as one of these values:

- `'on'` — Database transactions are automatically committed to the database.
- `'off'` — Database transactions must be committed to the database manually.

Example: `'AutoCommit','off'`

`LoginTimeout` — Login timeout
`0` (default) | positive numeric scalar

Login timeout, specified as the name-value argument consisting of `'LoginTimeout'` and a positive numeric scalar. The login timeout specifies the number of seconds that the driver waits while trying to connect to a database before throwing an error.

To specify no login timeout for the connection attempt, set the value to `0`.

When login timeout is unsupported by the database, the value is `-1`.

Example: `'LoginTimeout',5`

Data Types: `double`

`ReadOnly` — Read-only database data
`'off'` (default) | `'on'`

Read-only database data, specified as the comma-separated pair consisting of `'ReadOnly'` and one of these values:

- `'on'` — Database data is read-only.
- `'off'` — Database data is writable.

Example: `'ReadOnly','on'`

`ErrorHandling` — Error handling
`'store'` (default) | `'report'`

Error handling, specified as the comma-separated pair consisting of `'ErrorHandling'` and one of these values:

- `'store'` — Store an error message in the `Message` property of the `connection` object.
- `'report'` — Display an error message at the command line.

`DriverManager` — Driver manager for macOS platform
`'unixODBC'` (default) | `'iODBC'`

Driver manager for macOS platform, specified as `'unixODBC'` or `'iODBC'`. For more information, see Configuring an ODBC Driver on Windows, macOS, and Linux at `devart.com`. The ODBC driver manager manages communication between apps and ODBC drivers. All the drivers that ship with MATLAB depend on `unixODBC`. If you use your own driver, refer to your driver manual to determine which driver manager to use.

Example: `DriverManager=unixODBC`

Output Arguments

conn — Database connection
`connection` object

Database connection, returned as an ODBC `connection` object or JDBC `connection` object.

More About

JDBC Driver Name and Database Connection URL

The JDBC driver name and database connection URL take different forms for different databases. For details, consult your database driver documentation.

Database	JDBC Driver Name and Database URL Example Syntax
IBM® Informix®	**JDBC driver:** `com.informix.jdbc.IfxDriver` **Database URL:** `jdbc:informix-sqli://161.144.202.206:3000:INFORMIXSERVER=stars`
Microsoft SQL Server 2005	**JDBC driver:** `com.microsoft.sqlserver.jdbc.SQLServerDriver` **Database URL:** `jdbc:sqlserver://localhost:port;database=databasename`
MySQL	**JDBC driver:** `twz1.jdbc.mysql.jdbcMysqlDriver` **Database URL:** `jdbc:z1MySQL://natasha:3306/metrics` For MySQL Connector 8.0 and later: **JDBC driver:** `com.mysql.cj.jdbc.Driver` For previous versions of MySQL Connector: **JDBC driver:** `com.mysql.jdbc.Driver` **Database URL:** `jdbc:mysql://devmetrics.mrkps.com/testing` To insert or select characters with encodings that are not default, append the value `useUnicode=true&characterEncoding=`*`encoding`* to the URL, where *`encoding`* is any valid MySQL character encoding followed by &. For example, `useUnicode=true&characterEncoding=utf8&`. *The trailing & is required.*
Oracle oci7 drivers	**JDBC driver:** `oracle.jdbc.driver.OracleDriver` **Database URL:** `jdbc:oracle:oci7:@rex`
Oracle oci8 drivers	**JDBC driver:** `oracle.jdbc.driver.OracleDriver` **Database URL:** `jdbc:oracle:oci8:@111.222.333.44:1521:` **Database URL:** `jdbc:oracle:oci8:@frug`
Oracle 10 Connections with JDBC (Thin drivers)	**JDBC driver:** `oracle.jdbc.driver.OracleDriver` **Database URL:** `jdbc:oracle:thin:`
Oracle Thin drivers	**JDBC driver:** `oracle.jdbc.driver.OracleDriver` **Database URL:** `jdbc:oracle:thin:@144.212.123.24:1822:` **Database URL:** `jdbc:oracle:thin:@(DESCRIPTION = (ADDRESS = (PROTOCOL = TCP)(HOST = ServerName)(PORT = 1234)) (CONNECT_DATA = (SERVER = DEDICATED) (SERVICE_NAME = dbname) ) )`
PostgreSQL	**JDBC driver:** `org.postgresql.Driver` **Database URL:** `jdbc:postgresql://host:port/database`

Database	JDBC Driver Name and Database URL Example Syntax
PostgreSQL with SSL Connection	**JDBC driver:** `org.postgresql.Driver` **Database URL:** `jdbc:postgresql:servername:dbname:ssl=true&sslfactory=org.postgresql.ssl.NonValidatingFactory&` *The trailing & is required.*
Teradata®	**JDBC driver:** `com.teradata.jdbc.TeraDriver` **Database URL:** `jdbc:teradata://DatabaseServerName`

Tips

- If you specify a data source name in the `datasource` input argument that appears on both ODBC and JDBC data source lists, then the `database` function creates an ODBC database connection. In this case, if you must create a JDBC database connection instead, append `_JDBC` to the name of the data source.

Alternative Functionality

Database Explorer App

The `database` function connects to a database using the command line. To connect to a database and explore its data in a visual way, use the Database Explorer app.

Version History

Introduced before R2006a

R2020b: `database.ODBCConnection` syntax has been removed

Errors starting in R2020b

The `database.ODBCConnection` syntax has been removed. Use the syntaxes of the `database` function instead. Some differences between the workflows require updates to your code.

Update Code

In prior releases, you created a connection to a database by using the `database.ODBCConnection` syntax. For example:

```
conn = database.ODBCConnection(datasource,username,password);
```

Now use the `database` syntax instead.

```
conn = database(datasource,username,password);
```

See Also

Functions
`close` | `sqlread` | `fetch` | `isopen` | `update` | `sqlwrite`

Apps
Database Explorer

Topics

"Setup Requirements for Database Connection" on page 2-11
"Connection Options" on page 2-8
"Configure Driver and Data Source" on page 2-14
"Microsoft SQL Server ODBC for Windows" on page 2-23
"Microsoft SQL Server JDBC for Windows" on page 2-29
"PostgreSQL JDBC for Windows" on page 2-61
"Connect to Database" on page 2-129
"Import Data from Database Table Using sqlread Function" on page 5-58
"Insert Data into Database Table" on page 5-61
"Retrieve Database Metadata" on page 5-64
"Database Connection Error Messages" on page 3-7

datastore

(Not recommended) Create datastore to access collection of data in a database

Note `datastore` is not recommended. Use `databaseDatastore` instead.

Syntax

```
dbds = datastore(conn,sqlquery)
```

Description

This `datastore` function creates a `DatabaseDatastore` object. You can use this object to read large volumes of data in a relational database.

A `DatabaseDatastore` is one of the available datastore types. You can create other types of datastores using the MATLAB function `datastore`. After creating any datastore, you can analyze data by writing custom functions to run MapReduce using the `mapreduce` function. For details, see "Getting Started with MapReduce".

`dbds = datastore(conn,sqlquery)` creates a `DatabaseDatastore` object `dbds` using the database connection `conn`. This datastore contains query results from the executed SQL query `sqlquery`.

Examples

Create a DatabaseDatastore

Create a database connection `conn` using the ODBC driver. This code assumes that you are connecting to a MySQL database with the data source named `MySQL`, user name `username`, and password `pwd`. `MySQL` contains the table named `productTable` with 15 product records.

```
conn = database('MySQL','username','pwd');
```

Create a `DatabaseDatastore` object `dbds` using the database connection `conn` and SQL query `sqlquery`. This SQL query retrieves all products from the product table `productTable`.

```
sqlquery = 'SELECT * FROM productTable';

dbds = datastore(conn,sqlquery)
```

```
dbds = 

  DatabaseDatastore with properties:

       Connection: [1×1 database.odbc.connection]
            Query: 'SELECT * FROM productTable'
    VariableNames: {1×5 cell}
         ReadSize: 10000
```

`datastore` executes the SQL query `sqlquery` and creates a `cursor` object with the resulting data. `dbds` contains these properties:

- `connection` object
- Executed SQL query
- Column names of the executed SQL query
- Number of rows to read from the SQL query results

Display the database connection property `Connection`.

```
dbds.Connection
```

```
ans =

  connection with properties:

                DataSource: 'MySQLdb'
                  UserName: 'username'
                   Message: ''
                      Type: 'ODBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: 'toy_store'
                  Catalogs: {'information_schema', 'toy_store'}
                   Schemas: {}

  Database and Driver Information:

       DatabaseProductName: 'MySQL'
    DatabaseProductVersion: '5.5.46-0+deb7u1'
                DriverName: 'myodbc5a.dll'
             DriverVersion: '05.03.0004'
```

The `Message` property is blank when the database connection is successful.

Close the `DatabaseDatastore` and database connection.

```
close(dbds)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

`sqlquery` — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar.

For information about the SQL query language, see the SQL Tutorial.

Example: `SELECT * FROM invoice` selects all columns and rows from the `invoice` table.

Data Types: `char` | `string`

Output Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in database, returned as a `DatabaseDatastore` object.

Version History

Introduced in R2014b

See Also

`databaseDatastore` | `database` | `datastore` | `close` | `preview` | `read`

Topics

"Import Large Data Using DatabaseDatastore Object" on page 5-23
`DatabaseDatastore`
"Getting Started with Datastore"

hasdata

Namespace: `matlab.io.datastore`

Determine if data in `DatabaseDatastore` is available to read

Syntax

```
tf = hasdata(dbds)
```

Description

`tf = hasdata(dbds)` returns logical `1` (`true`) if there is data available to read from the `DatabaseDatastore` object `dbds`. Otherwise, it returns logical `0` (`false`).

Examples

Determine If `DatabaseDatastore` Object Contains Data

Create a database connection using a JDBC driver. To create this connection, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function. Then, create a `DatabaseDatastore` object and read the data stored in the object until no more data remains.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query reads the first 30 rows of data from the `airlinesmall` table.

```
sqlquery = 'select top 30 * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Read the first 10 rows.

```
dbds.ReadSize = 10;
read(dbds)
```

```
ans =

  10×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________
```

```
    1987      10          30           5        1329       1329       1434       1436
    1987      11           7           6        1316       1315       1713       1647
    1987      11          28           6         815        815       1015       1015
    1987      11           2           1         700        700        800        800
    1987      11          14           6         840        840       1127       1120
    1987      11           1           7        1625       1625       1823       1758
    1987      11          26           4        1314       1315       1538       1542
    1990      10          12           5        1755       1733       1858       1820
    1990      10          19           5        1130       1120       1203       1154
    1990      10           8           1        1515       1440       1609       1535
```

Determine if the `DatabaseDatastore` object has additional data.

```
hasdata(dbds)
```

```
ans =

  logical

   1
```

When more data is available in `dbds`, `hasdata` returns `1`.

Read the rest of the data in `dbds`, 10 rows at a time.

```
while(hasdata(dbds))
     read(dbds)
end
```

```
ans =

  10×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1990      10          23           2        1057       1055       1205       1155
    1990      10          27           6        1353       1355       1634       1640
    1990       9          11           2        1810       1812       1939       1930
    1992       7          18           6        1538       1540       1703       1720
    1992       7          19           7         932        932       1130       1052
    1992       8           4           2         NaN       1815        NaN       1940
    2001      12           9           7         656        650        824        823
    2001      12          22           6        1707       1715       1823       1821
    2001      12           8           6        1402       1410       1642       1626
    2001      12          23           7        1327       1310       1530       1530


ans =

  10×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________
```

```
    2001     11           18             7          1407           1415          1442          1457
    2001     11           26             1          2105           2110          2209          2237
    2001     11           22             4          1345           1355          1530          1549
    2002      7           25             4          1032           1035          1853          1852
    2002      6            5             3          2032           2031          2233          2248
    2002      6           26             3          2026           1840            47          2257
    2002      6            8             6          1557           1600          1703          1711
    2002      6           15             6          1120           1115          1401          1413
    2002      6           10             1           927            930          1031          1031
    2002      6           19             3           632            640           748           756
```

When no more data remains in `dbds`, `hasdata` returns logical `0` and the `while` loop stops.

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

Version History

Introduced in R2014b

See Also

`database` | `databaseDatastore` | `read` | `close`

Topics

"Import Large Data Using DatabaseDatastore Object" on page 5-23
"Analyze Large Data in Database Using Tall Arrays" on page 5-30
"Analyze Large Data in Database Using MapReduce" on page 5-27
`DatabaseDatastore`

isopen

Namespace: `database.odbc`

Determine if database connection is open

Syntax

```
i = isopen(conn)
```

Description

`i = isopen(conn)` returns `1` if the database connection is open and `0` if the database connection is closed or invalid.

Examples

Determine If Database Connection Is Open

Connect to a Microsoft® SQL Server® database and verify the database connection. Then, import data from the database into MATLAB®. Determine the highest unit cost among the retrieved products in the table. Close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Determine if the database connection is open. The `isopen` function returns the numeric scalar `1`, which means the database connection is open.

```
i = isopen(conn)
```

```
i =

     1
```

Select all the data from `productTable` and sort it by the product number. `data` is a table containing the imported data that results from executing the SQL `SELECT` statement.

```
selectquery = 'SELECT * FROM productTable ORDER BY productNumber';
data = select(conn,selectquery);
```

Display the first three rows of data.

```
data(1:3,:)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       'Building Blocks'
          2          4.0031e+05          1002             9       'Painting Set'
          3            4.01e+05          1009            17       'Slinky'
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans =

    24
```

Close the database connection.

```
close(conn)
```

Determine if the database connection is closed. The `isopen` function returns the numeric scalar `0`, which means the database connection is closed. If the database connection is invalid, the `isopen` function returns the same result.

```
i = isopen(conn)
```

```
i =

     0
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

Version History

Introduced in R2015b

See Also

`database` | `close` | `fetch`

Topics

"Import Data from Database Table Using sqlread Function" on page 5-58
"Insert Data into Database Table" on page 5-61
"Connect to Database" on page 2-129

isopen

Determine if SQLite connection is open

Syntax

```
i = isopen(conn)
```

Description

`i = isopen(conn)` uses the MATLAB interface to SQLite to return `1` if the SQLite database connection is open and `0` if it is closed or invalid.

Examples

Determine If Database Connection Is Open

Connect to an SQLite database and verify the database connection. Then, import data from the database into MATLAB®. Determine the highest unit cost among the retrieved products in the table. Close the database connection.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Determine if the database connection is open. The `isopen` function returns the numeric scalar `1`, which means the database connection is open.

```
i = isopen(conn)
```

```
i = logical
   1
```

Select all the data from `productTable` and sort it by the product number. `data` is a table containing the imported data that results from executing the SQL `SELECT` statement.

```
sqlquery = "SELECT * FROM productTable ORDER BY productNumber";
data = fetch(conn,sqlquery);
```

Display the first three rows of data.

```
head(data,3)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          1            400345            1001            14       "Building Blocks"
          2            400314            1002             9       "Painting Set"
          3            400999            1009            17       "Slinky"
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans = int64
    24
```

Close the database connection.

```
close(conn)
```

Determine if the database connection is closed. The `isopen` function returns the numeric scalar `0`, which means the database connection is closed. If the database connection is invalid, the `isopen` function returns the same result.

```
i = isopen(conn)
```

```
i = logical
   0
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

Version History

Introduced in R2022a

See Also

Objects
`sqlite`

Functions
`fetch` | `sqlread` | `close`

Topics
"Import Data Using MATLAB Interface to SQLite" on page 5-32
"Insert Data into SQLite Database Table" on page 5-36

preview

Namespace: `matlab.io.datastore`

Return subset of data from `DatabaseDatastore`

Syntax

```
data = preview(dbds)
```

Description

`data = preview(dbds)` returns the first eight rows of data from the `DatabaseDatastore` object `dbds` without changing its current position.

Note `preview` returns data as a table only. `preview` ignores database preference settings for data return formatting.

If there is no data to read from the query, `preview` throws an error.

Examples

Preview Data in DatabaseDatastore Object

Create a database connection using a JDBC driver. To create this connection, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function. Then, create a `DatabaseDatastore` object and preview the data stored in the object.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query reads all data from the `airlinesmall` table.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Preview the first eight records in the data set returned by executing the SQL query in the `DatabaseDatastore` object.

```
preview(dbds)
```

```
ans =
```

```
  8×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1990      9          11            2         1810         1812         1939         1930
    1990     10          27            6         1353         1355         1634         1640
    1990     10          23            2         1057         1055         1205         1155
    1990     10           8            1         1515         1440         1609         1535
    1990     10          19            5         1130         1120         1203         1154
    1990     10          12            5         1755         1733         1858         1820
    2001     11          22            4         1345         1355         1530         1549
    2001     11          26            1         2105         2110         2209         2237
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

Output Arguments

data — Query results
table

Query results, returned as a table of the first eight records in the data set. Executing the SQL statement specified in the `Query` property of the `DatabaseDatastore` object creates the data set.

If there is no data to read from the query, `preview` throws an error.

Version History

Introduced in R2014b

See Also

`database` | `databaseDatastore` | `read` | `close`

Topics

“Import Large Data Using DatabaseDatastore Object” on page 5-23
“Analyze Large Data in Database Using Tall Arrays” on page 5-30
“Analyze Large Data in Database Using MapReduce” on page 5-27
`DatabaseDatastore`

read

Namespace: `matlab.io.datastore`

Read data in `DatabaseDatastore`

Syntax

```
data = read(dbds)
[data,info] = read(dbds)
```

Description

`data = read(dbds)` returns data from the `DatabaseDatastore` object in increments specified by the `ReadSize` property of the `DatabaseDatastore` object. Subsequent calls to the `read` function continue reading from the endpoint of the previous call.

Note `read` returns data as a table only. `read` ignores database preference settings for data return formatting.

If there is no more data to read from the query, `read` throws an error.

`[data,info] = read(dbds)` returns database information `info`.

Note The syntax `data = read(dbds,rowcount)` has been removed. Set the `DatabaseDatastore` property `ReadSize` instead.

Examples

Read Data

Create a database connection using a JDBC driver. To create this connection, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function. Then, create a `DatabaseDatastore` object and read the data stored in the object.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query retrieves all data from the `airlinesmall` table. Specify reading a maximum of 10 records from the executed SQL query.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery,'ReadSize',10);
```

Read the data in the `DatabaseDatastore` object.

```
data = read(dbds)
```

```
data =

  10×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1987     10          30            5         1329         1329        1434         1436
    1987     11           7            6         1316         1315        1713         1647
    1987     11          28            6          815          815        1015         1015
    1987     11           2            1          700          700         800          800
    1987     11          14            6          840          840        1127         1120
    1987     11           1            7         1625         1625        1823         1758
    1987     11          26            4         1314         1315        1538         1542
    1987     10          28            3         1140         1140        1212         1215
    1987     10           9            5         1155         1155        1250         1300
    1987     10          22            4          715          715         807          803
```

`data` contains the query results.

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Read Data and Retrieve Database Information

Create a database connection using a JDBC driver. To create this connection, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function. Then, create a `DatabaseDatastore` object, read the data stored in the object, and retrieve information about the database.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query retrieves all data from the `airlinesmall` table. Specify reading a maximum of 10 records from the executed SQL query.

```
sqlquery = 'select * from airlinesmall';
```

```
dbds = databaseDatastore(conn,sqlquery,'ReadSize',10);
```

Read the data in the `DatabaseDatastore` object, and retrieve information about the database.

```
[data,info] = read(dbds)
```

```
data =

  10×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1987     10          30            5         1329         1329        1434         1436
    1987     11           7            6         1316         1315        1713         1647
    1987     11          28            6          815          815        1015         1015
    1987     11           2            1          700          700         800          800
    1987     11          14            6          840          840        1127         1120
    1987     11           1            7         1625         1625        1823         1758
    1987     11          26            4         1314         1315        1538         1542
    1987     10          28            3         1140         1140        1212         1215
    1987     10           9            5         1155         1155        1250         1300
    1987     10          22            4          715          715         807          803


info =

  struct with fields:

    datasource: 'MSSQLServerJDBCAuth'
        offset: 10
```

`data` contains the query results. The structure `info` contains the data source name `datasource` and current cursor position `offset`.

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database

`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

Output Arguments

data — Query results

table

Query results, returned as a table of the records in the data set. Executing the SQL statement specified in the `Query` property of the `DatabaseDatastore` object creates the data set. The `ReadSize` property of the `DatabaseDatastore` object specifies the number of rows in the table.

If there is no more data to read from the query, `read` throws an error.

`info` — Database information
structure

Database information, returned as a structure with these fields.

Field	Description
`datasource`	Data source name for ODBC drivers or a database name for JDBC drivers
`offset`	Current cursor position in the returned data set

Version History

Introduced in R2014b

See Also

`database` | `databaseDatastore` | `hasdata` | `close`

Topics

“Import Large Data Using DatabaseDatastore Object” on page 5-23
“Analyze Large Data in Database Using Tall Arrays” on page 5-30
“Analyze Large Data in Database Using MapReduce” on page 5-27
`DatabaseDatastore`

readall

Namespace: `matlab.io.datastore`

Read all data in `DatabaseDatastore`

Syntax

```
data = readall(dbds)
```

Description

`data = readall(dbds)` returns all the data in the `DatabaseDatastore` object `dbds`, and resets the `DatabaseDatastore` to the point where no data has been read from it.

Examples

Read All Data in DatabaseDatastore Object

Create a database connection using a JDBC driver. To create this connection, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function. Then, create a `DatabaseDatastore` object and read all data stored in the object.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query reads all data from the `airlinesmall` table.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery);
```

Read all data in the `DatabaseDatastore` object.

```
data = readall(dbds);
```

`data` contains the query results.

Display the first three rows of query results.

```
data(1:3,:)
```

```
ans =
```

```
  3×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1987     10          28            3         1140         1140        1212         1215
    1987     10           9            5         1155         1155        1250         1300
    1987     10          22            4          715          715         807          803
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

Output Arguments

data — Query results
table

Query results, returned as a table of the records in the data set. Executing the SQL statement specified in the `Query` property of the `DatabaseDatastore` object creates the data set.

Version History

Introduced in R2014b

See Also

`database` | `databaseDatastore` | `preview` | `read` | `close`

Topics

“Import Large Data Using DatabaseDatastore Object” on page 5-23
“Analyze Large Data in Database Using Tall Arrays” on page 5-30
“Analyze Large Data in Database Using MapReduce” on page 5-27
`DatabaseDatastore`

reset

Namespace: `matlab.io.datastore`

Reset `DatabaseDatastore` to initial state

Syntax

```
reset(dbds)
```

Description

`reset(dbds)` resets the `DatabaseDatastore` object `dbds` to the state where no data has been read from it. Resetting allows you to reread from the same `DatabaseDatastore`.

Examples

Reset DatabaseDatastore Object to Initial State

Create a database connection using a JDBC driver. To create this connection, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function. Then, create a `DatabaseDatastore` object, read the data stored in the object, and reset the object to its original state.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using the database connection and an SQL query. This SQL query retrieves all data from the `airlinesmall` table. Specify reading a maximum of 10 records from the executed SQL query.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery,'ReadSize',10);
```

Read data from the start of the data set.

```
read(dbds)
```

```
ans =

  10×29 table

    Year     Month     DayofMonth     DayOfWeek     DepTime     CRSDepTime     ArrTime     CRSArrTime
    ____     _____     __________     _________     _______     __________     _______     __________
```

```
    1987     10         30          5        1329       1329       1434       1436
    1987     11          7          6        1316       1315       1713       1647
    1987     11         28          6         815        815       1015       1015
    1987     11          2          1         700        700        800        800
    1987     11         14          6         840        840       1127       1120
    1987     11          1          7        1625       1625       1823       1758
    1987     11         26          4        1314       1315       1538       1542
    1987     10         28          3        1140       1140       1212       1215
    1987     10          9          5        1155       1155       1250       1300
    1987     10         22          4         715        715        807        803
```

`read` returns the first 10 records in the data set.

Reset the `DatabaseDatastore` object to its original state, where no data has been read from it. Resetting allows you to reread from the same `DatabaseDatastore` object.

```
reset(dbds)
```

Read data from the start of the data set.

```
read(dbds)
```

```
ans =

  10×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1987     10         30          5        1329       1329       1434       1436
    1987     11          7          6        1316       1315       1713       1647
    1987     11         28          6         815        815       1015       1015
    1987     11          2          1         700        700        800        800
    1987     11         14          6         840        840       1127       1120
    1987     11          1          7        1625       1625       1823       1758
    1987     11         26          4        1314       1315       1538       1542
    1987     10         28          3        1140       1140       1212       1215
    1987     10          9          5        1155       1155       1250       1300
    1987     10         22          4         715        715        807        803
```

`read` again returns the first 10 records in the data set.

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Input Arguments

dbds — Datastore containing data in database
`DatabaseDatastore` object

Datastore containing data in a database, specified as a `DatabaseDatastore` object created using the `databaseDatastore` function.

Version History

Introduced in R2014b

See Also

`database` | `databaseDatastore` | `exec` | `read` | `close`

Topics

"Import Large Data Using DatabaseDatastore Object" on page 5-23
"Analyze Large Data in Database Using Tall Arrays" on page 5-30
"Analyze Large Data in Database Using MapReduce" on page 5-27
`DatabaseDatastore`

databaseDatastore

Datastore for data in database

Description

MATLAB has various datastores that let you import large data sets into MATLAB for analysis. A `DatabaseDatastore` object is a type of datastore that contains data from a database table or the results from executing an SQL query in a relational database. For details about other datastores, see "Getting Started with Datastore".

With a `DatabaseDatastore` object, you can preview and read records or chunks in a data set and reset the `DatabaseDatastore` to its initial state. Also, you can analyze a large data set in a database using tall arrays or MapReduce.

Reading data from `DatabaseDatastore` objects is the same as executing the `fetch` function on the data set. Using `DatabaseDatastore` objects provides advantages that enable you to:

- Work with databases containing large amounts of data.
- Analyze large amounts of data using tall arrays with common MATLAB functions, such as `mean` and `histogram`. Create a tall array using the `tall` function. For details, see "Tall Arrays for Out-of-Memory Data".
- Write MapReduce algorithms that define the chunking and reduction of large amounts of data by using the `mapreduce` function. For details, see "Getting Started with MapReduce". For an example, see "Analyze Large Data in Database Using MapReduce" on page 5-27.
- Create parallelizable workflows by using a parallel pool constant when you create the connection for your `databaseDatastore` object. For more information, see `parallel.pool.Constant`. You can use the `setSecret` and `getSecret` functions to add and retrieve your user credentials when you create a parallel pool constant. For more information on security consideration topics, see "Keep Sensitive Information Out of Code".

Creation

Syntax

```
dbds = databaseDatastore(conn,source)
dbds = databaseDatastore(conn,source,Name,Value)

dbds = databaseDatastore(conn,source,opts)
dbds = databaseDatastore(conn,source,opts,Name,Value)
```

Description

`dbds = databaseDatastore(conn,source)` creates a `DatabaseDatastore` object using the database connection. This datastore contains data from a database table or the results from an executed SQL query.

`dbds = databaseDatastore(conn,source,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'ReadSize',100` retrieves 100 rows of data from the `DatabaseDatastore` object.

`dbds = databaseDatastore(conn,source,opts)` customizes the options for importing a large data set from a database using the `SQLImportOptions` object.

`dbds = databaseDatastore(conn,source,opts,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'Catalog','toy_store'` retrieves data from the `toy_store` database catalog.

Input Arguments

conn — Database connection

`connection` object

Database connection, specified as a `connection` object created with the `database` function, `connection` object created with the `mysql` function, `connection` object created with the `postgresql` function, or `sqlite` object.

Create a parallelizable `databaseDatastore` object by first creating a parallel pool constant. You can use the `getSecret` function to retrieve your user credentials when you create this constant.

Example: `conn = parallel.pool.Constant(@()postgresql(getsecret("PostgreSQL.username"),getsecret("Postgresql.password"),"Server","localhost","DatabaseName","toy_store"),@close);`

source — Source

character vector | string scalar

Source, specified as a character vector or string scalar. The source indicates whether the `DatabaseDatastore` object stores data from a database table or the results from an executed SQL query.

Example: `'inventorytable'`

Example: `"SELECT productnumber,productname FROM producttable"`

Data Types: `char` | `string`

opts — Database import options

`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `databaseDatastore(conn,source,'ReadSize',100,'Catalog','toy_store')` creates a `DatabaseDatastore` object and stores 100 rows of data from a table or SQL query using the `toy_store` database catalog.

ReadSize — Number of rows to return
numeric scalar

Number of rows to return, specified as the comma-separated pair consisting of 'ReadSize' and a positive numeric scalar. Use this name-value pair argument to limit the number of rows for retrieval from the DatabaseDatastore object.

Example: 1000

Data Types: double

Catalog — Database catalog name
character vector | string scalar

Database catalog name, specified as the comma-separated pair consisting of 'Catalog' and a character vector or string scalar. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have numerous catalogs.

Use the 'Catalog' name-value pair argument only when source is a database table.

Example: 'Catalog','toy_store'

Data Types: char | string

Schema — Database schema name
character vector | string scalar

Database schema name, specified as the comma-separated pair consisting of 'Schema' and a character vector or string scalar. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Use the 'Schema' name-value pair argument only when source is a database table.

Example: 'Schema','dbo'

Data Types: char | string

Limitations

- The DatabaseDatastore object supports only Microsoft SQL Server 2012 and later versions.
- If you set the VariableNamingRule name-value argument to the value "modify":
  - The variable names Properties, RowNames, and VariableNames are reserved identifiers for the table data type.
  - The length of each variable name must be less than the number returned by namelengthmax.

Properties

Connection — Database connection
connection object

This property is read-only.

Database connection, specified as a connection object created using database.

Query — SQL query
character vector

This property is read-only.

SQL query, specified as a character vector that specifies the SQL query to execute in the database.

Data Types: `char`

`VariableNames` — Column names of retrieved data table
cell array of character vectors

Column names of the retrieved data table, specified as a cell array of one or more character vectors.

Data Types: `char`

`SelectedVariableNames` — Subset of variables to import
character vector | cell array of character vectors | numeric array

Subset of variables to import, specified as a character vector, cell array of character vectors, or numeric array that contains indices. Use the `SelectedVariableNames` property to determine the database columns to import into the MATLAB workspace.

The values in the `SelectedVariableNames` property must be equal to the values in the `VariableNames` property or a subset of these values. By default, the `SelectedVariableNames` property contains all variable names specified in the `VariableNames` property. When the `SelectedVariableNames` property specifies all variable names, the import functions of the `DatabaseDatastore` object import all database columns.

Data Types: `double` | `char` | `cell`

`VariableNamingRule` — Variable naming rule
`"modify"` (default) | `"preserve"`

Variable naming rule, specified as one of these values:

- `"modify"` — Remove non-ASCII characters from variable names when the `DatabaseDatastore` function imports data.
- `"preserve"` — Preserve most variable names when the `DatabaseDatastore` function imports data. For details, see “Limitations” on page 12-165.

If you are using the MySQL or PostgreSQL native interface, `"preserve"` is the default value.

The `VariableNamingRule` property has these limitations:

- The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.
- The length of each variable name must be less than the number returned by `namelengthmax`.

Data Types: `string`

`ReadSize` — Number of rows to read
10000 (default) | numeric scalar

Number of rows to read from the retrieved data table, specified as a nonnegative numeric scalar. To specify the number of rows to read, set the `ReadSize` property.

Example: `dbds.ReadSize = 5000;`

Data Types: `double`

RowFilter — Filter to select rows to import
`matlab.io.RowFilter` object

Filter to select rows to import, specified as a `matlab.io.RowFilter` object. This filter specifies the conditions each row must satisfy when importing data.

Example: `ds = databaseDatastore(conn,"producttable"); rf = rowfilter("producttable"); rf = rf.productnumber > 10; ds.RowFilter = rf`

Object Functions

hasdata	Determine if data in DatabaseDatastore is available to read
preview	Return subset of data from DatabaseDatastore
read	Read data in DatabaseDatastore
readall	Read all data in DatabaseDatastore
reset	Reset DatabaseDatastore to initial state
close	Close and invalidate database and driver resource utilizer
isPartitionable	Determine whether datastore is partitionable
isShuffleable	Determine whether datastore is shuffleable
partition	Partition a datastore

Examples

Create DatabaseDatastore Object Using SQL Query Results

Create a database connection to a MySQL (R) database using an ODBC driver. Then, create a `DatabaseDatastore` object using the results from an SQL query and preview a large data set.

Create a database connection to the ODBC data source `MySQL ODBC`. Specify the user name and password.

```
datasource = "MySQL ODBC";
username = "username";
password = "password";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using a database connection and an SQL query. This SQL query retrieves all flight data from the `airlinesmall` table. `databaseDatastore` executes the SQL query.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery)
```

```
dbds = 

  DatabaseDatastore with properties:

              Connection: [1×1 database.odbc.connection]
                   Query: 'select * from airlinesmall'
           VariableNames: {1×29 cell}
   SelectedVariableNames: {1×29 cell}
      VariableNamingRule: 'modify'
```

```
                 ReadSize: 10000
```

dbds is a DatabaseDatastore object with these properties:

- Connection -- Database connection object
- Query -- Executed SQL query
- VariableNames -- List of column names from the executed SQL query
- ReadSize -- Maximum number of records to read from the executed SQL query

Display the database connection property.

```
dbds.Connection
```

```
ans = 

  connection with properties:

                  DataSource: 'MySQL ODBC'
                    UserName: 'root'
                     Message: ''
                        Type: 'ODBC Connection Object'
  Database Properties:

                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 0
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toy_store'
                    Catalogs: {'information_schema', 'mysql', 'performance_schema' ... and 3 more
                     Schemas: {}

  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '8.0.3-rc-log'
                  DriverName: 'myodbc8a.dll'
               DriverVersion: '08.00.0016'
```

The Message property is blank when the database connection is successful.

Preview the first eight records in the large data set returned by executing the SQL query in the DatabaseDatastore object.

```
preview(dbds)
```

```
ans =

  8×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
```

```
    ____     _____    __________    _________    _______    __________    _______    __________

    1990       9          22             6          1801          1750         2005          1938
    1990       9          11             2           908           910         1613          1554
    1990       9           2             7           NaN          1805          NaN          1900
    1990       9          29             6          1434          1435         1615          1630
    1990       9           3             1           925           755         1258          1144
    1990       9          22             6           900           900         1241          1222
    1990       9          20             4          1338          1335         1853          1907
    1990       9           3             1           710           711          837           847
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Create `DatabaseDatastore` Object Using Database Table

Retrieve a large data set from a database table by creating a `DatabaseDatastore` object. This example uses a MySQL® database.

Create a database connection to a MySQL database with the user name and password.

```
datasource = "MySQL ODBC";
username = "username";
password = "password";
conn = database(datasource,username,password);
```

Load flight information in the MATLAB® workspace.

```
flights = readtable('airlinesmall_subset.xlsx');
```

Create the `flights` database table using the flight information.

```
tablename = 'flights';
sqlwrite(conn,tablename,flights)
```

Create a `DatabaseDatastore` object using a database connection and the `flights` database table.

```
dbds = databaseDatastore(conn,tablename)
```

```
dbds = 
  DatabaseDatastore with properties:

               Connection: [1×1 database.odbc.connection]
                    Query: 'SELECT * from flights'
            VariableNames: {1×29 cell}
    SelectedVariableNames: {1×29 cell}
       VariableNamingRule: 'modify'
                 ReadSize: 10000
```

`dbds` is a `DatabaseDatastore` object with these properties:

- `Connection` — Database connection object
- `Query` — Executed SQL query

- `VariableNames` — List of column names from the executed SQL query
- `ReadSize` — Maximum number of records to read from the executed SQL query

Display the database connection property.

```
dbds.Connection
```

```
ans = 
  connection with properties:

                  DataSource: 'MySQL ODBC'
                    UserName: 'root'
                     Message: ''
                        Type: 'ODBC Connection Object'
  Database Properties:

                  AutoCommit: 'on'
                    ReadOnly: 'off'
                LoginTimeout: 0
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

              DefaultCatalog: 'toy_store'
                    Catalogs: {'information_schema', 'mysql', 'performance_schema' ... and 3 more
                     Schemas: {}

  Database and Driver Information:

         DatabaseProductName: 'MySQL'
      DatabaseProductVersion: '8.0.3-rc-log'
                  DriverName: 'myodbc8a.dll'
               DriverVersion: '08.00.0016'
```

The `Message` property is blank when the database connection is successful.

Preview the first eight records in the data set returned by executing the SQL query in the `DatabaseDatastore` object.

```
preview(dbds)
```

```
ans=8×29 table
    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1996      1          18            4         2117         2120        2305         2259
    1996      1          12            5         1252         1245        1511         1500
    1996      1          16            2         1441         1445        1708         1721
    1996      1           1            1         2258         2300        2336         2335
    1996      1           4            4         1814         1814        1901         1910
    1996      1          31            3         1822         1820        1934         1925
    1996      1          18            4          729          730         841          843
    1996      1          26            5         1704         1705        1829         1839
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Create DatabaseDatastore Object with Specific Record Count

Create a database connection using an ODBC driver. Then, create a `DatabaseDatastore` object by setting the `ReadSize` property, and preview a large data set.

Create a database connection to the ODBC data source `MySQL ODBC`. Specify the user name and password.

```
datasource = "MySQL ODBC";
username = "username";
password = "password";
conn = database(datasource,username,password);
```

Create a `DatabaseDatastore` object using a database connection and an SQL query. This SQL query retrieves all flight data from the `airlinesmall` table. Specify reading a maximum of 1000 records from the executed SQL query. `databaseDatastore` executes the SQL query.

```
sqlquery = 'select * from airlinesmall';

dbds = databaseDatastore(conn,sqlquery,'ReadSize',1000)
```

```
dbds = 

  DatabaseDatastore with properties:

                Connection: [1×1 database.odbc.connection]
                     Query: 'select * from airlinesmall'
             VariableNames: {1×29 cell}
     SelectedVariableNames: {1×29 cell}
        VariableNamingRule: 'modify'
                  ReadSize: 1000
```

`dbds` is a `DatabaseDatastore` object with these properties:

- `Connection` -- Database connection object
- `Query` -- Executed SQL query
- `VariableNames` -- List of column names from the executed SQL query
- `ReadSize` -- Maximum number of records to read from the executed SQL query

Display the database connection property.

```
dbds.Connection
```

```
ans = 

  connection with properties:

                  DataSource: 'MySQL ODBC'
                    UserName: 'root'
```

```
                   Message: ''
                      Type: 'ODBC Connection Object'
  Database Properties:

                AutoCommit: 'on'
                  ReadOnly: 'off'
              LoginTimeout: 0
    MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: 'toy_store'
                  Catalogs: {'information_schema', 'mysql', 'performance_schema' ... and 3 more
                   Schemas: {}

  Database and Driver Information:

       DatabaseProductName: 'MySQL'
    DatabaseProductVersion: '8.0.3-rc-log'
                DriverName: 'myodbc8a.dll'
             DriverVersion: '08.00.0016'
```

The `Message` property is blank when the database connection is successful.

Preview the first eight records in the large data set returned by executing the SQL query in the `DatabaseDatastore` object.

```
preview(dbds)
```

```
ans =

  8×29 table

    Year    Month    DayofMonth    DayOfWeek    DepTime    CRSDepTime    ArrTime    CRSArrTime
    ____    _____    __________    _________    _______    __________    _______    __________

    1990      9          22            6         1801         1750        2005         1938
    1990      9          11            2          908          910        1613         1554
    1990      9           2            7          NaN         1805         NaN         1900
    1990      9          29            6         1434         1435        1615         1630
    1990      9           3            1          925          755        1258         1144
    1990      9          22            6          900          900        1241         1222
    1990      9          20            4         1338         1335        1853         1907
    1990      9           3            1          710          711         837          847
```

Close the `DatabaseDatastore` object and the database connection.

```
close(dbds)
```

Create `DatabaseDatastore` Object Using Custom Import Options

Customize import options when importing a large data set from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database

columns that contain logical data. Import and preview the data by creating a `DatabaseDatastore` object and using the `preview` function.

This example uses the `airlinesmall_subset.xls` spreadsheet, which contains the column `Cancelled`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load flight information into the MATLAB® workspace.

```
flights = readtable('airlinesmall_subset.xlsx');
```

Create the `flights` database table using the flight information.

```
tablename = 'flights';
sqlwrite(conn,tablename,flights)
```

Create an `SQLImportOptions` object using the `flights` database table with the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `Cancelled` variable.

```
varnames = 'Cancelled';
varOpts = getoptions(opts,varnames)
```

```
varOpts =
  SQLVariableImportOptions with properties:

  Variable Properties :
              Name: 'Cancelled'
              Type: 'double'
         FillValue: NaN
```

Set the import options for the data type of the specified variable to `logical`. Also, set the import options to replace missing data in the specified variable with the fill value `true`.

```
opts = setoptions(opts,varnames,'Type','logical', ...
    'FillValue',true);
```

Create the `DatabaseDatastore` object to import a large data set using the import options.

```
dbds = databaseDatastore(conn,tablename,opts);
```

Import the logical data in the selected variable and display a preview of the data. The imported data shows that the variable has the `logical` data type.

```
opts.SelectedVariableNames = varnames;
data = preview(dbds);
cancelled = data.Cancelled
```

```
cancelled = 8×1 logical array

   0
   0
   0
   0
   0
   0
   0
   0
```

Delete the `flights` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Create `DatabaseDatastore` Object Using Custom Import Options and Database Catalog and Schema

Customize import options when importing a large data set from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database columns that contain logical data. Create a `DatabaseDatastore` object using the specified database catalog and schema. Import the database data and preview it by using the `preview` function with the `DatabaseDatastore` object.

This example uses the `airlinesmall_subset.xls` spreadsheet, which contains the column `Cancelled`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load flight information into the MATLAB® workspace.

```
flights = readtable('airlinesmall_subset.xlsx');
```

Create the `flights` database table using the flight information and the `toy_store` database catalog and `dbo` database schema.

```
tablename = 'flights';
sqlwrite(conn,tablename,flights, ...
    'Catalog','toy_store','Schema','dbo')
```

Create an `SQLImportOptions` object using the `flights` database table and the `databaseImportOptions` function. Specify the `toy_store` database catalog and `dbo` database schema.

```
opts = databaseImportOptions(conn,tablename, ...
    'Catalog','toy_store','Schema','dbo');
```

Retrieve the default import options for the `Cancelled` variable.

```
varnames = 'Cancelled';
varOpts = getoptions(opts,varnames)
```

```
varOpts =
  SQLVariableImportOptions with properties:

  Variable Properties :
              Name: 'Cancelled'
              Type: 'double'
         FillValue: NaN
```

Set the import options for the data type of the specified variable to `logical`. Also, set the import options to replace missing data in the specified variable with the fill value `true`.

```
opts = setoptions(opts,varnames,'Type','logical', ...
    'FillValue',true);
```

Create the `DatabaseDatastore` object to import a large data set using import options, the `toy_store` database catalog, and the `dbo` database schema.

```
dbds = databaseDatastore(conn,tablename,opts, ...
    'Catalog','toy_store','Schema','dbo');
```

Import the logical data in the selected variable and display a preview of the data. The imported data shows that the variable has the `logical` data type.

```
opts.SelectedVariableNames = varnames;
data = preview(dbds);
cancelled = data.Cancelled
```

```
cancelled = 8×1 logical array

   0
   0
   0
   0
   0
   0
   0
   0
```

Delete the `flights` database table from the `toy_store` database catalog and the `dbo` database schema by using the `execute` function.

```
sqlquery = ['DROP TABLE toy_store.dbo.' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Create a Parallelizable `databaseDatastore` Object

Create a parallelizable `databaseDatastore` object by using a `parallel.pool.Constant` object. You can use the `setSecret` and `getSecret` functions to store and retrieve your user credentials.

Create a query to use on your data set.

```
query = "SELECT col1, col2, col3 from table where col1 > ____ & col1 < ____";
```

Store your user credentials.

```
setsecret("PostgreSQL.username");
setsecret("PostgreSQL.password");
```

Create a parallel pool constant and specify your user credentials by using the `getSecret` function.

```
conn = parallel.pool.Constant(@()postgresql(getsecret("PostgreSQL.username"),getsecret("Postgres
"Server","localhost","DatabaseName","toy_store"),@close);
```

Create a `databaseDatastore` object and read in your data in parallel.

```
dbds = databaseDatastore(conn,query);
data = readall(dbds,UseParallel=true);
```

Version History

Introduced in R2014b

R2024a: Parallelizable `databaseDatastore` Object

Behavior changed in R2024a

Read in large data sets by using a parallelizable `databaseDatastore` object.

See Also

`database` | `sqlread` | `fetch` | `databaseImportOptions` | `setoptions` | `getoptions` | `execute` | `reset` | `preview` | `mysql`

Topics

“Import Large Data Using DatabaseDatastore Object” on page 5-23
“Analyze Large Data in Database Using Tall Arrays” on page 5-30
“Analyze Large Data in Database Using MapReduce” on page 5-27
“Getting Started with Datastore”
“Getting Started with MapReduce”
“Customize Options for Importing Data from Database into MATLAB” on page 5-67
“Importing Data Common Errors” on page 3-3

External Websites

SQL Tutorial

SQLPreparedStatement

SQL prepared statement

Description

The `SQLPreparedStatement` object enables you to create an SQL prepared statement. An SQL prepared statement can import, update, insert, or delete data in a database. Also, an SQL prepared statement can call stored procedures in a database.

The SQL statement can be one of these statements:

- `SELECT`
- `INSERT`
- `UPDATE`
- `DELETE`
- `CALL`

An SQL prepared statement contains parameters that are bound to values. By binding the parameters, you can execute the same SQL statement for different values repeatedly. The benefits of using SQL prepared statements include improved performance and security.

Note If you use SQL prepared statements with a JDBC driver and a database other than Microsoft SQL Server or PostgreSQL, the behavior of the SQL prepared statement varies based on the JDBC driver implementation of the statement. The behavior can cause unexpected results.

Creation

Create an `SQLPreparedStatement` object with the `databasePreparedStatement` function.

Properties

`SQLQuery` — SQL prepared statement
string scalar

This property is read-only.

SQL prepared statement query, specified as a string scalar.

Example: `"SELECT * FROM inventoryTable WHERE inventoryDate > ? AND inventoryDate < ?"`

Data Types: `string`

`ParameterCount` — Parameter count
numeric scalar

This property is read-only.

Parameter count, specified as a numeric scalar for the total number of parameters in the SQL prepared statement.

Data Types: `double`

`ParameterTypes` — Parameter types
string array

This property is read-only.

Parameter types, specified as a string array. The bind values must be one of the parameter types.

The parameter type is one of these data type values:

- `"double"`
- `"string"`
- `"datetime"`
- `"logical"`

Example: `["string" "string"]`

Data Types: `string`

`ParameterValues` — Parameter values
cell array

Parameter values, specified as a cell array of the values to bind with the defined parameters in the SQL prepared statement.

Example: `{2 5}`

Data Types: `cell`

Object Functions

bindParamValues	Bind values to parameters
close	Close SQL prepared statement

Examples

Import Data Using SQL Prepared Statement

Create an SQL prepared statement to import data from a Microsoft® SQL Server® database using a JDBC database connection. Use the `SELECT` SQL statement for the SQL query. Import the data from the database and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Create an SQL prepared statement for importing data from the SQL Server database using the JDBC database connection. The question marks in the `SELECT` SQL statement indicate it is an SQL

prepared statement. This statement selects all data from the database table `inventoryTable` for the inventory that has an inventory date within a specified date range.

```
query = strcat("SELECT * FROM inventoryTable ", ...
    "WHERE inventoryDate > ? AND inventoryDate < ?");
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {[]  []}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query
- `ParameterCount` — Parameter count
- `ParameterTypes` — Parameter types
- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select both parameters in the SQL prepared statement using their numeric indices. Specify the values to bind as the inventory date range between January 1, 2014, and December 31, 2014. Match the format of dates in the database. The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1 2];
values = {"2014-01-01 00:00:00.000", ...
    "2014-12-31 00:00:00.000"};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {["2014-01-01 00:00:00.000"]  ["2014-12-31 00:00:00.000"]}
```

Import data from the database using the `fetch` function and bound parameter values. The results contain four rows of data that represent all inventory with an inventory date between January 1, 2014 and December 31, 2014.

```
results = fetch(conn,pstmt)
```

```
results=4×4 table
    productNumber    Quantity    Price         inventoryDate       
    _____________    ________    _____    _______________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
```

```
        7           6034        16     {'2014-08-06 08:38:00'}
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Limitations

- The `SQLPreparedStatement` object supports a JDBC database connection only.

Version History

Introduced in R2019b

See Also

`database` | `close` | `fetch`

Topics

“Import Data Using SQL Prepared Statement with Multiple Parameter Values” on page 5-75
“SQL Prepared Statement Error Messages” on page 3-16

databasePreparedStatement

Create SQL prepared statement

Syntax

`pstmt = databasePreparedStatement(conn,query)`

Description

`pstmt = databasePreparedStatement(conn,query)` creates an `SQLPreparedStatement` object using the database connection and SQL query.

Examples

Import Data Using SQL Prepared Statement

Create an SQL prepared statement to import data from a Microsoft® SQL Server® database using a JDBC database connection. Use the `SELECT` SQL statement for the SQL query. Import the data from the database and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Create an SQL prepared statement for importing data from the SQL Server database using the JDBC database connection. The question marks in the `SELECT` SQL statement indicate it is an SQL prepared statement. This statement selects all data from the database table `inventoryTable` for the inventory that has an inventory date within a specified date range.

```
query = strcat("SELECT * FROM inventoryTable ", ...
    "WHERE inventoryDate > ? AND inventoryDate < ?");
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {[]  []}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query
- `ParameterCount` — Parameter count
- `ParameterTypes` — Parameter types

- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select both parameters in the SQL prepared statement using their numeric indices. Specify the values to bind as the inventory date range between January 1, 2014, and December 31, 2014. Match the format of dates in the database. The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1 2];
values = {"2014-01-01 00:00:00.000", ...
    "2014-12-31 00:00:00.000"};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {["2014-01-01 00:00:00.000"]  ["2014-12-31 00:00:00.000"]}
```

Import data from the database using the `fetch` function and bound parameter values. The results contain four rows of data that represent all inventory with an inventory date between January 1, 2014 and December 31, 2014.

```
results = fetch(conn,pstmt)
```

```
results=4×4 table
    productNumber    Quantity    Price        inventoryDate
    _____________    ________    _____    _______________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
          7            6034        16     {'2014-08-06 08:38:00'}
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Insert Data Using SQL Prepared Statement

Create an SQL prepared statement to insert data from MATLAB® into a Microsoft® SQL Server® database using a JDBC database connection. Use the `INSERT` SQL statement for the SQL query. Execute the SQL prepared statement and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Import data from the database using the `sqlread` function. Display the last few rows of data in the database table `inventoryTable`.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
tail(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

         11             567         0     {'2012-09-11 00:30:24'}
         12            1278         0     {'2010-10-29 18:17:47'}
         13            1700      14.5     {'2009-05-24 10:58:59'}
```

Create an SQL prepared statement for inserting data using the JDBC database connection. The question marks in the `INSERT` SQL statement indicate it is an SQL prepared statement. This statement inserts data from MATLAB into the database table `inventoryTable`.

```
query = "INSERT INTO inventoryTable VALUES(?,?,?,?)";
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt =
  SQLPreparedStatement with properties:

           SQLQuery: "INSERT INTO inventoryTable values(?,?,?,?)"
     ParameterCount: 4
     ParameterTypes: ["numeric"    "numeric"    "numeric"    "string"]
    ParameterValues: {[]  []  []  []}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query
- `ParameterCount` — Parameter count
- `ParameterTypes` — Parameter types
- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select all parameters in the SQL prepared statement using their numeric indices. Specify the values to bind for the product number, quantity, price, and inventory date. Match the format of dates in the database. The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1 2 3 4];
values = {20,1000,55,"2019-04-25 00:00:00.000"};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt =
  SQLPreparedStatement with properties:

           SQLQuery: "INSERT INTO inventoryTable values(?,?,?,?)"
     ParameterCount: 4
     ParameterTypes: ["numeric"    "numeric"    "numeric"    "string"]
    ParameterValues: {[20]  [1000]  [55]  ["2019-04-25 00:00:00.000"]}
```

Insert data from MATLAB into the database using the bound parameter values. Execute the SQL INSERT statement using the execute function.

```
execute(conn,pstmt)
```

Display the inserted data in the database table inventoryTable. The last row in the table contains the inserted data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
tail(data,4)
```

```
ans=4×4 table
    productNumber    Quantity    Price           inventoryDate
    _____________    ________    _____    ___________________________

         11             567          0    {'2012-09-11 00:30:24'    }
         12            1278          0    {'2010-10-29 18:17:47'    }
         13            1700       14.5    {'2009-05-24 10:58:59'    }
         20            1000         55    {'2019-04-25 00:00:00.000'}
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Update Data Using SQL Prepared Statement

Create an SQL prepared statement to update data in a Microsoft® SQL Server® database using a JDBC database connection. Use the UPDATE SQL statement for the SQL query. Execute the SQL prepared statement and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Import data from the database using the sqlread function. Display the first few rows of data in the database table inventoryTable.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

          1            1700       14.5    {'2014-09-23 09:38:34'}
          2            1200          9    {'2014-07-08 22:50:45'}
          3             356         17    {'2014-05-14 07:14:28'}
```

Create an SQL prepared statement for updating data using the JDBC database connection. The question marks in the UPDATE SQL statement indicate it is an SQL prepared statement. This statement updates data in the database table inventoryTable.

```
query = strcat("UPDATE inventoryTable SET Quantity = ? ", ...
    "WHERE productNumber = ?");
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "UPDATE inventoryTable SET Quantity = ? WHERE productNumber = ?"
     ParameterCount: 2
     ParameterTypes: ["numeric"    "numeric"]
    ParameterValues: {[]  []}
```

pstmt is an SQLPreparedStatement object with these properties:

- SQLQuery — SQL prepared statement query
- ParameterCount — Parameter count
- ParameterTypes — Parameter types
- ParameterValues — Parameter values

Bind parameter values in the SQL prepared statement. Select all parameters in the SQL prepared statement using their numeric indices. Specify the values to bind for the quantity and product number. The bindParamValues function updates the values in the ParameterValues property of the pstmt object.

```
selection = [1 2];
values = {2000,1};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "UPDATE inventoryTable SET Quantity = ? WHERE productNumber = ?"
     ParameterCount: 2
     ParameterTypes: ["numeric"    "numeric"]
    ParameterValues: {[2000]  [1]}
```

Update data in the database using the bound parameter values. Execute the SQL UPDATE statement using the execute function.

```
execute(conn,pstmt)
```

Display the updated data in the database table inventoryTable. The first row in the table contains the updated quantity.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________
```

```
    1             2000      14.5     {'2014-09-23 09:38:34'}
    2             1200         9     {'2014-07-08 22:50:45'}
    3              356        17     {'2014-05-14 07:14:28'}
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Delete Data Using SQL Prepared Statement

Create an SQL prepared statement to delete data in a Microsoft® SQL Server® database using a JDBC database connection. Use the `DELETE` SQL statement for the SQL query. Execute the SQL prepared statement and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Import data from the database using the `sqlread` function. Display rows of data in the database table `productTable`. The data contains rows for product numbers `16` through `20`, which you will delete later in this example.

```
tablename = "productTable";
data = sqlread(conn,tablename)
```

```
data=15×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       {'Victorian Doll' }
          8          2.1257e+05          1001             5       {'Train Set'      }
          7          3.8912e+05          1007            16       {'Engine Kit'     }
          2          4.0031e+05          1002             9       {'Painting Set'   }
          4          4.0034e+05          1008            21       {'Space Cruiser'  }
          1          4.0035e+05          1001            14       {'Building Blocks'}
          5          4.0046e+05          1005             3       {'Tin Soldier'    }
          6          4.0088e+05          1004             8       {'Sail Boat'      }
          3            4.01e+05          1009            17       {'Slinky'         }
         10          8.8865e+05          1006            24       {'Teddy Bear'     }
         16          5.6789e+05          1001            10       {'Magnetic Links' }
         17           5.688e+05          1002            15       {'Hot Rod'        }
         18           5.679e+05          1003            20       {'Doll House'     }
         19          5.7761e+05          1004            25       {'Plush Monkey'   }
         20          5.0034e+05          1005            30       {'Kitchen Set'    }
```

Create an SQL prepared statement for deleting data using the JDBC database connection. The question marks in the `DELETE` SQL statement indicate it is an SQL prepared statement. This statement deletes data in the database table `productTable` for a specified range of product numbers.

```
query = strcat("DELETE FROM productTable ", ...
    "WHERE productNumber > ? AND productNumber < ?");
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "DELETE FROM productTable WHERE productNumber > ? AND productNumber < ?"
     ParameterCount: 2
     ParameterTypes: ["numeric"    "numeric"]
    ParameterValues: {[]  []}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query
- `ParameterCount` — Parameter count
- `ParameterTypes` — Parameter types
- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select all parameters in the SQL prepared statement using their numeric indices. Specify the values to bind for the range of product numbers between 15 and 21 (exclusive). The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1 2];
values = {15,21};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "DELETE FROM productTable WHERE productNumber > ? AND productNumber < ?"
     ParameterCount: 2
     ParameterTypes: ["numeric"    "numeric"]
    ParameterValues: {[15]  [21]}
```

Delete data in the database using the bound parameter values. Execute the SQL `DELETE` statement using the `execute` function.

```
execute(conn,pstmt)
```

Display data in the database table `productTable`. The rows with product numbers `16` through `20` are no longer in the table.

```
tablename = "productTable";
data = sqlread(conn,tablename)
```

```
data=10×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       {'Victorian Doll' }
          8          2.1257e+05          1001             5       {'Train Set'      }
          7          3.8912e+05          1007            16       {'Engine Kit'     }
          2          4.0031e+05          1002             9       {'Painting Set'   }
```

```
 4          4.0034e+05          1008            21         {'Space Cruiser'  }
 1          4.0035e+05          1001            14         {'Building Blocks'}
 5          4.0046e+05          1005             3         {'Tin Soldier'    }
 6          4.0088e+05          1004             8         {'Sail Boat'      }
 3            4.01e+05          1009            17         {'Slinky'         }
10          8.8865e+05          1006            24         {'Teddy Bear'     }
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Call Stored Procedure Using SQL Prepared Statement

Create an SQL prepared statement to call a stored procedure in a Microsoft® SQL Server® database using a JDBC database connection. Use the `CALL` SQL statement for the SQL query. Execute the SQL prepared statement and display the results.

For this example, the SQL Server database contains the stored procedure `getSupplierInfo`, which returns the information for suppliers in a specified city. This code defines the procedure.

```
CREATE PROCEDURE dbo.getSupplierInfo
    (@cityName varchar(20))
AS
BEGIN
      -- SET NOCOUNT ON added to prevent extra result
    -- sets from interfering with SELECT statements.
    SET NOCOUNT ON
    SELECT * FROM dbo.suppliers WHERE City = @cityName
END
```

For SQL Server, the statement `SET NOCOUNT ON` suppresses the results of `INSERT`, `UPDATE`, and non-`SELECT` statements preceding the final `SELECT` query, so that you can import the results of the `SELECT` query.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
conn = database(datasource,'','');
```

Create an SQL prepared statement for calling the stored procedure using the JDBC database connection. The question marks in the `CALL` SQL statement indicate it is an SQL prepared statement. This statement calls the `getSupplierInfo` stored procedure in the database.

```
query = "{CALL dbo.getSupplierInfo(?)}";
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "{CALL dbo.getSupplierInfo(?)}"
     ParameterCount: 1
     ParameterTypes: "string"
```

```
    ParameterValues: {[]}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query
- `ParameterCount` — Parameter count
- `ParameterTypes` — Parameter types
- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select the parameter in the SQL prepared statement using its numeric index. Specify the value to bind as the city `New York`. The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1];
values = "New York";
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "{CALL dbo.getSupplierInfo(?)}"
     ParameterCount: 1
     ParameterTypes: "string"
    ParameterValues: {["New York"]}
```

Display the results of the stored procedure. Execute the SQL `CALL` statement using the `fetch` function. The SQL prepared statement returns all information for suppliers located in New York City.

```
results = fetch(conn,pstmt)
```

```
results=2×5 table
    SupplierNumber        SupplierName            City            Country             FaxNumber
    ______________    ____________________    ____________    _________________    _______________

         1001         {'Wonder Products' }    {'New York'}    {'United States'}    {'212 435 1617
         1006         {'ACME Toy Company'}    {'New York'}    {'United States'}    {'212 435 1618
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function.

Note The `databasePreparedStatement` function supports a JDBC database connection only.

query — SQL prepared statement
character vector | string scalar

SQL prepared statement query, specified as a character vector or string scalar that contains one of these SQL statements:

- SELECT
- INSERT
- UPDATE
- DELETE
- CALL

Example: "SELECT * FROM inventoryTable WHERE inventoryDate > ? AND inventoryDate < ?" selects all data from the database table inventoryTable with an inventory date between two parameters.

Example: "INSERT INTO inventoryTable VALUES(?,?,?,?)" inserts data into the database table inventoryTable based on parameters for four database columns.

Data Types: char | string

Output Arguments

pstmt — SQL prepared statement
SQLPreparedStatement object

SQL prepared statement, returned as an SQLPreparedStatement object.

Version History

Introduced in R2019b

See Also

database | close | bindParamValues | close | fetch | execute

Topics

"Import Data Using SQL Prepared Statement with Multiple Parameter Values" on page 5-75
"SQL Prepared Statement Error Messages" on page 3-16

bindParamValues

Namespace: `database.preparedstatement`

Bind values to parameters

Syntax

```
pstmt = bindParamValues(pstmt,selection,values)
```

Description

`pstmt = bindParamValues(pstmt,selection,values)` binds parameters specified in the `selection` argument to the values specified in the `values` argument for an `SQLPreparedStatement` object.

Examples

Import Data Using SQL Prepared Statement

Create an SQL prepared statement to import data from a Microsoft® SQL Server® database using a JDBC database connection. Use the `SELECT` SQL statement for the SQL query. Import the data from the database and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Create an SQL prepared statement for importing data from the SQL Server database using the JDBC database connection. The question marks in the `SELECT` SQL statement indicate it is an SQL prepared statement. This statement selects all data from the database table `inventoryTable` for the inventory that has an inventory date within a specified date range.

```
query = strcat("SELECT * FROM inventoryTable ", ...
    "WHERE inventoryDate > ? AND inventoryDate < ?");
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {[]  []}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query

- `ParameterCount` — Parameter count
- `ParameterTypes` — Parameter types
- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select both parameters in the SQL prepared statement using their numeric indices. Specify the values to bind as the inventory date range between January 1, 2014, and December 31, 2014. Match the format of dates in the database. The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1 2];
values = {"2014-01-01 00:00:00.000", ...
    "2014-12-31 00:00:00.000"};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {["2014-01-01 00:00:00.000"]  ["2014-12-31 00:00:00.000"]}
```

Import data from the database using the `fetch` function and bound parameter values. The results contain four rows of data that represent all inventory with an inventory date between January 1, 2014 and December 31, 2014.

```
results = fetch(conn,pstmt)
```

```
results=4×4 table
    productNumber    Quantity    Price         inventoryDate        
    _____________    ________    _____    _________________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
          7            6034        16     {'2014-08-06 08:38:00'}
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Input Arguments

pstmt — SQL prepared statement
`SQLPreparedStatement` object

SQL prepared statement, specified as an `SQLPreparedStatement` object.

selection — Selected parameters
numeric scalar | numeric array

Selected parameters, specified as a numeric scalar for one index or a numeric array for multiple indices.

Example: 1

Example: [1 2 3]

Data Types: double

values — Parameter values
numeric scalar | string scalar | character vector | ...

Parameter values to bind for the selected parameters, specified as a numeric scalar, string scalar, character vector, `datetime` array, `logical`, or cell array. The function treats missing values as `NaN` or `missing`. Use a cell array to specify multiple values.

The values for each parameter must have one of the types specified by the ParameterTypes property of the `SQLPreparedStatement` object.

Example: true

Example: "USA"

Example: {true,"USA",2,datetime('now')}

Data Types: double | logical | char | string | cell | datetime

Output Arguments

pstmt — SQL prepared statement
`SQLPreparedStatement` object

SQL prepared statement, returned as a `SQLPreparedStatement` object.

Version History

Introduced in R2019b

See Also

`database` | `close` | `databasePreparedStatement` | `close` | `fetch`

Topics

“Import Data Using SQL Prepared Statement with Multiple Parameter Values” on page 5-75
“SQL Prepared Statement Error Messages” on page 3-16

close

Namespace: `database.preparedstatement`

Close SQL prepared statement

Syntax

`close(pstmt)`

Description

`close(pstmt)` closes the SQL prepared statement specified by an `SQLPreparedStatement` object.

Examples

Import Data Using SQL Prepared Statement

Create an SQL prepared statement to import data from a Microsoft® SQL Server® database using a JDBC database connection. Use the `SELECT` SQL statement for the SQL query. Import the data from the database and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Create an SQL prepared statement for importing data from the SQL Server database using the JDBC database connection. The question marks in the `SELECT` SQL statement indicate it is an SQL prepared statement. This statement selects all data from the database table `inventoryTable` for the inventory that has an inventory date within a specified date range.

```
query = strcat("SELECT * FROM inventoryTable ", ...
    "WHERE inventoryDate > ? AND inventoryDate < ?");
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {[]  []}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query
- `ParameterCount` — Parameter count

- `ParameterTypes` — Parameter types
- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select both parameters in the SQL prepared statement using their numeric indices. Specify the values to bind as the inventory date range between January 1, 2014, and December 31, 2014. Match the format of dates in the database. The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1 2];
values = {"2014-01-01 00:00:00.000", ...
    "2014-12-31 00:00:00.000"};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {["2014-01-01 00:00:00.000"]  ["2014-12-31 00:00:00.000"]}
```

Import data from the database using the `fetch` function and bound parameter values. The results contain four rows of data that represent all inventory with an inventory date between January 1, 2014 and December 31, 2014.

```
results = fetch(conn,pstmt)
```

```
results=4×4 table
    productNumber    Quantity    Price          inventoryDate       
    _____________    ________    _____    _________________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
          7            6034        16     {'2014-08-06 08:38:00'}
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Input Arguments

pstmt — SQL prepared statement
`SQLPreparedStatement` object

SQL prepared statement, specified as an `SQLPreparedStatement` object.

Version History

Introduced in R2019b

See Also

`database` | `close` | `databasePreparedStatement` | `bindParamValues` | `fetch`

Topics

"Import Data Using SQL Prepared Statement with Multiple Parameter Values" on page 5-75
"SQL Prepared Statement Error Messages" on page 3-16

datainsert

Namespace: `database.odbc`

(To be removed) Export MATLAB data into database table

Note The `datainsert` function will be removed in a future release. Use the `sqlwrite` function instead. For details, see "Compatibility Considerations".

Syntax

```
datainsert(conn,tablename,colnames,data)
```

Description

`datainsert(conn,tablename,colnames,data)` exports data from the MATLAB workspace and inserts it into existing columns of a database table using the database connection `conn`.

Examples

Export MATLAB Cell Array Data

Use an ODBC connection and a cell array to export inventory data from MATLAB into a MySQL database table.

Create a database connection `conn` to the MySQL database using the native ODBC interface. Here, this code assumes that you are connecting to an ODBC data source named `MySQL` with a user name and password. This database contains the table `inventoryTable` with these columns:

- `productNumber`
- `Quantity`
- `Price`
- `inventoryDate`

```
conn = database('MySQL','username','pwd');
```

Display the last rows in `inventoryTable` before inserting data.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [14]    [2000]    [19.1000]    '2014-10-22 10:52...'
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
```

Create a cell array of column names for the database table `inventoryTable`.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};
```

Define a cell array of input data to insert.

```
data = {50 100 15.50 datestr(now,'yyyy-mm-dd HH:MM:SS')};
```

Insert the input data into the table `inventoryTable` using the database connection.

```
tablename = 'inventoryTable';

datainsert(conn,tablename,colnames,data)
```

Display the inserted data in `inventoryTable`.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
    [50]    [ 100]    [15.5000]    '2014-10-22 11:29...'
```

The last row contains the inserted data.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Export MATLAB Table Data

Use a JDBC connection and a MATLAB table to export inventory data from MATLAB into a MySQL database table.

Create a database connection `conn` to the MySQL database using the JDBC driver. Use the `Vendor` name-value pair argument of the `database` function to specify a connection to a MySQL database. Here, this code assumes that you are connecting to a database named `dbname` on a database server named `sname` with a user name and password. This database contains the table `inventoryTable` with these columns:

- `productNumber`
- `Quantity`
- `Price`
- `inventoryDate`

```
conn = database('dbname','username','pwd', ...
    'Vendor','MySQL', ...
    'Server','sname');
```

Display the last rows in `inventoryTable` before inserting data.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [14]    [2000]    [19.1000]    '2014-10-22 10:52...'
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
```

Create a cell array of column names for the database table `inventoryTable`.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};
```

Define the input data as a table.

```
data = table(50,100,15.50,{datestr(now,'yyyy-mm-dd HH:MM:SS')}, ...
    'VariableNames',colnames);
```

Insert the input data into the table `inventoryTable` using the database connection.

```
tablename = 'inventoryTable';

datainsert(conn,tablename,colnames,data)
```

Display the inserted data in `inventoryTable`.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
    [50]    [ 100]    [15.5000]    '2014-10-22 11:29...'
```

The last row contains the inserted data.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Export MATLAB Structure Data

Use an ODBC connection and a MATLAB structure to export inventory data from MATLAB into a MySQL database table.

Create a database connection `conn` to the MySQL database using the native ODBC interface. Here, this code assumes that you are connecting to an ODBC data source named `MySQL` with a user name and password. This database contains the table `inventoryTable` with these columns:

- `productNumber`
- `Quantity`
- `Price`
- `inventoryDate`

```
conn = database('MySQL','username','pwd');
```

Display the last rows in `inventoryTable` before inserting data.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [14]    [2000]    [19.1000]    '2014-10-22 10:52...'
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
```

Create a cell array of column names for the database table `inventoryTable`.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};
```

Define the input data as a structure.

```
data = struct('productNumber',50,'Quantity',100,'Price',15.50, ...
    'inventoryDate',datestr(now,'yyyy-mm-dd HH:MM:SS'));
```

Insert the input data into the table `inventoryTable` using the database connection.

```
tablename = 'inventoryTable';

datainsert(conn,tablename,colnames,data)
```

Display the inserted data in `inventoryTable`.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
curs = fetch(curs);
curs.Data
```

```
ans =

    ...
    [15]    [1200]    [20.3000]    '2014-10-22 10:52...'
    [16]    [1400]    [34.3000]    '1999-12-31 00:00...'
    [50]    [ 100]    [15.5000]    '2014-10-22 11:29...'
```

The last row contains the inserted data.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Export MATLAB Numeric Matrix Data

Use a JDBC connection and a numeric matrix to export sales data from MATLAB into a MySQL database table.

Create a database connection `conn` to the MySQL database using the JDBC driver. Use the `Vendor` name-value pair argument of `database` to specify a connection to a MySQL database. Here, this code assumes that you are connecting to a database named `dbname` on a database server named `sname` with a user name and password. This database contains the table `salesVolume` with the column `stockNumber` and columns for each month of the year.

```
conn = database('dbname','username','pwd', ...
    'Vendor','MySQL', ...
    'Server','sname');
```

Display the last rows in `salesVolume` before inserting data.

```
curs = exec(conn,'SELECT * FROM salesVolume');
curs = fetch(curs);
curs.Data
```

```
ans =

  Columns 1 through 8

    ...
    [470816]    [3100]    [9400]    [1540]    [1500]    [1350]    [1190]    [ 900]
    [510099]    [ 235]    [1800]    [1040]    [ 900]    [ 750]    [ 700]    [ 400]
    [899752]    [ 123]    [1700]    [ 823]    [ 701]    [ 689]    [ 621]    [ 545]

  Columns 9 through 13

    ...
    [867]    [ 923]    [1400]    [ 3000]    [35000]
    [350]    [ 500]    [ 100]    [ 3000]    [18000]
    [421]    [ 495]    [ 650]    [ 4200]    [11000]
```

Create a cell array of column names for the database table `salesVolume`.

```
colnames = {'stockNumber','January','February' ...
    'March','April','May', ...
    'June','July','August', ...
    'September','October','November', ...
    'December'};
```

Define the numeric matrix `data` that contains the sales volume data.

```
data = [777666,0,350,400,450,250,450,500,515, ...
    235,100,300,600];
```

Insert the contents of `data` into the table `salesVolume` using the database connection.

```
tablename = 'salesVolume';

datainsert(conn,tablename,colnames,data)
```

Display the inserted data in `salesVolume`.

```
curs = exec(conn,'SELECT * FROM salesVolume');
curs = fetch(curs);
curs.Data
```

```
ans = 

  Columns 1 through 8

    ...
    [510099]    [ 235]    [1800]    [1040]    [ 900]    [ 750]    [ 700]    [ 400]
    [899752]    [ 123]    [1700]    [ 823]    [ 701]    [ 689]    [ 621]    [ 545]
    [777666]    [   0]    [ 350]    [ 400]    [ 450]    [ 250]    [ 450]    [ 500]

Columns 9 through 13

    ...
    [350]    [ 500]    [ 100]    [ 3000]    [18000]
    [421]    [ 495]    [ 650]    [ 4200]    [11000]
    [515]    [ 235]    [ 100]    [  300]    [  600]
```

The last row contains the inserted data.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection

`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

tablename — Database table name

string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

colnames — Database table column names

cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table `tablename`.

Example: `{'col1','col2','col3'}`

Data Types: `cell` | `string`

data — Insert data

cell array | numeric matrix | table | structure | dataset

Insert data, specified as a cell array, numeric matrix, table, structure, or dataset array.

If you are connecting to a database using a JDBC driver, then convert the insert data to a supported format before running `datainsert`. If `data` contains MATLAB dates, times, or timestamps, use this formatting:

- Dates must be character vectors of the form `yyyy-mm-dd`.
- Times must be character vectors of the form `HH:MM:SS`.
- Timestamps must be character vectors of the form `yyyy-mm-dd HH:MM:SS.FFF`.

The database preference settings `NullNumberWrite` and `NullStringWrite` do not apply to this function. If `data` contains `null` entries and `NaN`s, convert these entries to an empty value `''`.

The `datainsert` function supports inserting MATLAB date numbers and `NaN`s when `data` is a numeric matrix. Date numbers inserted into database date and time columns convert to `java.sql.Date`. Upon insertion into the target database, any converted date and time data accurately reverts to the native database format.

If `data` is a structure, then field names in the structure must match `colnames`.

If `data` is a table or a dataset array, then the variable names in the table or dataset array must match `colnames`.

Tips

- When you establish a database connection using a JDBC driver, `datainsert` performs faster than `fastinsert`.
- `datainsert` uses the SQL `TRANSACTION` statement to insert records with faster performance for these databases:
  - Microsoft SQL Server
  - MySQL
  - Oracle
  - PostgreSQL

  For other databases, refer to your database documentation to start a transaction manually. Before running `datainsert`, use `exec` to start the transaction.
- The value of the `AutoCommit` property in the `connection` object determines whether `datainsert` automatically commits the data to the database.
  - To view the `AutoCommit` value, access it using the `connection` object; for example, `conn.AutoCommit`.
  - To set the `AutoCommit` value, use the corresponding name-value pair argument in the `database` function.
  - To commit the data to the database, use the `commit` function or issue an SQL `COMMIT` statement using the `exec` function.
  - To roll back the data, use `rollback` or issue an SQL `ROLLBACK` statement using the `exec` function.

Alternative Functionality

To export MATLAB data into a database, you can use the `fastinsert` and `insert` functions. For maximum performance, use `datainsert`.

Version History

Introduced in R2011a

R2018a: `datainsert` function will be removed

Not recommended starting in R2018a

The `datainsert` function will be removed in a future release. Use the `sqlwrite` function instead. Some differences between the workflows require updates to your code.

Update Code

In prior releases, you exported data from the MATLAB workspace into a database by using the `datainsert` function and four input arguments. For example:

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};
data = table(50,100,15.50,{datestr(now,'yyyy-mm-dd HH:MM:SS')}, ...
    'VariableNames',colnames);
tablename = 'inventoryTable';
datainsert(conn,tablename,colnames,data)
```

Now the `sqlwrite` function requires only three input arguments.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};
data = table(50,100,15.50,{datestr(now,'yyyy-mm-dd HH:MM:SS')}, ...
    'VariableNames',colnames);
tablename = 'inventoryTable';
sqlwrite(conn,tablename,data)
```

See Also

`sqlwrite` | `database` | `fastinsert` | `insert` | `select` | `close`

Topics

"Insert Data into Database Table" on page 5-61
"Export Data Using Bulk Insert" on page 5-13
"Replace Existing Data in Database" on page 5-12
"Roll Back Data After Updating Record" on page 5-9
"Data Type Support" on page 1-3

External Websites

SQL Tutorial

Database Explorer

Configure, explore, and import database data

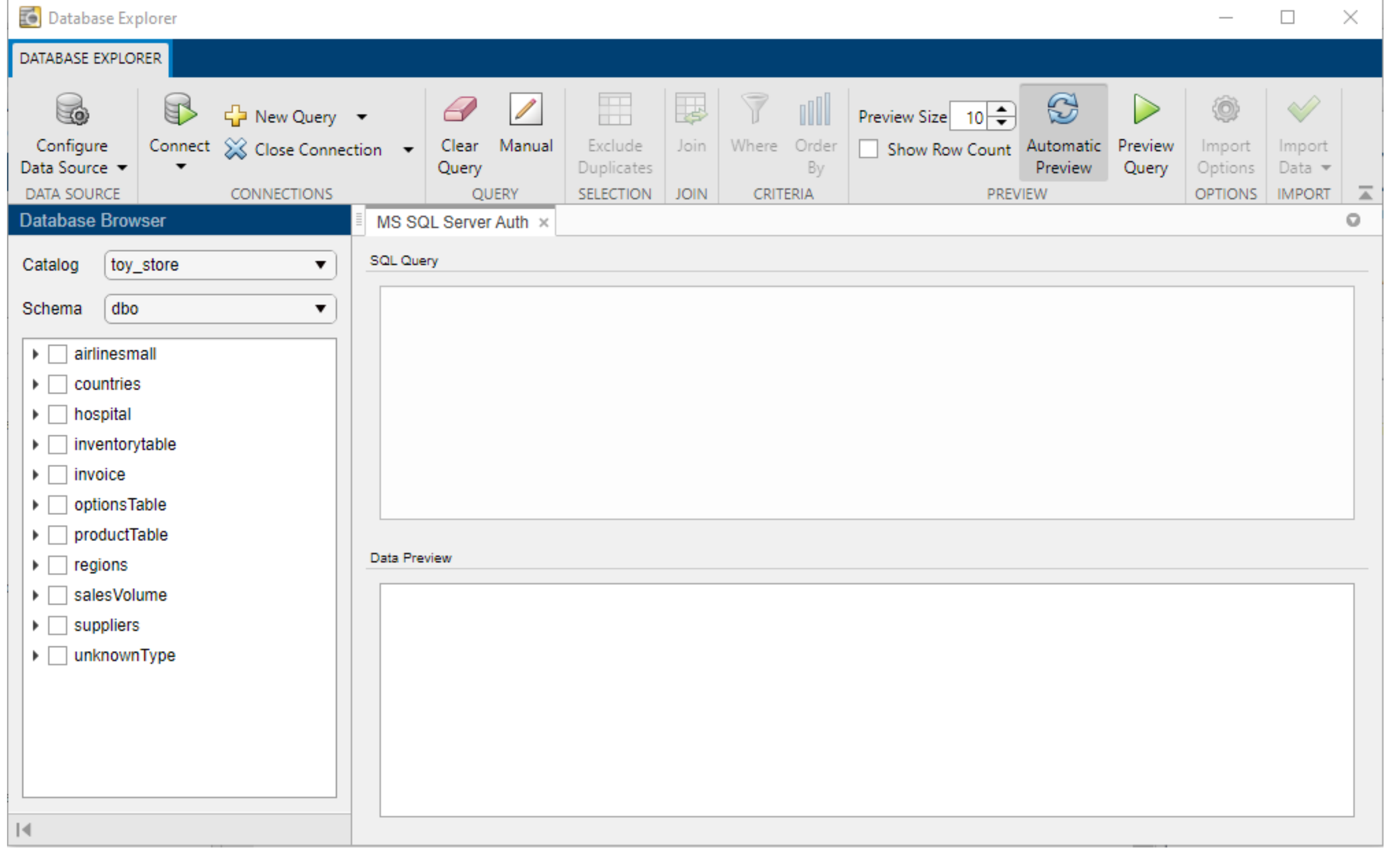
Description

The Database Explorer app lets you quickly connect to a database, explore the database data, and import data into the MATLAB workspace in a visual way. If you have minimal proficiency writing SQL queries or want to browse the data in your database quickly, use this app to interact with your database.

Using the Database Explorer app, you can:

- Create and configure ODBC and JDBC data sources.
- Establish multiple connections to the same or different databases.
- Select tables and columns of interest.
- Fine-tune selections using SQL query criteria.
- Preview selected data.
- Customize import options.
- Import selected data into the MATLAB workspace for analysis.
- Save generated SQL queries.
- Generate MATLAB code.

To watch an introductory video, see Using the Database Explorer App.



Open the Database Explorer App

- MATLAB Toolstrip: On the **Apps** tab, click the **Show more** arrow to open the apps gallery. Then, under **Database Connectivity and Reporting**, click **Database Explorer**.
- MATLAB command prompt: Enter `databaseExplorer`.

Examples

Preview Rows in Single Table

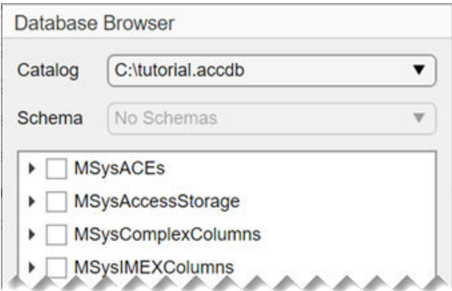
Connect to a Microsoft Access database using the Database Explorer app. Then, select columns from a single table and preview the data. The app previews query results by default.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see “Microsoft Access ODBC for Windows” on page 2-19.

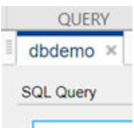
In the **Connections** section of the **Database Explorer** tab, click **Connect** and select the data source for the connection. The connection dialog box opens. Leave the user name and password blank, and click **Connect**.

Note For other databases, the Catalog and Schema dialog box opens. Select the name of the catalog and schema from the **Catalog** and **Schema** lists, as appropriate for your database.

The Database Explorer app creates a connection to the Microsoft Access database. The **Database Browser** pane displays the available tables in the database.



The data source tab, which is named **dbdemo**, appears to the right of the **Database Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



For any table, you can select the table information in these ways:

- To select tables, click the database table name in the **Database Browser** pane. The Database Explorer app updates the **SQL Query** pane with an SQL query that selects all columns and rows from the chosen table. Simultaneously, the Database Explorer app updates the **Data Preview** pane with a preview of the query results. The first 10 rows of data appear in the **Data Preview** pane by default.
- To select individual columns from a selected table, expand the table name node in the **Database Browser** tree view. Select specific check boxes to choose individual table columns and display them in the **Data Preview** pane. The SQL query adjusts to each selection automatically.

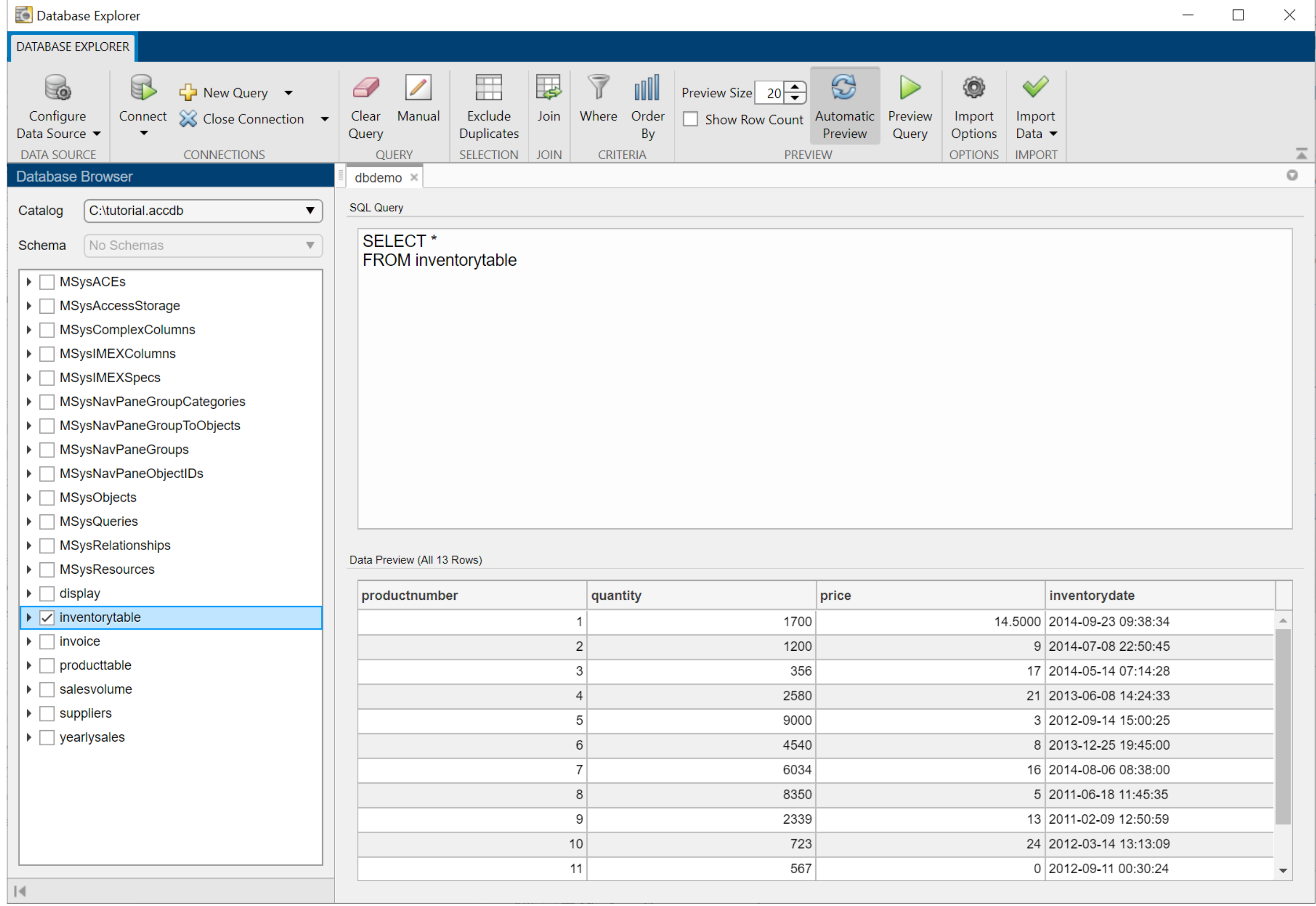
Note The order of the columns in the **Data Preview** pane matches the order in which you select them in the **Database Browser** pane.

Select the table name **inventorytable**.

To change the data you see, select or clear check boxes in the **Database Browser** pane. The app updates the SQL query in the **SQL Query** pane. The app updates the data in the **Data Preview** pane.

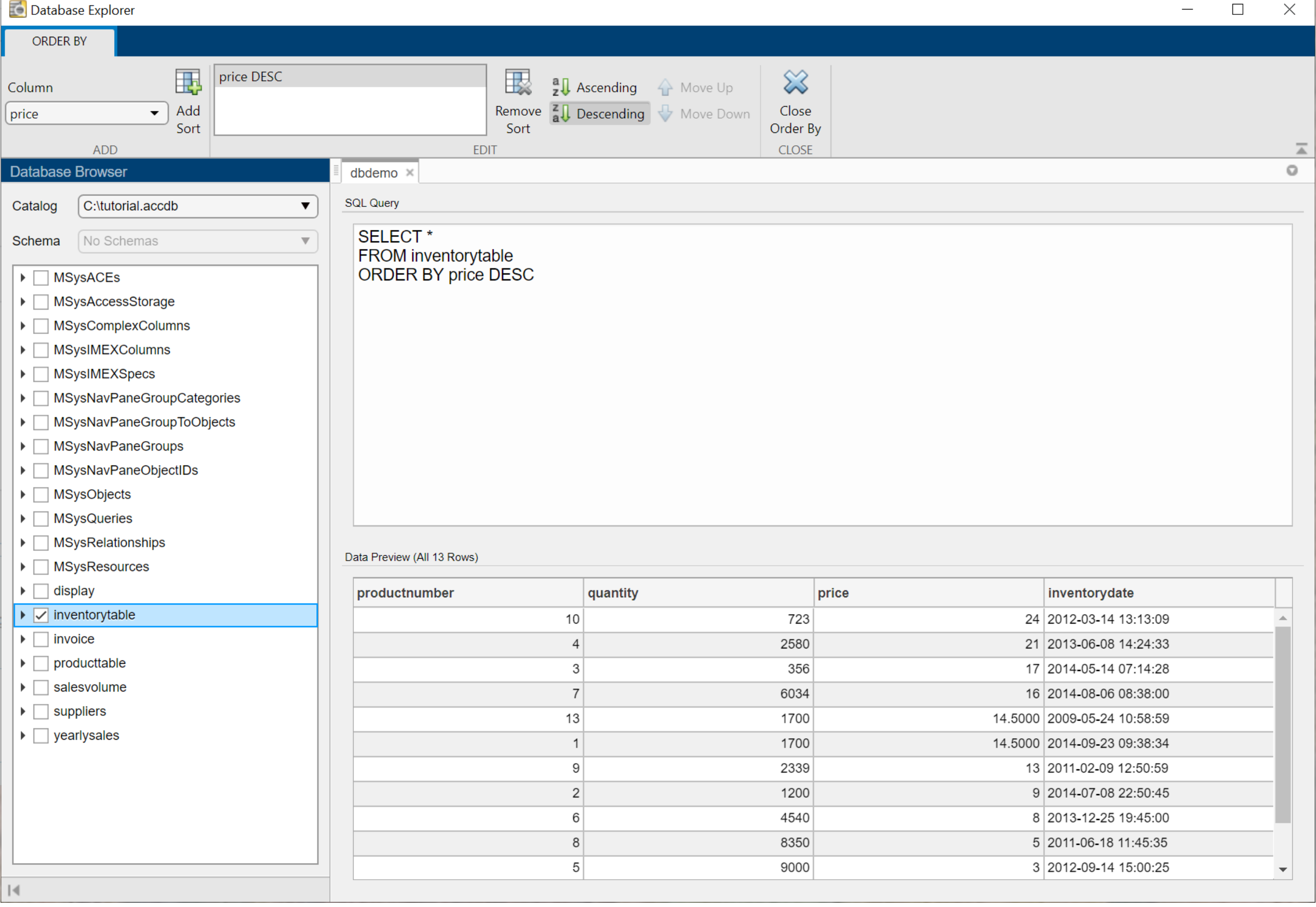
The **Data Preview** pane displays 10 rows. The total number of rows selected in the database appears, within parentheses, next to the name of the pane, **Data Preview**. Change the number of rows by selecting or entering a value in the **Preview Size** box in the **Preview** section of the **Database Explorer** tab. Select the value `20`. The number of rows adjusts in the **Data Preview** pane.

Note The value in the **Preview Size** box controls the maximum number of rows displayed in the **Data Preview** pane. If this value is larger than the total number of rows in the query results, then the total number of rows is displayed, within parentheses, next to the name of the pane, **Data Preview**.



You can sort the rows of data by a specific column. In the **Criteria** section, click **Order By**. The **Order By** tab is displayed in the toolstrip.

In the **Add** section, in the **Column** list, select the column `price`. In the **Add** section, click **Add Sort**. The Database Explorer app sorts the data in ascending order in the **Data Preview** pane. To change the order, click **Descending** in the **Edit** section.



Note To add more sorts, select another column from the **Column** list and click **Add Sort**. You can change the position of the sort in the SQL query by clicking it in the list in the **Edit** section, and then clicking **Move Up** or **Move Down**.

In the **Close** section, click **Close Order By** to close the **Order By** tab.

In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

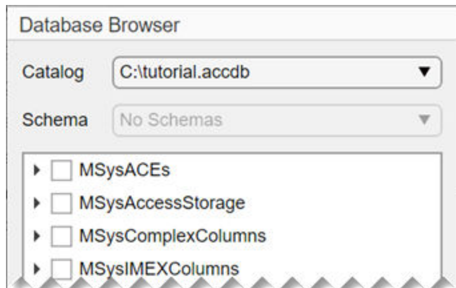
Join Multiple Tables and Import Query Results

Connect to a Microsoft Access database using the Database Explorer app. Then, join data in multiple tables by selecting columns in the tables. The app previews query results by default. After previewing the data, import all query results into the MATLAB Workspace and perform simple data analysis.

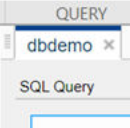
Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see "Microsoft Access ODBC for Windows" on page 2-19.

In the **Connections** section of the **Database Explorer** tab, click **Connect** and select the data source for the connection. The connection dialog box opens. Leave the user name and password blank, and click **Connect**.

The Database Explorer app creates a connection to the Microsoft Access database. The **Database Browser** pane displays the available tables in the database.



The data source tab, which is named **dbdemo**, appears to the right of the **Database Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



In the **Database Browser** pane, select the **inventorytable** table as the first table for the join. The Database Explorer app updates the **SQL Query** pane with an SQL query that selects all columns and rows from the **inventorytable** table. Simultaneously, the app updates the **Data Preview** pane with a preview of the query results. The first 10 rows of data appear in the pane by default.

Database Explorer

DATABASE EXPLORER

Configure Data Source | Connect | New Query | Close Connection | Clear Query | Manual | Exclude Duplicates | Join | Where | Order By | Preview Size 10 | Show Row Count | Automatic Preview | Preview Query | Import Options | Import Data

DATA SOURCE | CONNECTIONS | QUERY | SELECTION | JOIN | CRITERIA | PREVIEW | OPTIONS | IMPORT

Database Browser

Catalog C:\tutorial.accdb

Schema No Schemas

- MSysACEs
- MSysAccessStorage
- MSysComplexColumns
- MSysIMEXColumns
- MSysIMEXSpecs
- MSysNavPaneGroupCategories
- MSysNavPaneGroupToObjects
- MSysNavPaneGroups
- MSysNavPaneObjectIDs
- MSysObjects
- MSysQueries
- MSysRelationships
- MSysResources
- display
- inventorytable
- invoice
- producttable
- salesvolume
- suppliers
- yearlysales

dbdemo

SQL Query

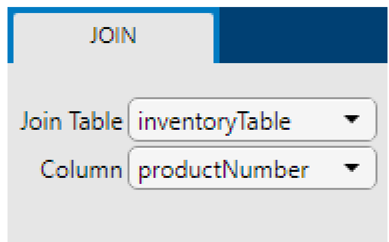
```
SELECT *
FROM inventorytable
```

Data Preview (First 10 Rows)

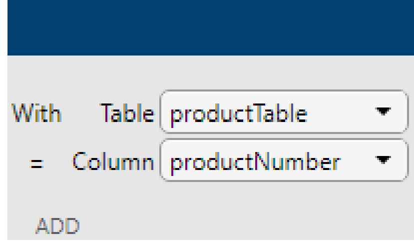
productnumber	quantity	price	inventorydate
1	1700	14.5000	2014-09-23 09:38:34
2	1200	9	2014-07-08 22:50:45
3	356	17	2014-05-14 07:14:28
4	2580	21	2013-06-08 14:24:33
5	9000	3	2012-09-14 15:00:25
6	4540	8	2013-12-25 19:45:00
7	6034	16	2014-08-06 08:38:00
8	8350	5	2011-06-18 11:45:35
9	2339	13	2011-02-09 12:50:59
10	723	24	2012-03-14 13:13:09

In the **Join** section, click **Join** to display the **Join** tab in the toolstrip. In the **Add** section, the name of the table selected in the **Database Browser** pane appears in the left **Table** list. For details about joining tables, see "Join Tables Using Database Explorer App" on page 4-10.

In the left **Column** list, select the name of the shared column `productnumber`.



In the right **Table** list, select the table `producttable` as the table to join. Select the name of the shared column `productnumber` in this table in the right **Column** list.



In the **Add** section, click **Add Join**. The **Join Diagram** pane displays a pictorial representation of the join between the selected tables. The **SQL Query** pane updates the SQL query with the new join. The **Data Preview** pane reflects the results of the updated SQL query.

The Database Explorer app selects the inner join by default.

Note Some databases do not support all join types.

productnumber	quantity	price	inventorydate
9	2339	13	2011-02-09 12:50:59
8	8350	5	2011-06-18 11:45:35
7	6034	16	2014-08-06 08:38:00
2	1200	9	2014-07-08 22:50:45
4	2580	21	2013-06-08 14:24:33
1	1700	14.5000	2014-09-23 09:38:34
5	9000	3	2012-09-14 15:00:25
6	4540	8	2013-12-25 19:45:00
3	356	17	2014-05-14 07:14:28
10	723	24	2012-03-14 13:13:09

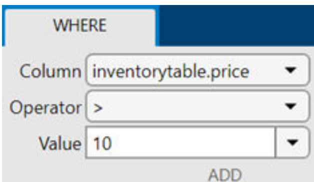
In the **Close** section, click **Close Join** to close the **Join** tab.

In the tree view of the **Database Browser** pane, select **productdescription** under **producttable**. The **SQL Query** and **Data Preview** panes update with the selected table column.

Add filter criteria to the SQL query. In the **Criteria** section, click **Where** to display the **Where** tab in the toolstrip.

Filter the SQL query results for prices greater than $10. In the **Add** section, in the **Column** list, select `inventorytable.price`. Select the > operator for the filter in the **Operator** list. Enter `10` in the **Value** list. Click **Add Filter**.

Note If you enter filters using the `LIKE` or `NOT LIKE` operators, then enter the value in single quotes to represent a string.



The **SQL Query** and **Data Preview** panes display the updated query results based on the new filter with the `WHERE` condition.

```
SELECT inventorytable.productnumber,
       inventorytable.quantity,
       inventorytable.price,
       inventorytable.inventorydate,
       producttable.productdescription
FROM ( inventorytable
INNER JOIN producttable
ON inventorytable.productnumber = producttable.productnumber)
WHERE inventorytable.price > 10
```

Data Preview (All 6 Rows)

productnumber	quantity	price	inventorydate	productdescription
1	1700	14.5000	2014-09-23 09:38:34	Building Blocks
3	356	17	2014-05-14 07:14:28	Slinky
4	2580	21	2013-06-08 14:24:33	Space Cruiser
7	6034	16	2014-08-06 08:38:00	Engine Kit
9	2339	13	2011-02-09 12:50:59	Victorian Doll
10	723	24	2012-03-14 13:13:09	Teddy Bear

In the **Close** section, click **Close Where** to close the **Where** tab.

Import all SQL query results into the MATLAB Workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB Workspace variable, and click **OK**. The MATLAB Workspace displays the table `data`.

Display the SQL query results at the command line.

```
data
```

```
data =

  6×5 table

    productnumber    quantity    price        inventorydate        productdescription
    _____________    ________    _____    _____________________    __________________

     1               1700        14.5     '2014-09-23 09:38:34'    'Building Blocks'
     3                356          17     '2014-05-14 07:14:28'    'Slinky'
     4               2580          21     '2013-06-08 14:24:33'    'Space Cruiser'

    ...
```

Find the maximum product price.

```
max(data.price)
```

```
ans =

    24
```

In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

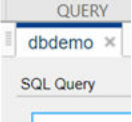
Join Tables Using Left Join and Import Query Results

Connect to a Microsoft Access database using the Database Explorer app. Then, create an SQL query that joins two tables using a left join. The Database Explorer app previews query results by default. After previewing the data, import all query results into the MATLAB workspace and perform simple data analysis.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see “Microsoft Access ODBC for Windows” on page 2-19.

In the **Connections** section of the **Database Explorer** tab, from the **Connect** list, select the data source for connection. The connection dialog box opens. Leave the user name and password blank, and click **Connect**.

The Database Explorer app creates a connection to the Microsoft Access database. The **Database Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Database Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



In the **Database Browser** pane, select the **suppliers** table as the first table for the join.

The Database Explorer app updates the **SQL Query** pane with an SQL query that selects all columns and rows from the **suppliers** table. Simultaneously, the Database Explorer app updates the **Data Preview** pane with a preview of the query results. The first 10 rows of data appear in the pane by default.

In the **Join** section, click **Join** to display the **Join** tab in the toolstrip. In the **Add** section, the name of the table selected in the **Database Browser** pane appears in the left **Table** list. For details about joining tables, see "Join Tables Using Database Explorer App" on page 4-10.

In the left **Column** list, select the name of the shared column `suppliernumber`. In the right **Table** list, select the name `producttable` as the table to join. Select the name of the shared column `suppliernumber` in this table in the right **Column** list.

In the **Add** section, click **Add Join**. The Database Explorer app creates an inner join by default. In the **Edit** section, click **Left** to change the join from an inner join to a left join. The **Join Diagram** pane displays a pictorial representation of the join between the selected tables. The **SQL Query** pane updates the SQL query with the new join. The **Data Preview** pane reflects the results of the updated SQL query.

In the **Close** section, click **Close Join** to close the **Join** tab.

Increase the number of rows displayed in the **Data Preview** pane. In the **Preview** section, enter `20` in the **Preview Size** box.

In the tree view of the **Database Browser** pane, select **unitcost** under **producttable**. The **Data Preview** pane updates with a new column.

Database Explorer

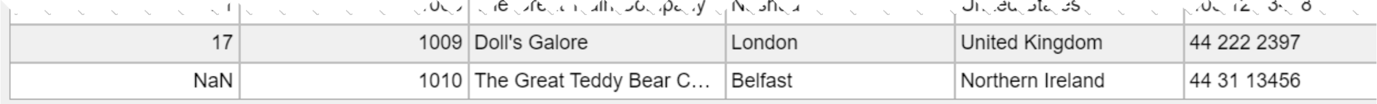
SQL Query

```
SELECT producttable.unitcost,
       suppliers.suppliernumber,
       suppliers.suppliername,
       suppliers.city,
       suppliers.country,
       suppliers.faxnumber
FROM ( suppliers
LEFT JOIN producttable
ON suppliers.suppliernumber = producttable.suppliernumber)
```

Data Preview (All 11 Rows)

unitcost	suppliernumber	suppliername	city	country	faxnumber
14	1001	Wonder Products	New York	United States	212 435 1617
5	1001	Wonder Products	New York	United States	212 435 1617
9	1002	Terrific Toys	London	United Kingdom	44 456 9345
13	1003	Wacky Widgets	Adelaide	Australia	618 8490 2211
8	1004	Incredible Machines	Dublin	Ireland	01 222 3456
3	1005	Custers Tin Soldiers	Boston	United States	617 939 1234
24	1006	ACME Toy Company	New York	United States	212 435 1618
16	1007	Garvin's Electrical Gizmos	Wellesley	United States	617 919 3456
21	1008	The Great Train Company	Nashua	United States	403 121 3478
17	1009	Doll's Galore	London	United Kingdom	44 222 2397
NaN	1010	The Great Teddy Bear C...	Belfast	Northern Ireland	44 31 13456

The NaN value in the **unitcost** column indicates that the corresponding supplier does not supply products.



17	1009	Doll's Galore	London	United Kingdom	44 222 2397
NaN	1010	The Great Teddy Bear C...	Belfast	Northern Ireland	44 31 13456

Add filter criteria to the SQL query. In the **Criteria** section, click **Where** to display the **Where** tab in the toolstrip.

Filter the SQL query results for products with a unit cost greater than $10. In the **Add** section, in the **Column** list, select the column name `producttable.unitcost`. Select the > operator for the filter in the **Operator** list. Enter `10` in the **Value** list. Click **Add Filter**.

Note If you enter filters using the `LIKE` or `NOT LIKE` operators, then enter the value in single quotes to represent a string.

The **SQL Query** and **Data Preview** panes display the updated query results based on the new filter with the `WHERE` condition.

Change the value of the filter from `10` to `20`. Click **Update Filter**. The **SQL Query** and **Data Preview** panes update with the results of the modified query.

In the **Close** section, click **Close Where** to close the **Where** tab.

Import all SQL query results into the MATLAB Workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB Workspace variable, and click **OK**. The MATLAB Workspace displays the table `data`.

Display the SQL query results at the command line.

```
data
```

```
data =

  2×6 table

    suppliernumber         suppliername             city          country          faxnumber       unitcost
    ______________    __________________________    __________    _______________    ______________    ________

    1008              'The Great Train Company'    'Nashua'      'United States'    '403 121 3478'    21
    1006              'ACME Toy Company'           'New York'    'United States'    '212 435 1618'    24
```

Find the maximum product price.

```
max(data.unitcost)
```

```
ans =

    24
```

In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

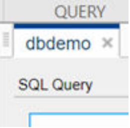
Sort Query Results

Connect to a Microsoft Access database using the Database Explorer app. Create a simple SQL query and sort the results by the data in one column. The Database Explorer app previews query results by default. Then, import the sorted data into the MATLAB workspace.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see “Microsoft Access ODBC for Windows” on page 2-19.

In the **Connections** section of the **Database Explorer** tab, from the **Connect** list, select the data source for connection. The connection dialog box opens. Leave the user name and password blank, and click **Connect**.

The Database Explorer app creates a connection to the Microsoft Access database. The **Database Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Database Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



In the **Database Browser** pane, select the **inventorytable** table. The **SQL Query** pane displays the SQL query that selects all columns and rows from this table. The **Data Preview** pane displays the first 10 rows of the query results.

Sort the results of the SQL query. In the **Criteria** section, click **Order By** to display the **Order By** tab in the toolstrip.

In the **Add** section, in the **Column** list, select the `price` column. Click **Add Sort**.

In the **Edit** section, click **Descending** to sort the prices in decreasing order. The **Data Preview** pane displays the updated query results with sorted prices.

Database Explorer

ORDER BY

Column: price | Add Sort | price DESC | Remove Sort | Ascending | Descending | Move Up | Move Down | Close Order By

ADD | EDIT | CLOSE

Database Browser

Catalog: C:\tutorial.accdb

Schema: No Schemas

- MSysACEs
- MSysAccessStorage
- MSysComplexColumns
- MSysIMEXColumns
- MSysIMEXSpecs
- MSysNavPaneGroupCategories
- MSysNavPaneGroupToObjects
- MSysNavPaneGroups
- MSysNavPaneObjectIDs
- MSysObjects
- MSysQueries
- MSysRelationships
- MSysResources
- display
- inventorytable
- invoice
- producttable
- salesvolume
- suppliers
- yearlysales

dbdemo

SQL Query

```
SELECT *
FROM inventorytable
ORDER BY price DESC
```

Data Preview (First 10 Rows)

productnumber	quantity	price	inventorydate
10	723	24	2012-03-14 13:13:09
4	2580	21	2013-06-08 14:24:33
3	356	17	2014-05-14 07:14:28
7	6034	16	2014-08-06 08:38:00
13	1700	14.5000	2009-05-24 10:58:59
1	1700	14.5000	2014-09-23 09:38:34
9	2339	13	2011-02-09 12:50:59
2	1200	9	2014-07-08 22:50:45
6	4540	8	2013-12-25 19:45:00
8	8350	5	2011-06-18 11:45:35

In the **Close** section, click **Close Order By** to close the **Order By** tab.

Import all SQL query results into the MATLAB Workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB Workspace variable, and click **OK**. The MATLAB Workspace displays the table `data`.

In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

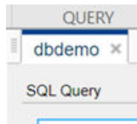
Filter Query Results

Connect to a Microsoft Access database using the Database Explorer app. Create a simple SQL query and filter the results. Use a text filter to retrieve specific rows of data. The Database Explorer app previews query results by default. Then, import the filtered data into the MATLAB workspace.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see "Microsoft Access ODBC for Windows" on page 2-19.

In the **Connections** section of the **Database Explorer** tab, from the **Connect** list, select the data source for connection. The connection dialog box opens. Leave the user name and password blank, and click **Connect**.

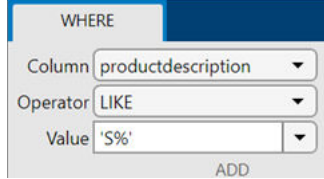
The Database Explorer app creates a connection to the Microsoft Access database. The **Database Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Database Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



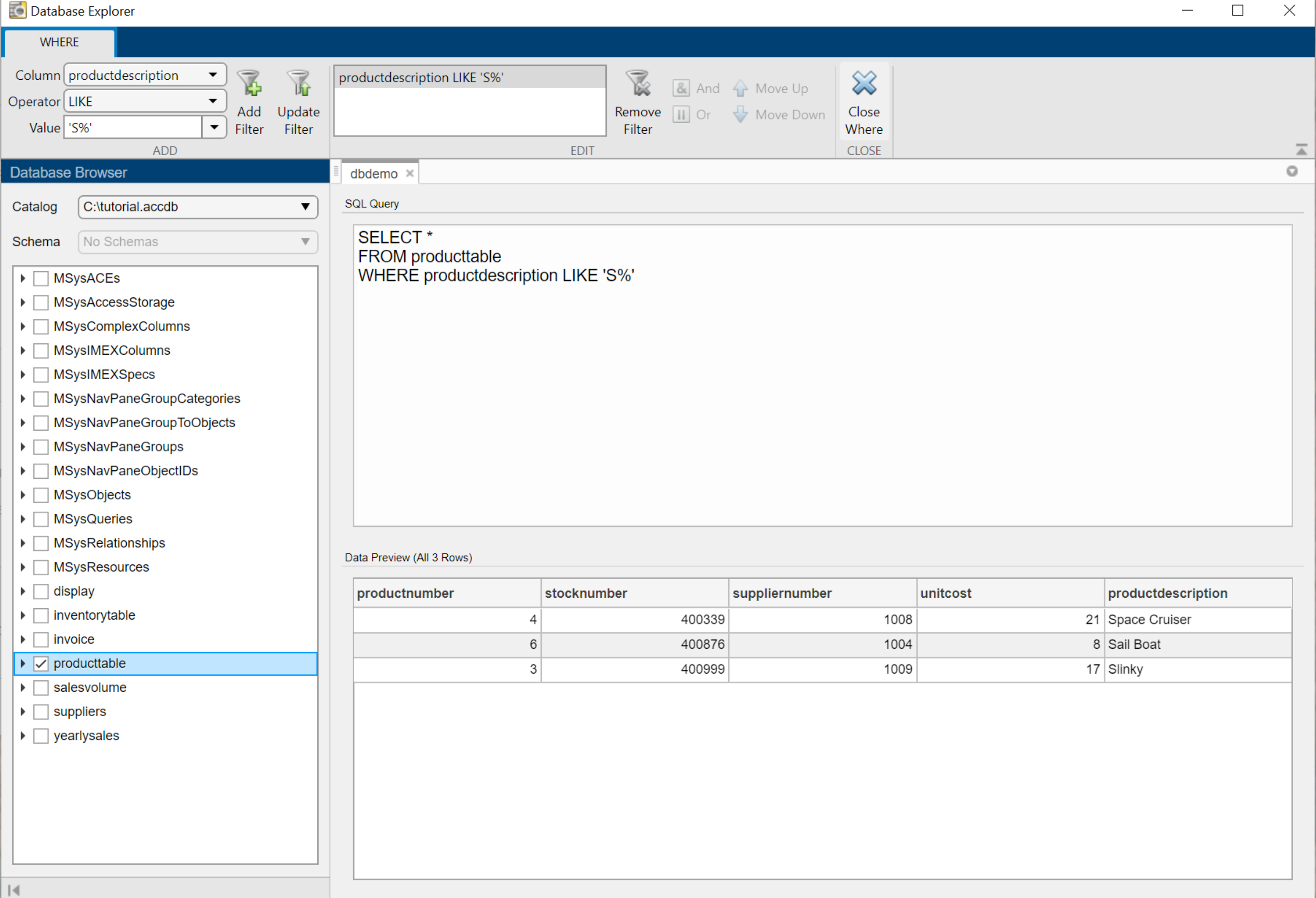
In the **Database Browser** pane, select the **producttable** table. The **SQL Query** pane displays the SQL query that selects all columns and rows from this table. The **Data Preview** pane displays the first 10 rows of the query results.

Add filter criteria to the SQL query. In the **Criteria** section, click **Where** to display the **Where** tab in the toolstrip.

Filter for products with a product description that starts with the letter `S`. In the **Add** section, in the **Column** list, select `productdescription`. In the **Operator** list, select `LIKE`. To filter for text, enclose the text in single quotes. In the **Value** list, enter `'S%'`.



Click **Add Filter**. The **Data Preview** pane displays three rows of data. The product description in each row starts with the letter S.



In the **Close** section, click **Close Where** to close the **Where** tab.

Import all SQL query results into the MATLAB Workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB Workspace variable, and click **OK**. The MATLAB Workspace displays the table `data`.

In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

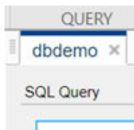
Remove Duplicate Rows from Query Results

Connect to a Microsoft Access database using the Database Explorer app. Create a simple SQL query and remove duplicate rows from the query results. The Database Explorer app previews query results by default. After removing duplicates, import the data into the MATLAB workspace.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see "Microsoft Access ODBC for Windows" on page 2-19.

In the **Connections** section of the **Database Explorer** tab, from the **Connect** list, select the data source for connection. The connection dialog box opens. Leave the user name and password blank, and click **Connect**.

The Database Explorer app creates a connection to the Microsoft Access database. The **Database Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Database Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



In the **Database Browser** pane, select the **producttable** table. Clear all the boxes for columns in the **producttable** table except for **suppliernumber**. The **SQL Query** pane displays the SQL query that selects the **suppliernumber** column from this table. The **Data Preview** pane displays the first 10 rows of the query results.

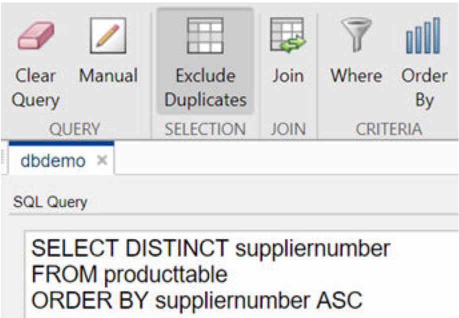
Sort the results of the SQL query. In the **Criteria** section, click **Order By** to display the **Order By** tab in the toolstrip. In the **Add** section, in the **Column** list, select the `suppliernumber` column, and click **Add Sort**.

In the **Close** section, click **Close Order By** to close the **Order By** tab.

The **Data Preview** pane displays the rows sorted in increasing order, which is the default order.

The **Data Preview** pane shows the duplicate supplier number `1001`.

In the **Selection** section, click **Exclude Duplicates** to remove duplicate rows in the **Data Preview** pane. The Database Explorer App adds the SQL statement `DISTINCT` to the query in the **SQL Query** pane. This statement removes duplicate rows from the query results.



The **Data Preview** pane displays unique rows only.

Import all SQL query results into the MATLAB Workspace. In the **Import** section, click . In the Import Data dialog box, enter the name `data` for the MATLAB Workspace variable, and click **OK**. The MATLAB Workspace displays the table `data`.

In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

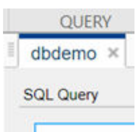
Enter SQL Query Manually

Connect to a Microsoft Access database using the Database Explorer app. Enter an SQL query manually or paste an existing SQL query into the **SQL Query** pane. Then, import the query results into the MATLAB workspace.

Set up the data source for the `tutorial.accdb` database and name it `dbdemo`. For details, see "Microsoft Access ODBC for Windows" on page 2-19.

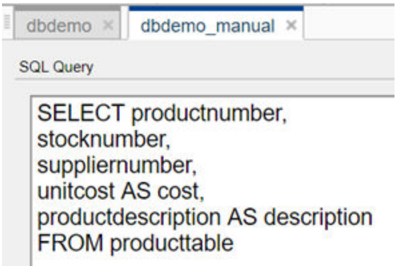
In the **Connections** section of the **Database Explorer** tab, from the **Connect** list, select the data source for connection. The connection dialog box opens. Leave the user name and password blank, and click **Connect**.

The Database Explorer app creates a connection to the Microsoft Access database. The **Database Browser** pane displays the available tables in the database. The data source tab, which is named **dbdemo**, appears to the right of the **Database Browser** pane. The data source tab contains two empty panes, **SQL Query** and **Data Preview**.



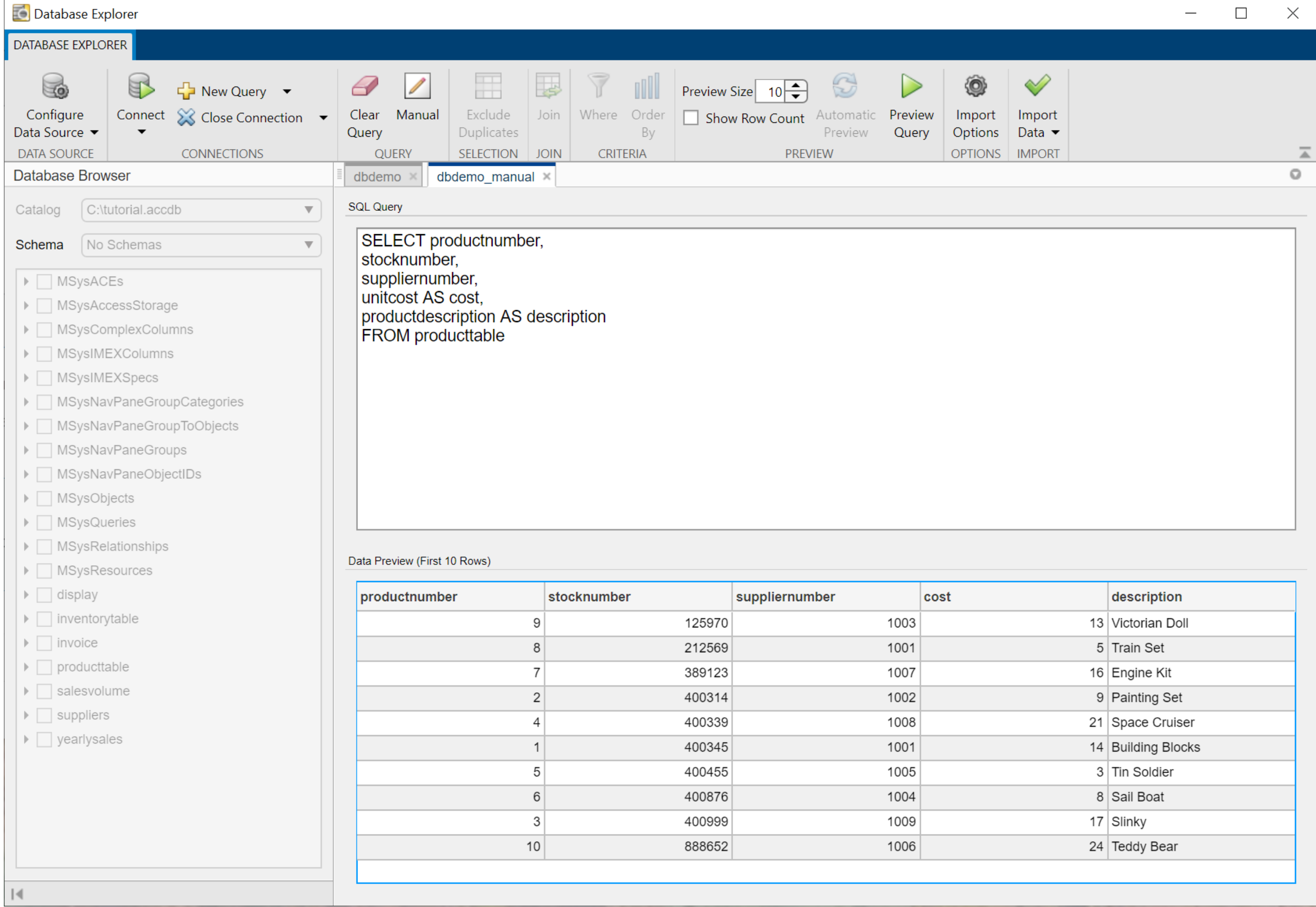
In the **Query** section, click **Manual**. A new data source tab appears to the right of the **dbdemo** tab with the name **dbdemo_manual**. The suffix `_manual` attached to the tab name indicates that you are entering an SQL query manually.

Enter an SQL query in the **SQL Query** pane. Here, select all columns and rows from the `producttable` table, and rename the `unitcost` and `productdescription` columns. Use the SQL statement `AS` to create aliases.



In the **Preview** section, click **Preview Query** to preview the query results.

The **Data Preview** pane shows the results of the SQL query. The pane displays the first 10 rows of data by default.



Import all SQL query results into the MATLAB Workspace. In the **Import** section, click [checkmark icon]. In the Import Data dialog box, enter the name `data` for the MATLAB Workspace variable, and click **OK**. The MATLAB Workspace displays the table `data`.

In the **Connections** section, close the database connection by clicking **Close Connection**.

Note If multiple connections are open, close the database connection of your choice by selecting the corresponding data source from the **Close Connection** list.

Version History

Introduced in R2017b

See Also

Functions

`database` | `exec` | `fetch` | `close`

Topics

“Connection Options” on page 2-8
“Configure Driver and Data Source” on page 2-14
“Create SQL Queries Using Database Explorer App” on page 4-2
“Join Tables Using Database Explorer App” on page 4-10
“Data Preview Using Database Explorer App” on page 4-14
“Customize Import Options Using Database Explorer App” on page 4-7
“Generate SQL Query and MATLAB Script” on page 4-20
“Modify and Delete Data Sources” on page 4-17
“Database Explorer App Error Messages” on page 3-14

External Websites

SQL Tutorial

exec

Namespace: `database.odbc`

(Not recommended) Execute SQL statement and open cursor

Note The `exec` function is not recommended. For SQL statements that return data, use the `fetch` function or the `select` function instead. For other SQL statements, use the `execute` function instead. For details, see "Compatibility Considerations".

The scrollable cursor functionality has no replacement.

Syntax

```
curs = exec(conn,sqlquery)
curs = exec(conn,sqlquery,Name,Value)
curs = exec(conn,sqlquery,qTimeOut)
```

Description

`curs = exec(conn,sqlquery)` creates the `cursor` object after executing the SQL statement `sqlquery` for the database connection `conn`.

`curs = exec(conn,sqlquery,Name,Value)` specifies options using one or more name-value pair arguments. For example, `'MaxRows',10` limits the number of rows to return to 10 before SQL query execution.

`curs = exec(conn,sqlquery,qTimeOut)` uses the timeout value `qTimeOut` for SQL query execution.

Examples

Select Data Using Native ODBC Driver

Use a native ODBC connection to import product data from a Microsoft SQL Server database into MATLAB. Then, determine the highest unit cost among products.

Create an ODBC database connection to a Microsoft SQL Server database with Windows authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select all data from the table `productTable` using the `connection` object. Assign the SQL `SELECT` statement to the variable `sqlquery`. The `cursor` object contains the executed SQL query.

```
sqlquery = 'SELECT * FROM productTable';
curs = exec(conn,sqlquery)
```

```
curs =

   cursor with properties:

         Data: 0
     RowLimit: 0
     SQLQuery: 'SELECT * FROM productTable'
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

For an ODBC connection, the `Type` property contains `ODBCCursor Object`. For JDBC connections, this property contains `Database Cursor Object`.

Import data from the table into MATLAB.

```
curs = fetch(curs);
data = curs.Data;
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans =

    24
```

After you finish working with the `cursor` object, close it. Close the database connection.

```
close(curs)
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use the `exec` function. For procedures that return output arguments, use `runstoredprocedure`.

For information about the SQL query language, see the SQL Tutorial.

Data Types: char | string

qTimeOut — Timeout value
numeric scalar

Timeout value, specified as a numeric scalar denoting the maximum amount of time, in seconds, that exec tries to execute the SQL statement sqlquery.

Data Types: double

Name-Value Pair Arguments

Specify optional pairs of arguments as Name1=Value1,...,NameN=ValueN, where Name is the argument name and Value is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose Name *in quotes.*

Example: curs = exec(conn,sqlquery,'MaxRows',rowlimit);

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return before executing the SQL query, specified as the comma-separated pair consisting of 'MaxRows' and a positive numeric scalar. By default, the exec function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB from the SQL query execution. For details about this option and other memory management options, see “Data Import Memory Management” on page 5-20.

Data Types: double

CursorType — Cursor type
'forward_only' (default) | 'scrollable'

Cursor type, specified as the comma-separated pair consisting of 'CursorType' and one of the values in this table.

Value	Description
'forward_only'	Create a basic cursor.
'scrollable'	Create a scrollable cursor.

Output Arguments

curs — Database cursor
cursor object

Database cursor, returned as a cursor object.

Limitations

The name-value pair argument 'MaxRows' has these limitations:

- If you are using Microsoft Access, the native ODBC interface is not supported.
- Not all database drivers support setting the maximum number of rows before query execution. For an unsupported driver, modify your SQL query to limit the maximum number of rows to return. The SQL syntax varies with the driver. For details, consult the driver documentation.

Tips

- The order of records in your database does not remain constant. Sort data using the SQL `ORDER BY` command in your `sqlquery` statement.
- For Microsoft Excel, tables in `sqlquery` are Excel worksheets. By default, some worksheet names include a `$` symbol. To select data from a worksheet with this name format, use an SQL statement of the form `SELECT * FROM "Sheet1$"` (or `'Sheet1$'`).
- Before you modify database tables, ensure that the database is not open for editing. If you try to edit the database while it is open, you receive this MATLAB error:

  ```
  [Vendor][ODBC Driver] The database engine could not lock
  table 'TableName' because it is already in use by
  another person or process.
  ```
- The PostgreSQL database management system supports multidimensional fields, but SQL `SELECT` statements fail when retrieving these fields unless you specify an index.
- Some databases require that you include a symbol, such as `#`, before and after a date in a query, as follows:

  ```
  curs = exec(conn,'SELECT * FROM mydb WHERE mydate > #03/05/2005#')
  ```

Alternative Functionality

App

The `exec` function executes SQL statements using the command line. To execute SQL statements interactively, use the Database Explorer app.

Version History

Introduced before R2006a

R2018b: exec function is not recommended

Not recommended starting in R2018b

The `exec` function is not recommended. For SQL statements that return data, use the `fetch` function with the `connection` object or the `select` function instead. For other SQL statements, use the `execute` function instead. Some differences between the workflows might require updates to your code.

There are no plans to remove the `exec` function at this time.

Update Code

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

You can also import data in one step using the `select` function.

```
data = select(conn,selectquery);
```

The scrollable cursor functionality has no replacement.

See Also

`close` | `database` | `fetch` | `setdbprefs` | `select`

Topics

"Import Data from Database Table Using sqlread Function" on page 5-58
"Call Stored Procedure That Returns Data" on page 5-17
"Roll Back Data in Database" on page 5-2
"Change Database Connection Catalog" on page 5-4
"Create Table and Add Column" on page 5-5
"Run Custom Database Function" on page 5-19
"Data Import Memory Management" on page 5-20
"Data Retrieval Restrictions" on page 1-5

External Websites

SQL Tutorial

exec

Execute SQL statement using SQLite connection

Note The `exec` function will be removed in a future release. Use the `execute` function to manage the SQLite database instead.

Syntax

`exec(conn,sqlquery)`

Description

`exec(conn,sqlquery)` performs database operations on an SQLite database file by executing the SQL statement `sqlquery` for the SQLite connection `conn` using the MATLAB interface to SQLite. For example, use this syntax to create database tables in the SQLite database file. To import data into MATLAB from the SQLite database file, use the `fetch` function.

Examples

Create Table Using MATLAB Interface to SQLite

Using the MATLAB® Interface to SQLite, create a table in a new SQLite database file.

Create the SQLite connection `conn` to the new SQLite database file `tutorial.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,'tutorial.db');
```

```
conn = sqlite(dbfile,'create');
```

Create the table `inventoryTable` using `exec`.

```
createInventoryTable = ['create table inventoryTable ' ...
    '(productNumber NUMERIC, Quantity NUMERIC, ' ...
    'Price NUMERIC, inventoryDate VARCHAR)'];
```

```
exec(conn,createInventoryTable)
```

`inventoryTable` is an empty table in `tutorial.db`.

To insert data into the database file, use the `insert` function.

Close the SQLite connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

`sqlquery` — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use the `exec` function. For procedures that return output arguments, use `runstoredprocedure`.

For information about the SQL query language, see the SQL Tutorial.

Data Types: `char` | `string`

Version History

Introduced in R2016a

See Also

`close` | `sqlite` | `insert` | `fetch`

Topics

"Import Data Using MATLAB Interface to SQLite" on page 5-32
"Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5

External Websites

SQL Tutorial

execute

Namespace: `database.odbc`

Execute SQL statement using relational database connection

Syntax

```
execute(conn,sqlquery)
execute(conn,pstmt)
```

Description

`execute(conn,sqlquery)` executes an SQL query that contains a non-`SELECT` SQL statement by using the relational database connection.

`execute(conn,pstmt)` executes an SQL prepared statement that contains a non-`SELECT` SQL statement by using the relational database connection.

Examples

Execute Non-SELECT SQL Statement

Using a relational database connection, create and execute a non-`SELECT` SQL statement that deletes a database table.

This example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Import the data from the `patients` database table.

```
data = sqlread(conn,tablename);
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Call Stored Procedure Without Input and Output Arguments

Working with a Microsoft SQL Server database, run a stored procedure by using the native ODBC database connection `conn`.

Define a stored procedure named `create_table` that creates a table named `test_table` by executing the following code. This procedure has no input or output arguments. The code assumes that you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE create_table

AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

CREATE TABLE test_table
     (
        CATEGORY_ID     INTEGER     IDENTITY PRIMARY KEY,
        CATEGORY_DESC   CHAR(50)    NOT NULL
        );

END
GO
```

Connect to the Microsoft SQL Server database. This code assumes that you are connecting to a data source named `MS SQL Server` with a user name and password.

```
conn = database('MS SQL Server','username','pwd');
```

Call the stored procedure `create_table`.

```
execute(conn,'create_table')
```

Insert Data Using SQL Prepared Statement

Create an SQL prepared statement to insert data from MATLAB® into a Microsoft® SQL Server® database using a JDBC database connection. Use the `INSERT` SQL statement for the SQL query. Execute the SQL prepared statement and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Import data from the database using the `sqlread` function. Display the last few rows of data in the database table `inventoryTable`.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
tail(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

         11             567         0     {'2012-09-11 00:30:24'}
         12            1278         0     {'2010-10-29 18:17:47'}
         13            1700      14.5     {'2009-05-24 10:58:59'}
```

Create an SQL prepared statement for inserting data using the JDBC database connection. The question marks in the `INSERT` SQL statement indicate it is an SQL prepared statement. This statement inserts data from MATLAB into the database table `inventoryTable`.

```
query = "INSERT INTO inventoryTable VALUES(?,?,?,?)";
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "INSERT INTO inventoryTable values(?,?,?,?)"
     ParameterCount: 4
     ParameterTypes: ["numeric"    "numeric"    "numeric"    "string"]
    ParameterValues: {[]  []  []  []}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query
- `ParameterCount` — Parameter count
- `ParameterTypes` — Parameter types
- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select all parameters in the SQL prepared statement using their numeric indices. Specify the values to bind for the product number, quantity, price, and inventory date. Match the format of dates in the database. The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1 2 3 4];
values = {20,1000,55,"2019-04-25 00:00:00.000"};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "INSERT INTO inventoryTable values(?,?,?,?)"
     ParameterCount: 4
     ParameterTypes: ["numeric"    "numeric"    "numeric"    "string"]
    ParameterValues: {[20]  [1000]  [55]  ["2019-04-25 00:00:00.000"]}
```

Insert data from MATLAB into the database using the bound parameter values. Execute the SQL `INSERT` statement using the `execute` function.

```
execute(conn,pstmt)
```

Display the inserted data in the database table `inventoryTable`. The last row in the table contains the inserted data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
tail(data,4)
```

```
ans=4×4 table
    productNumber    Quantity    Price          inventoryDate
    _____________    ________    _____    ___________________________

         11             567         0     {'2012-09-11 00:30:24'    }
         12            1278         0     {'2010-10-29 18:17:47'    }
         13            1700      14.5     {'2009-05-24 10:58:59'    }
         20            1000        55     {'2019-04-25 00:00:00.000'}
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Input Arguments

conn — Database connection
connection object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid non-`SELECT` SQL statement.

The SQL statement can be a stored procedure that does not return any result sets. For stored procedures that return one or more result sets, use the `fetch` function. For procedures that return output arguments, use the `runstoredprocedure` function.

For information about the SQL query language, see the SQL Tutorial.

Example: `'DROP TABLE patients'`

Data Types: `char` | `string`

pstmt — SQL prepared statement
SQLPreparedStatement object

SQL prepared statement, specified as an `SQLPreparedStatement` object.

Version History
Introduced in R2018b

See Also

`close` | `database` | `fetch` | `sqlread` | `runstoredprocedure` | `databasePreparedStatement` | `bindParamValues` | `close`

Topics

"Create Table and Add Column" on page 5-5
"Delete Data from Databases" on page 5-6
"Roll Back Data in Database" on page 5-2
"Import Data Using SQL Prepared Statement with Multiple Parameter Values" on page 5-75
"SQL Prepared Statement Error Messages" on page 3-16

External Websites

SQL Tutorial

execute

Execute SQL statement using SQLite database connection

Syntax

`execute(conn,sqlquery)`

Description

`execute(conn,sqlquery)` executes an SQL query that contains a non-`SELECT` SQL statement by using the SQLite database connection with the MATLAB interface to SQLite.

Examples

Execute Non-SELECT SQL Statement

Using an SQLite database connection and the MATLAB® interface to SQLite, create and execute a non-`SELECT` SQL statement that creates a temporary view in the database and imports its contents.

Create an SQLite database connection to the SQLite database file `tutorial.db`.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Create an SQL statement that creates a temporary view named `PRODUCTNAMES`. The view selects all product names using the `productDescription` column of the `productTable` database table. Execute the `CREATE` SQL statement.

```
sqlquery = strcat("CREATE TEMP VIEW PRODUCTNAMES AS", ...
    " SELECT productDescription FROM productTable");
execute(conn,sqlquery)
```

Import the product names using the new temporary view and display the first three names.

```
sqlquery = "SELECT * FROM PRODUCTNAMES";
results = fetch(conn,sqlquery);
head(results,3)
```

```
    productDescription
    __________________

     "Victorian Doll"
     "Train Set"
     "Engine Kit"
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
sqlite object

SQLite database connection, specified as an sqlite object created using the sqlite function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid non-SELECT SQL statement. For information about the SQL query language, see the SQL Tutorial.

Example: "DROP VIEW PRODUCTNAMES"

Data Types: char | string

Version History

Introduced in R2022a

See Also

Objects
sqlite

Functions
fetch | sqlwrite | close

Topics
“Insert Data into SQLite Database Table” on page 5-36
“Create Table and Add Column in SQLite Database” on page 5-38
“Delete Data from SQLite Database” on page 5-39
“Roll Back Data in SQLite Database” on page 5-41

External Websites
SQL Tutorial
SQLite Home Page

fastinsert

Namespace: `database.odbc`

(To be removed) Add MATLAB data to database tables

Note The `fastinsert` function will be removed in a future release. Use the `sqlwrite` function instead. For details, see “Compatibility Considerations”.

Syntax

`fastinsert(conn,tablename,colnames,data)`

Description

`fastinsert(conn,tablename,colnames,data)` exports data from the MATLAB workspace and inserts it into an existing database table using the database connection `conn`. You can specify the database table name and column names, and specify the data for insertion into the database.

You do not specify the type of data you are exporting. The data is exported in its current MATLAB format.

Examples

Insert Row into Table Using ODBC Driver

First, connect to the Microsoft® SQL Server® database. Then, export data from MATLAB® into the database and close the database connection.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select and display all rows in the table sorted by the product number using the `select` function.

```
selectquery = 'SELECT * FROM productTable ORDER BY productNumber';

data = select(conn,selectquery)
```

```
data = 

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    1                4.0035e+05     1001              14          'Building Blocks'
    2                4.0031e+05     1002               9          'Painting Set'
    3                  4.01e+05     1009              17          'Slinky'
```

Store the column names of `productTable` in a cell array.

```
tablename = 'productTable';
colnames = {'productNumber','stockNumber','supplierNumber', ...
    'unitCost','productDescription'};
```

Store the data for the insert in a cell array that contains these values:

- `productNumber` equal to 4
- `stockNumber` equal to 500565
- `supplierNumber` equal to 1010
- `unitCost` equal to $20
- `productDescription` equal to `'Cooking Set'`

Then, convert the cell array to a table.

```
insertdata = {4,500565,1010,20,'Cooking Set'};
insertdata = cell2table(insertdata,'VariableNames',colnames)
```

```
insertdata = 

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    4                5.0057e+05     1010              20          'Cooking Set'
```

Insert data into the table.

```
fastinsert(conn,tablename,colnames,insertdata)
```

Select and display all rows in the table again.

```
data = select(conn,selectquery)
```

```
data = 

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

    1                4.0035e+05     1001              14          'Building Blocks'
    2                4.0031e+05     1002               9          'Painting Set'
    3                  4.01e+05     1009              17          'Slinky'
```

```
    4                 5.0057e+05     1010              20           'Cooking Set'
```

A new row appears in the `productTable` with data from `insertdata`.

Close the database connection.

```
close(conn)
```

Insert Multiple Rows into Table

First, connect to the Microsoft® SQL Server® database. Then, export multiple rows of data from MATLAB® into the database and close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Select and display data in the table `inventoryTable`. Import data using the `select` function.

```
selectquery = 'SELECT * FROM inventoryTable';
data = select(conn,selectquery)
```

```
data =

    productNumber    Quantity    Price    inventoryDate
    _____________    ________    _____    _____________

     1               1700        15       '2014-09-23'
     2               1200         9       '2014-07-08'
     3                356        17       '2014-05-14'
     4               2580        21       '2013-06-08'
     5               9000         3       '2012-09-14'
     6               4540         8       '2013-12-25'
     7               6034        16       '2014-08-06'
     8               8350         5       '2011-06-18'
     9               2339        13       '2011-02-09'
    10                723        24       '2012-03-14'
```

Assign multiple rows of data to the cell array `insertdata`. Each row contains data for the columns in `inventoryTable`. The first row of data contains:

- Product number is 11
- Quantity is 125
- Price is $23.00
- Inventory date is the current date

```
insertdata = {11,125,23.00,datestr(now,'yyyy-mm-dd'); ...
    12,1160,14.7,datestr(now,'yyyy-mm-dd'); ...
    13,150,54.5,datestr(now,'yyyy-mm-dd')};
```

Store the column names of `inventoryTable` in a cell array.

```
tablename = 'inventoryTable';
colnames = {'productNumber','Quantity','Price','inventoryDate'};
```

Insert data into the table.

```
fastinsert(conn,tablename,colnames,insertdata)
```

Select and display data in the table `inventoryTable` again.

```
data = select(conn,selectquery)
```

```
data = 

    productNumber    Quantity    Price    inventoryDate
    _____________    ________    _____    _____________

     1               1700        15       '2014-09-23'
     2               1200         9       '2014-07-08'
     3                356        17       '2014-05-14'
     4               2580        21       '2013-06-08'
     5               9000         3       '2012-09-14'
     6               4540         8       '2013-12-25'
     7               6034        16       '2014-08-06'
     8               8350         5       '2011-06-18'
     9               2339        13       '2011-02-09'
    10                723        24       '2012-03-14'
    11                125        23       '2016-11-02'
    12               1160        15       '2016-11-02'
    13                150        55       '2016-11-02'
```

Three new rows appear in `inventoryTable` with data from `insertdata`.

Close the database connection.

```
close(conn)
```

Insert Numeric Data into Table

First, connect to the Microsoft® SQL Server® database. Then, export numeric data from MATLAB® into the database and close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Define the numeric matrix `numdata` that contains sales volume data.

```
numdata = [777666,0,350,400,450,250,450,500,515,235,100,300,600];
```

Select and display data in the `salesVolume` table before insertion. Import data using the `select` function.

```
selectquery = 'SELECT * FROM salesVolume';
data = select(conn,selectquery)
```

```
data =

    StockNumber    January    February    March    April    May     June    July    August    Sep
    ___________    _______    ________    _____    _____    ____    ____    ____    ______    ___

    1.2597e+05     1400       1100          981      882     794     752     654    773         80
    2.1257e+05     2400       1721         1414     1191     983     825     731    653         72
    3.8912e+05     1800       1200          890      670     550     450     400    410         40
    4.0031e+05     3000       2400         1800     1500    1200     900     700    650        167
    4.0034e+05     4300          0         2600     1800    1600    1550     895    700         75
    4.0035e+05     5000       3500         2800     2300    1700    1400    1000    900        160
    4.0046e+05     1200        900          800      500     399     345     300    175         76
    4.0088e+05     3000       2400         1500     1500    1300    1100     900    867         92
      4.01e+05     3000       1500         1000      900     750     700     400    350         50
    8.8865e+05        0        900          821      701     689     621     545    421         49
    4.0814e+05     6000       3100         8800     2300    1700    1400    1000    900        160
    2.1046e+05     1800       9700          800      500    3997     349     300    175         76
    4.7082e+05     3100       9400         1540     1500    1350    1190     900    867         92
     5.101e+05      235       1800         1040      900     750     700     400    350         50
    8.9975e+05      123       1700          823      701     689     621     545    421         49
```

Store the column names of `salesVolume` in a cell array.

```
tablename = 'salesVolume';
colnames = {'stockNumber','January','February','March','April','May', ...
    'June','July','August','September','October','November', ...
    'December'};
```

Insert data into the table.

```
fastinsert(conn,tablename,colnames,numdata)
```

Select and display data in the `salesVolume` table again.

```
data = select(conn,selectquery)
```

```
data =

    StockNumber    January    February    March    April    May     June    July    August    Sep
    ___________    _______    ________    _____    _____    ____    ____    ____    ______    ___

    1.2597e+05     1400       1100          981      882     794     752     654    773         80
    2.1257e+05     2400       1721         1414     1191     983     825     731    653         72
    3.8912e+05     1800       1200          890      670     550     450     400    410         40
    4.0031e+05     3000       2400         1800     1500    1200     900     700    650        167
    4.0034e+05     4300          0         2600     1800    1600    1550     895    700         75
    4.0035e+05     5000       3500         2800     2300    1700    1400    1000    900        160
    4.0046e+05     1200        900          800      500     399     345     300    175         76
    4.0088e+05     3000       2400         1500     1500    1300    1100     900    867         92
      4.01e+05     3000       1500         1000      900     750     700     400    350         50
    8.8865e+05        0        900          821      701     689     621     545    421         49
    4.0814e+05     6000       3100         8800     2300    1700    1400    1000    900        160
    2.1046e+05     1800       9700          800      500    3997     349     300    175         76
    4.7082e+05     3100       9400         1540     1500    1350    1190     900    867         92
     5.101e+05      235       1800         1040      900     750     700     400    350         50
    8.9975e+05      123       1700          823      701     689     621     545    421         49
    7.7767e+05        0        350          400      450     250     450     500    515         23
```

A new row appears in `salesVolume` with data from `numdata`.

Close the database connection.

```
close(conn)
```

Insert and Commit Data in Table

First, connect to the Microsoft® SQL Server® database. Then, export data from MATLAB® into the database and commit the insert transaction. Close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password. Use the name-value pair argument `AutoCommit` to specify manually committing transactions to the database.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','','AutoCommit','off');
```

Check the database connection. If the `Message` property is empty, the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Insert the cell array `data` into the table `inventoryTable` with column names `colnames`.

```
data = {157,358,740.00,datestr(now,'yyyy-mm-dd HH:MM:SS')};
colnames = {'productNumber','Quantity','Price','inventoryDate'};
tablename = 'inventoryTable';

fastinsert(conn,tablename,colnames,data)
```

Commit the insert transaction.

```
commit(conn)
```

Close the database connection.

```
close(conn)
```

Insert Boolean Data into Table

First, connect to the Microsoft® SQL Server® database. Then, export Boolean data from MATLAB® into the database. Close the database connection.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

This database contains the table `Invoice` with these columns:

- `InvoiceNumber`
- `InvoiceDate`
- `productNumber`
- `Paid`
- `Receipt`

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Display the data in the `Invoice` table before insertion.

```
selectquery = 'SELECT * FROM Invoice';
data = select(conn,selectquery)
```

```
data =

  10×5 table

    InvoiceNumber          InvoiceDate            ProductNumber    Paid       Receipt
    _____________    _________________________    _____________    _____    ______________
```

```
      2101          '2010-08-01 00:00:00.000'     1            false    [8000×1 uint8]
      3546          '2010-03-01 00:00:00.000'     2            true     [8000×1 uint8]
     33116          '2011-05-15 00:00:00.000'     3            true     [8000×1 uint8]
     34155          '2011-07-12 00:00:00.000'     4            false    [8000×1 uint8]
     34267          '2011-07-22 00:00:00.000'     5            true     [8000×1 uint8]
     37197          '2011-09-03 00:00:00.000'     6            true     [8000×1 uint8]
     37281          '2011-09-21 00:00:00.000'     7            false    [8000×1 uint8]
     41011          '2011-12-12 00:00:00.000'     8            true     [8000×1 uint8]
     61178          '2012-01-15 00:00:00.000'     9            false    [8000×1 uint8]
     62145          '2012-01-23 00:00:00.000'    10            true     [8000×1 uint8]
```

Create the variable `insertdata` as a structure containing the invoice number `2105`, product number `11`, and the Boolean data `false` to signify unpaid. Boolean data is represented as the MATLAB® data type `logical`. This code assumes that the receipt image is missing.

```
insertdata.InvoiceNumber{1} = 2105;
insertdata.InvoiceDate{1} = datestr(now,'yyyy-mm-dd HH:MM:SS');
insertdata.productNumber{1} = 11;
insertdata.Paid{1} = false;
```

Insert the paid invoice data into the `Invoice` table with column names `colnames` using the database connection.

```
colnames = {'InvoiceNumber';'InvoiceDate';'productNumber';'Paid'};
tablename = 'Invoice';

fastinsert(conn,tablename,colnames,insertdata)
```

View the new record in the database to verify that the `Paid` column value is Boolean. In some databases, the MATLAB® logical value `false` shows as a Boolean `false`, `No`, or a cleared check box.

```
data = select(conn,selectquery)
```

```
data =

  11×5 table

    InvoiceNumber          InvoiceDate          ProductNumber    Paid       Receipt
    _____________    _________________________    _____________    _____    ______________

      2101          '2010-08-01 00:00:00.000'     1            false    [8000×1 uint8]
      3546          '2010-03-01 00:00:00.000'     2            true     [8000×1 uint8]
     33116          '2011-05-15 00:00:00.000'     3            true     [8000×1 uint8]
     34155          '2011-07-12 00:00:00.000'     4            false    [8000×1 uint8]
     34267          '2011-07-22 00:00:00.000'     5            true     [8000×1 uint8]
     37197          '2011-09-03 00:00:00.000'     6            true     [8000×1 uint8]
     37281          '2011-09-21 00:00:00.000'     7            false    [8000×1 uint8]
     41011          '2011-12-12 00:00:00.000'     8            true     [8000×1 uint8]
     61178          '2012-01-15 00:00:00.000'     9            false    [8000×1 uint8]
     62145          '2012-01-23 00:00:00.000'    10            true     [8000×1 uint8]
      2105          '2017-01-04 10:19:42.000'    11            false    ''
```

The last row contains the Boolean data `false`.

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
connection object

Database connection, specified as an ODBC connection object or JDBC connection object created using the database function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: "employees"

Data Types: string | char

colnames — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table tablename.

Example: {'col1','col2','col3'}

Data Types: cell | string

data — Data to insert
numeric matrix | cell array | table | dataset | structure

Data to insert, specified as a numeric matrix, cell array, table, dataset array, or structure that contains all data for insertion into the existing database table tablename. If data is a structure, then field names in the structure must match colnames. If data is a table or a dataset array, then the variable names in the table or dataset array must match colnames.

To insert data into a structure, table, or dataset array, use this special formatting. Each field or variable in a structure, table, or dataset array must be a cell array or double vector. The double vector must be of size n-by-1, where n is the number of rows to be inserted.

To reduce conversion time, convert dates to serial date numbers using datenum before calling fastinsert.

Tips

- The value of the AutoCommit property in the connection object determines whether fastinsert automatically commits the data to the database.
  - To view the AutoCommit value, access it using the connection object; for example, conn.AutoCommit.
  - To set the AutoCommit value, use the corresponding name-value pair argument in the database function.

  - To commit the data to the database, use the `commit` function or issue an SQL `COMMIT` statement using the `exec` function.
  - To roll back the data, use `rollback` or issue an SQL `ROLLBACK` statement using the `exec` function.
- If an error message like the following appears when you run `fastinsert`, the table might be open in edit mode.

  ```
  [Vendor][ODBC Product Driver] The database engine could
  not lock table 'TableName' because it is already in use
  by another person or process.
  ```

  In this case, close the table in the database and rerun the `fastinsert` function.

Alternative Functionality

To export MATLAB data into a database, you can use the `datainsert` and `insert` functions. For maximum performance, use `datainsert`.

Version History

Introduced before R2006a

R2018a: `fastinsert` function will be removed

Not recommended starting in R2018a

The `fastinsert` function will be removed in a future release. Use the `sqlwrite` function instead. Some differences between the workflows require updates to your code.

Update Code

In prior releases, you exported data from the MATLAB workspace into a database by using the `fastinsert` function and four input arguments. For example:

```
tablename = 'productTable';
colnames = {'productNumber','stockNumber','supplierNumber', ...
    'unitCost','productDescription'};
insertdata = {4,500565,1010,20,'Cooking Set'};
insertdata = cell2table(insertdata,'VariableNames',colnames)
fastinsert(conn,tablename,colnames,insertdata)
```

Now the `sqlwrite` function requires only three input arguments.

```
tablename = 'productTable';
colnames = {'productNumber','stockNumber','supplierNumber', ...
    'unitCost','productDescription'};
insertdata = {4,500565,1010,20,'Cooking Set'};
insertdata = cell2table(insertdata,'VariableNames',colnames)
sqlwrite(conn,tablename,insertdata)
```

See Also

`sqlwrite` | `commit` | `database` | `insert` | `logical` | `rollback` | `close` | `select`

Topics

“Export Data Using Bulk Insert” on page 5-13

"Replace Existing Data in Database" on page 5-12
"Roll Back Data After Updating Record" on page 5-9
"Data Type Support" on page 1-3

External Websites

SQL Tutorial

fetch

Namespace: `database.odbc`

Import data into MATLAB workspace from execution of SQL statement

Syntax

```
results = fetch(conn,sqlquery)
results = fetch(conn,sqlquery,opts)
results = fetch( ___ ,Name,Value)
[results,metadata] = fetch( ___ )

results = fetch(conn,pstmt)
results = fetch(conn,pstmt,Name,Value)
```

Description

`results = fetch(conn,sqlquery)` returns all rows of data after executing the SQL statement `sqlquery` for the `connection` object. `fetch` imports data in batches.

`results = fetch(conn,sqlquery,opts)` customizes options for importing data from an executed SQL query by using the `SQLImportOptions` object.

`results = fetch( ___ ,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, specify `MaxRows = 5` to import five rows of data.

`[results,metadata] = fetch( ___ )` also returns the `metadata` table, which contains metadata information about the imported data.

`results = fetch(conn,pstmt)` returns all rows of data after executing the SQL `SELECT` prepared statement `pstmt` for the `connection` object.

`results = fetch(conn,pstmt,Name,Value)` specifies additional options using one or more name-value arguments. For example, specify `DataReturnFormat = "structure"` to import data as a structure.

Examples

Import All Data Using `connection` Object

Import all product data from a Microsoft® SQL Server® database table into MATLAB® by using the `connection` object. Determine the highest unit cost among products in the table. Then, use a row filter to import only the data for products with a unit cost less than 15.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank username and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import all the data from `productTable` by using the `connection` object and SQL query, and display the imported data.

```
sqlquery = 'SELECT * FROM productTable';
results = fetch(conn,sqlquery)
```

```
results =

  15×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    ___________________

          9          1.2597e+05          1003            13       {'Victorian Doll' }
          8          2.1257e+05          1001             5       {'Train Set'      }
          7          3.8912e+05          1007            16       {'Engine Kit'     }
          2          4.0031e+05          1002             9       {'Painting Set'   }
          4          4.0034e+05          1008            21       {'Space Cruiser'  }
          1          4.0034e+05          1001            14       {'Building Blocks'}
          5          4.0046e+05          1005             3       {'Tin Soldier'    }
          6          4.0088e+05          1004             8       {'Sail Boat'      }
          3            4.01e+05          1009            17       {'Slinky'         }
         10          8.8865e+05          1006            24       {'Teddy Bear'     }
         11          4.0814e+05          1004            11       {'Convertible'    }
         12          2.1046e+05          1010            22       {'Hugsy'          }
         13          4.7082e+05          1012            17       {'Pancakes'       }
         14           5.101e+05          1011            19       {'Shawl'          }
         15          8.9975e+05          1011            20       {'Snacks'         }
```

Determine the highest unit cost for all products in the table.

```
max(results.unitCost)
```

```
ans =

    24
```

Now, import the data using a row filter. The filter condition is that `unitCost` must be less than 15.

```
rf = rowfilter("unitcost");
rf = rf.unitcost < 15;
results = fetch(conn,sqlquery,"RowFilter",rf)
```

```
results =

  7×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    ___________________

          9          1.2597e+05          1003            13       {'Victorian Doll' }
          8          2.1257e+05          1001             5       {'Train Set'      }
          2          4.0031e+05          1002             9       {'Painting Set'   }
          1          4.0034e+05          1001            14       {'Building Blocks'}
          5          4.0046e+05          1005             3       {'Tin Soldier'    }
          6          4.0088e+05          1004             8       {'Sail Boat'      }
         11          4.0814e+05          1004            11       {'Convertible'    }
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query Using Import Options

Customize import options when importing data from the results of an SQL query on a database. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different columns in the SQL query. Import data using the `fetch` function.

This example uses the `employees_database.mat` file, which contains the columns `first_name`, `hire_date`, and `DEPARTMENT_NAME`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load employee information into the MATLAB® workspace.

```
employeedata = load('employees_database.mat');
```

Create the `employees` and `departments` database tables using the employee information.

```
emps = employeedata.employees;
depts = employeedata.departments;

sqlwrite(conn,'employees',emps)
sqlwrite(conn,'departments',depts)
```

Create an `SQLImportOptions` object using an SQL query and the `databaseImportOptions` function. This query retrieves all information for employees who are sales managers or programmers.

```
sqlquery = strcat("SELECT * from employees e join departments d ", ...
    "on (e.department_id = d.department_id) WHERE ", ...
    "(job_id = 'IT_PROG' or job_id = 'SA_MAN')");
opts = databaseImportOptions(conn,sqlquery)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
               VariableTypes: {'double', 'char', 'char' ... and 13 more}
       SelectedVariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
                  FillValues: { NaN, '', ''  ... and 13 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 16 VariableOptions
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:

   Variable Options:
                           (1) |            (2) |           (3) |       (4) |              (5) |           (6
         Name: 'employee_id' | 'first_name' | 'last_name' | 'email' | 'phone_number' | 'hire_date
         Type:      'double' |         'char' |        'char' |  'char' |           'char' |       'char
  MissingRule:        'fill' |         'fill' |        'fill' |  'fill' |           'fill' |       'fil
    FillValue:           NaN |             '' |            '' |      '' |               '' |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `hire_date`, `DEPARTMENT_NAME`, and `first_name` variables using the `setoptions` function. Then, display the updated import options. Because `hire_date` stores date and time data, change the data type of this variable to `datetime`. Because `DEPARTMENT_NAME` designates a finite set of repeating values, change the data type of this variable to `categorical`. Also, change the name of this variable to lowercase. Because `first_name` stores text data, change the data type of this variable to `string`.

```
opts = setoptions(opts,'hire_date','Type','datetime');
opts = setoptions(opts,'DEPARTMENT_NAME','Name','department_name', ...
    'Type','categorical');
opts = setoptions(opts,'first_name','Type','string');

vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:

   Variable Options:
                           (1) |            (2) |           (3) |       (4) |              (5) |           (6
         Name: 'employee_id' | 'first_name' | 'last_name' | 'email' | 'phone_number' | 'hire_date
         Type:      'double' |       'string' |        'char' |  'char' |           'char' |   'datetime
  MissingRule:        'fill' |         'fill' |        'fill' |  'fill' |           'fill' |       'fil
    FillValue:           NaN |      <missing> |            '' |      '' |               '' |           Na
```

```
    To access sub-properties of each variable, use getoptions
```

Select the three modified variables using the `SelectVariableNames` property.

```
opts.SelectedVariableNames = ["first_name","hire_date","department_name"];
```

Set the filter condition to import only the data for the employees hired before January 1, 2006.

```
opts.RowFilter = opts.RowFilter.hire_date < datetime(2006,01,01)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
               VariableTypes: {'double', 'string', 'char' ... and 13 more}
       SelectedVariableNames: {'first_name', 'hire_date', 'department_name'}
                  FillValues: { NaN,  <missing>, ''  ... and 13 more }
                   RowFilter: hire_date < 01-Jan-2006

             VariableOptions: Show all 16 VariableOptions
```

Import and display the results of the SQL query using the `fetch` function.

```
employees_data = fetch(conn,sqlquery,opts)
```

```
employees_data=4×3 table
    first_name     hire_date     department_name
    __________    ___________    _______________

    "David"       25-Jun-2005          IT
    "John"        01-Oct-2004          Sales
    "Karen"       05-Jan-2005          Sales
    "Alberto"     10-Mar-2005          Sales
```

Delete the `employees` and `departments` database tables using the `execute` function.

```
execute(conn,'DROP TABLE employees')
execute(conn,'DROP TABLE departments')
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query as Structure

Specify the data return format and the number of imported rows for the results of an SQL query. Import data using an SQL query and the `fetch` function.

This example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Select all data from the `patients` database table and import five rows from the table as a structure. Use the `'DataReturnFormat'` name-value pair argument to specify returning the result data as a structure. Also, use the `'MaxRows'` name-value pair argument to specify five rows. Display the imported data.

```
sqlquery = ['SELECT * FROM ' tablename];
results = fetch(conn,sqlquery,'DataReturnFormat','structure', ...
    'MaxRows',5)
```

```
results = struct with fields:
                    LastName: {5×1 cell}
                      Gender: {5×1 cell}
                         Age: [5×1 double]
                    Location: {5×1 cell}
                      Height: [5×1 double]
                      Weight: [5×1 double]
                      Smoker: [5×1 double]
                    Systolic: [5×1 double]
                   Diastolic: [5×1 double]
    SelfAssessedHealthStatus: {5×1 cell}
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Preserve Variable Names When Importing Data

Import product data from a Microsoft® SQL Server® database table into MATLAB® by using an ODBC connection. The table contains a variable name with a non-ASCII character. When importing data, preserve the names of all the variables.

Create an ODBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = "MSSQLServerAuth";
conn = database(datasource,"","");
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Add a column to the database table `productTable`. The column name contains a non-ASCII character.

```
sqlquery = "ALTER TABLE productTable ADD tamaño varchar(30)";
execute(conn,sqlquery)
```

Import data from the database table `productTable`. The `fetch` function returns a MATLAB table that contains the product data. Display the first three rows of the data in the table.

```
sqlquery = "SELECT * FROM productTable";
data = fetch(conn,sqlquery);
head(data,3)
```

```
ans=3×6 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription     tama_o
    _____________    ___________    ______________    ________    __________________    ________

          9          1.2597e+05          1003            13       {'Victorian Doll'}    {0×0 cha
          8          2.1257e+05          1001             5       {'Train Set'     }    {0×0 cha
          7          3.8912e+05          1007            16       {'Engine Kit'    }    {0×0 cha
```

The `fetch` function converts the name of the new variable into ASCII characters.

Preserve the name of the variable that contains the non-ASCII character by specifying the `VariableNamingRule` name-value pair argument. Import the data again.

```
data = fetch(conn,sqlquery, ...
    'VariableNamingRule',"preserve");
head(data,3)
```

```
ans=3×6 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription     tamaño
    _____________    ___________    ______________    ________    __________________    ________

          9          1.2597e+05          1003            13       {'Victorian Doll'}    {0×0 cha
          8          2.1257e+05          1001             5       {'Train Set'     }    {0×0 cha
          7          3.8912e+05          1007            16       {'Engine Kit'    }    {0×0 cha
```

The `fetch` function preserves the non-ASCII character in the variable name.

Close the database connection.

```
close(conn)
```

Retrieve Metadata Information About Imported Data

Retrieve metadata information when importing data from an SQL query. Import data using the `fetch` function and explore the metadata information by using dot notation.

This example uses the `outages.csv` file, which contains outage data. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MS SQL Server Auth";
conn = database(datasource,"","");
```

Load outage information into the MATLAB® workspace.

```
outages = readtable("outages.csv");
```

Create the `outages` database table using the outage information.

```
tablename = "outages";
sqlwrite(conn,tablename,outages)
```

Import the data into the MATLAB workspace and return metadata information about the imported data.

```
sqlquery = "SELECT * FROM outages";
[results,metadata] = fetch(conn,sqlquery);
```

View the names of the variables in the imported data.

```
metadata.Properties.RowNames
```

```
ans = 6×1 cell
    {'Region'         }
    {'OutageTime'     }
    {'Loss'           }
    {'Customers'      }
    {'RestorationTime'}
    {'Cause'          }
```

View the data type of each variable in the imported data.

```
metadata.VariableType
```

```
ans = 6×1 cell
    {'char'  }
    {'char'  }
    {'double'}
    {'double'}
    {'char'  }
    {'char'  }
```

View the missing data value for each variable in the imported data.

```
metadata.FillValue
```

```
ans=6×1 cell array
    {0×0 char}
    {0×0 char}
    {[   NaN]}
    {[   NaN]}
    {0×0 char}
    {0×0 char}
```

View the indices of the missing data for each variable in the imported data.

```
metadata.MissingRows
```

```
ans=6×1 cell array
    {  0×1 double}
    {  0×1 double}
    {604×1 double}
    {328×1 double}
    { 29×1 double}
    {  0×1 double}
```

Display the first eight rows of the imported data that contain missing restoration time. `data` contains restoration time in the fifth variable. Use the numeric indices to find the rows with missing data.

```
index = metadata.MissingRows{5,1};
nullrestoration = results(index,:);
head(nullrestoration)
```

```
ans=8×6 table
       Region                  OutageTime              Loss      Customers     RestorationTime
    _____________    ___________________________    ______    __________    _______________    _

    {'SouthEast'}    {'2003-01-23 00:49:00.000'}    530.14    2.1204e+05      {0×0 char}       {
    {'NorthEast'}    {'2004-09-18 05:54:00.000'}         0             0      {0×0 char}       {
    {'MidWest'  }    {'2002-04-20 16:46:00.000'}     23141           NaN      {0×0 char}       {
    {'NorthEast'}    {'2004-09-16 19:42:00.000'}      4718           NaN      {0×0 char}       {
    {'SouthEast'}    {'2005-09-14 15:45:00.000'}    1839.2    3.4144e+05      {0×0 char}       {
    {'SouthEast'}    {'2004-08-17 17:34:00.000'}     624.1    1.7879e+05      {0×0 char}       {
    {'SouthEast'}    {'2006-01-28 23:13:00.000'}    498.78           NaN      {0×0 char}       {
    {'West'     }    {'2003-06-20 18:22:00.000'}         0             0      {0×0 char}       {
```

Delete the `outages` database table using the `execute` function.

```
sqlstr = "DROP TABLE ";
sqlquery = strcat(sqlstr,tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Import Data Using SQL Prepared Statement

Create an SQL prepared statement to import data from a Microsoft® SQL Server® database using a JDBC database connection. Use the `SELECT` SQL statement for the SQL query. Import the data from the database and display the results.

Create a JDBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MSSQLServerJDBCAuth';
conn = database(datasource,'','');
```

Create an SQL prepared statement for importing data from the SQL Server database using the JDBC database connection. The question marks in the `SELECT` SQL statement indicate it is an SQL prepared statement. This statement selects all data from the database table `inventoryTable` for the inventory that has an inventory date within a specified date range.

```
query = strcat("SELECT * FROM inventoryTable ", ...
    "WHERE inventoryDate > ? AND inventoryDate < ?");
pstmt = databasePreparedStatement(conn,query)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {[]  []}
```

`pstmt` is an `SQLPreparedStatement` object with these properties:

- `SQLQuery` — SQL prepared statement query
- `ParameterCount` — Parameter count
- `ParameterTypes` — Parameter types
- `ParameterValues` — Parameter values

Bind parameter values in the SQL prepared statement. Select both parameters in the SQL prepared statement using their numeric indices. Specify the values to bind as the inventory date range between January 1, 2014, and December 31, 2014. Match the format of dates in the database. The `bindParamValues` function updates the values in the `ParameterValues` property of the `pstmt` object.

```
selection = [1 2];
values = {"2014-01-01 00:00:00.000", ...
    "2014-12-31 00:00:00.000"};
pstmt = bindParamValues(pstmt,selection,values)
```

```
pstmt = 
  SQLPreparedStatement with properties:

           SQLQuery: "SELECT * FROM inventoryTable where inventoryDate > ? AND inventoryDate < ?"
     ParameterCount: 2
     ParameterTypes: ["string"    "string"]
    ParameterValues: {["2014-01-01 00:00:00.000"]  ["2014-12-31 00:00:00.000"]}
```

Import data from the database using the `fetch` function and bound parameter values. The results contain four rows of data that represent all inventory with an inventory date between January 1, 2014 and December 31, 2014.

```
results = fetch(conn,pstmt)
```

```
results=4×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

          1            1700      14.5     {'2014-09-23 09:38:34'}
          2            1200         9     {'2014-07-08 22:50:45'}
          3             356        17     {'2014-05-14 07:14:28'}
          7            6034        16     {'2014-08-06 08:38:00'}
```

Close the SQL prepared statement and database connection.

```
close(pstmt)
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use the `fetch` function. For procedures that return output arguments, use `runstoredprocedure`.

For information about the SQL query language, see the SQL Tutorial.

Data Types: `char` | `string`

opts — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

pstmt — SQL prepared statement
`SQLPreparedStatement` object

SQL prepared statement, specified as an `SQLPreparedStatement` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = fetch(conn,sqlquery,"MaxRows",50,"DataReturnFormat","structure")` imports 50 rows of data as a structure.

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `fetch` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

`DataReturnFormat` — Data return format
`"table"` (default) | `"cellarray"` | `"numeric"` | `"structure"`

Data return format, specified as the comma-separated pair consisting of `"DataReturnFormat"` and one of these values:

- `"table"`
- `"cellarray"`
- `"numeric"`
- `"structure"`

Use the `"DataReturnFormat"` name-value pair argument to specify the data type of the result data `results`. To specify integer classes for numeric data, use the `opts` input argument.

You can specify these values using character vectors or string scalars.

Example: `"DataReturnFormat","cellarray"` imports data as a cell array.

`VariableNamingRule` — Variable naming rule
`"modify"` (default) | `"preserve"`

Variable naming rule, specified as the comma-separated pair consisting of `'VariableNamingRule'` and one of these values:

- `"modify"` — Remove non-ASCII characters from variable names when the `fetch` function imports data.
- `"preserve"` — Preserve most variable names when the `fetch` function imports data. For details, see the Limitations section.

Example: `'VariableNamingRule',"modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; fetch(conn,sqlquery,"RowFilter",rf)`

Output Arguments

`results` — Result data

table (default) | cell array | structure | numeric matrix

Result data, returned as a table, cell array, structure, or numeric matrix. The result data contains all rows of data from the executed SQL statement by default.

Use the `"MaxRows"` name-value pair argument to specify the number of rows of data to import. Use the `"DataReturnFormat"` name-value pair argument to specify the data type of the result data.

When the executed SQL statement does not return any rows, the result data is an empty table.

`metadata` — Metadata information

table

Metadata information, returned as a table with these variables.

Variable Name	Variable Description	Variable Data Type
`VariableType`	Data type of each variable in the imported data	Cell array of character vectors
`FillValue`	Value of missing data for each variable in the imported data	Cell array of missing data values
`MissingRows`	Indices for each occurrence of missing data in each variable of the imported data	Cell array of numeric indices

By default, the `fetch` function imports text data as a character vector and numeric data as a double. `FillValue` is an empty character array (for text data) or `NaN` (for numeric data) by default. To change the missing data value to another value, use the `SQLImportOptions` object.

The `RowNames` property of the `metadata` table contains the names of the variables in the imported data.

Limitations

The name-value argument `MaxRows` has these limitations:

- If you are using Microsoft Access, the native ODBC interface is not supported.
- Not all database drivers support setting the maximum number of rows before query execution. For an unsupported driver, modify your SQL query to limit the maximum number of rows to return. The SQL syntax varies with the driver. For details, consult the driver documentation.

The name-value argument `VariableNamingRule` has these limitations:

- The `fetch` function returns an error if you specify the `VariableNamingRule` name-value argument and set the `DataReturnFormat` name-value argument to `"cellarray"`, `"structure"`, or `"numeric"`.
- The `fetch` function returns a warning if you set the `VariableNamingRule` property of the `SQLImportOptions` object to `"preserve"` and set the `DataReturnFormat` name-value argument to `"structure"`.

- The `fetch` function returns an error if you use the `VariableNamingRule` name-value argument with the `SQLImportOptions` object `opts`.
- If you set the `VariableNamingRule` name-value argument to the value `"modify"`:
  - These variable names are reserved identifiers for the `table` data type: `Properties`, `RowNames`, and `VariableNames`.
  - The length of each variable name must be less than the number returned by `namelengthmax`.

The name-value argument `RowFilter` has this limitation:

- The `fetch` function returns an error if you specify the `RowFilter` name-value argument with the `SQLImportOptions` object `opts`. It is ambiguous which of the `RowFilter` object to use in this case, especially if the filter conditions are different.

Tips

- The order of records in your database does not remain constant. Sort data using the SQL `ORDER BY` command in your `sqlquery` statement.
- For Microsoft Excel, tables in `sqlquery` are Excel worksheets. By default, some worksheet names include a `$` symbol. To select data from a worksheet with this name format, use an SQL statement of the form `SELECT * FROM "Sheet1$"` (or `'Sheet1$'`).
- Before you modify database tables, ensure that the database is not open for editing. If you try to edit the database while it is open, you receive this MATLAB error:

  ```
  [Vendor][ODBC Driver] The database engine could not lock
  table 'TableName' because it is already in use by
  another person or process.
  ```
- The PostgreSQL database management system supports multidimensional fields, but SQL `SELECT` statements fail when retrieving these fields unless you specify an index.
- Some databases require that you include a symbol, such as `#`, before and after a date in a query, as follows:

  ```
  execute(conn,'SELECT * FROM mydb WHERE mydate > #03/05/2005#')
  ```
- Executing the `fetch` function with the `opts` input argument and the `DataReturnFormat` name-value argument set to the `"numeric"` value has no effect. A corresponding warning message appears in the Command Window.

Alternative Functionality

App

The `fetch` function imports data using the command line. To import data interactively, use the Database Explorer app.

Version History

Introduced in R2006b

R2023a: Selectively import rows of data based on filter condition

You can use the `RowFilter` name-value argument to selectively import rows of data from a database table.

R2018b: `fetch` function returns results as a table
Behavior changed in R2018b

The `fetch` function returns results as a table instead of a cell array, by default. In prior releases, when the `fetch` function found no data to import, it returned a cell array containing the character vector `'No Data'`. Now, when the function finds no data to import, it returns an empty table.

R2018b: `fetch` function ignores `'DataReturnFormat'`, `'NullNumberRead'`, and `'NullStringRead'` database preferences
Behavior changed in R2018b

The `fetch` function ignores these database preferences:

- `'DataReturnFormat'`
- `'NullNumberRead'`
- `'NullStringRead'`

You can set the data type of the imported data by using the `'DataReturnFormat'` name-value pair argument of the `fetch` function. For more customization of data types and fill values for missing data in the imported data, use the `SQLImportOptions` object.

See Also

Functions
`close` | `database` | `databaseImportOptions` | `setoptions` | `getoptions` | `reset` | `execute` | `databasePreparedStatement` | `bindParamValues` | `close`

Topics
“Import Data from Database Table Using sqlread Function” on page 5-58
“Retrieve Image Data Types” on page 5-48
“Data Import Memory Management” on page 5-20
“Customize Options for Importing Data from Database into MATLAB” on page 5-67
“Importing Data Common Errors” on page 3-3
“Import Data Using SQL Prepared Statement with Multiple Parameter Values” on page 5-75
“SQL Prepared Statement Error Messages” on page 3-16

External Websites
SQL Tutorial

get

Namespace: `database.odbc`

(To be removed) Retrieve object properties

Note The `get` function will be removed in a future release. There is no replacement for this functionality. To import data, use the `fetch` function. For details, see “Compatibility Considerations”.

Syntax

```
s = get(object)
v = get(object,property)
```

Description

`s = get(object)` returns the structure `s`, which contains the `object` and its corresponding properties.

`v = get(object,property)` returns the value `v` of `property` for the `object`.

Examples

Get `cursor` Object Properties

Retrieve the properties of a `cursor` object.

Establish an ODBC database connection to a MySQL database with the user name `username` and password `pwd`.

```
conn = database('MySQL','username','pwd');
```

Create a `cursor` object.

```
curs = exec(conn,'SELECT * FROM inventoryTable');
```

Retrieve the properties of `curs` and assign them as fields in the structure `v`.

```
v = get(curs)
```

```
v = 

  struct with fields:

         Data: 0
     RowLimit: 0
     SQLQuery: 'SELECT * FROM inventoryTable'
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
   Scrollable: 0
     Position: []
```

Display the SQL query in the `cursor` object.

```
v.SQLQuery

ans =

    'SELECT * FROM inventoryTable'
```

Close the `cursor` object and database connection.

```
close(curs)
close(conn)
```

Input Arguments

`object` — Database Toolbox object

`cursor` object

Database Toolbox object, specified as a `cursor` object.

`property` — Property of Database Toolbox object

character vector | string scalar

Property of the Database Toolbox object, specified as a character vector or string scalar.

The following table shows available property names and returned values.

`cursor` Object Property	Description
`'Data'`	Data in the `cursor` object data element (the query results).
`'RowLimit'`	Maximum number of rows.
`'SQLQuery'`	SQL statement for a `cursor` object, as specified by `exec`.
`'Message'`	Error message returned from `exec` or `fetch`.
`'Type'`	Object type, specifically `'Database Cursor Object'`.
`'Statement'`	Handle to Java statement object.
`'Scrollable'`	Logical value to identify the `cursor` object as scrollable or basic. This property is set to 1 for a scrollable cursor and 0 otherwise. This property is hidden and read-only.
`'Position'`	Current position of the cursor in the data set. This property is available only for a scrollable cursor. This property behaves differently for native ODBC, JDBC, and other database drivers. This property is read-only.

Data Types: `char` | `string`

Output Arguments

`s` — Object properties

structure

Object properties, returned as a structure that contains the object and its corresponding properties.

`v` — Object property value

character vector | numeric scalar | cell array | object

Object property value, returned as a character vector, numeric scalar, cell array, or object.

Version History

Introduced before R2006a

R2021a: `get` function will be removed

Warns starting in R2021a

The `get` function will be removed in a future release. Use the `fetch` function to import data. Some differences between the workflows might require updates to your code.

Update Code

Use the `fetch` function with the `connection` object to import data from a database in one step.

In prior releases, you wrote multiple lines of code to create the `cursor` object, retrieve object properties, and import data. For example:

```
curs = exec(conn,sqlquery);
curs = fetch(curs);
s = get(curs);
results = curs.Data;
close(curs)
```

Now you can import data in one step using the `fetch` function.

```
results = fetch(conn,sqlquery);
```

There is no replacement functionality for the `get` function.

See Also

`getdatasources` | `fetch` | `database` | `sqlfind`

Topics

"Retrieve Database Metadata" on page 5-64

External Websites

SQL Tutorial

getdatasources

(To be removed) Return names of ODBC and JDBC data sources

Note The `getdatasources` function will be removed in a future release. Use the `listDataSources` function instead.

Syntax

`d = getdatasources`

Description

`d = getdatasources` returns the names of valid ODBC and JDBC data sources on the system.

Examples

Retrieve Data Source Names

Connect to a database using its data source name.

Retrieve all ODBC and JDBC data source names on the system.

```
d = getdatasources
```

```
d =

  1×11 cell array

  Columns 1 through 3

    'Excel Files'    'MS Access Database'    'MS SQL Server'

...
```

`d` is a cell array of character vectors. Each character vector is a data source name that is defined on the system.

Use the data source name in the `database` function to connect to a database at the command line. Or, in the Database Explorer app, click **New Query** and then select the data source name from the **Data Source** list.

Output Arguments

d — Data sources
cell array of character vectors

Data sources, returned as a cell array of character vectors.

`d` is empty when the `ODBC.INI` file is valid, but no defined data sources exist.

For ODBC data sources, the `getdatasources` function retrieves data source names from the `ODBC.INI` file located in the folder returned by running:

```
myODBCdir = getenv('WINDIR')
```

The function also retrieves the names of data sources that are in the system registry but not in the `ODBC.INI` file.

For JDBC data sources, the `getdatasources` function retrieves data source names that you define using the JDBC Data Source Configuration dialog box in the Database Explorer app.

Version History

Introduced before R2006a

See Also

Functions

`database` | `listDataSources`

Apps

Database Explorer

Topics

"Connect to Database" on page 2-129
"Configure Driver and Data Source" on page 2-14

insert

Namespace: `database.odbc`

(To be removed) Add MATLAB data to database tables

Note The `insert` function will be removed in a future release. Use the `sqlwrite` function instead. For details, see "Compatibility Considerations".

Syntax

`insert(conn,tablename,colnames,data)`

Description

`insert(conn,tablename,colnames,data)` exports data from the MATLAB workspace and inserts it into an existing database table using the database connection `conn`. You can specify the database table name and column names, and specify the data for insertion into the database.

If `conn` is a JDBC database connection, then the `insert` function has the same functionality as the `fastinsert` function.

Examples

Insert Table Record Using Native ODBC

Create an ODBC database connection to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with `admin` as the user name and password.

```
conn = database('dbdemo','admin','admin');
```

This database contains the table `producttable` with these columns:

- `productnumber`
- `stocknumber`
- `suppliernumber`
- `unitcost`
- `productdescription`

Select and display the data from the `producttable` table. The `cursor` object contains the executed query. Import the data from the executed query using the `fetch` function.

```
curs = exec(conn,'SELECT * FROM producttable');
curs = fetch(curs);
curs.Data
```

```
ans =

    productnumber    stocknumber    suppliernumber    unitcost    productdescription
```

```
    -------------    ----------    -------------    --------    ------------------
     9               125970        1003             13          'Victorian Doll'
     8               212569        1001              5          'Train Set'
     7               389123        1007             16          'Engine Kit'
     2               400314        1002              9          'Painting Set'
     4               400339        1008             21          'Space Cruiser'
     1               400345        1001             14          'Building Blocks'
     5               400455        1005              3          'Tin Soldier'
     6               400876        1004              8          'Sail Boat'
     3               400999        1009             17          'Slinky'
    10               888652        1006             24          'Teddy Bear'
```

Store the column names of `producttable` in a cell array.

```
colnames = {'productnumber','stocknumber','suppliernumber',...
    'unitcost','productdescription'};
```

Store data for insertion in the cell array `data` that contains these values:

- `productnumber` equal to 11
- `stocknumber` equal to 400565
- `suppliernumber` equal to 1010
- `unitcost` equal to $10
- `productdescription` equal to `'Rubik''s Cube'`

Then, convert the cell array to the table `data_table`.

```
data = {11,400565,1010,10,'Rubik''s Cube'};
data_table = cell2table(data,'VariableNames',colnames)
```

```
data_table = 

    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    -------------    -----------    --------------    --------    ------------------
    11               400565         1010              10          'Rubik's Cube'
```

Insert the table data into `producttable`.

```
tablename = 'producttable';
insert(conn,tablename,colnames,data_table)
```

Display the data from `producttable` again.

```
curs = exec(conn,'SELECT * FROM producttable');
curs = fetch(curs);
curs.Data
```

```
ans = 

    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    -------------    -----------    --------------    --------    ------------------
     9               125970         1003              13          'Victorian Doll'
     8               212569         1001               5          'Train Set'
     7               389123         1007              16          'Engine Kit'
     2               400314         1002               9          'Painting Set'
     4               400339         1008              21          'Space Cruiser'
     1               400345         1001              14          'Building Blocks'
     5               400455         1005               3          'Tin Soldier'
     6               400876         1004               8          'Sail Boat'
     3               400999         1009              17          'Slinky'
    10               888652         1006              24          'Teddy Bear'
    11               400565         1010              10          'Rubik's Cube'
```

A new row appears in `producttable` with the data from `data_table`.

After you finish working with the `cursor` object, close it.

```
close(curs)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
sqlite object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

colnames — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table `tablename`.

Example: `{'col1','col2','col3'}`

Data Types: `cell` | `string`

data — Insert data
cell array | numeric matrix | table | dataset | structure

Insert data, specified as a cell array, numeric matrix, table, dataset array, or structure. These values depend on the type of database connection.

For a `connection` object, you do not specify the type of data that you are exporting. The `insert` function exports the data in its current MATLAB format. If `data` is a structure, then field names in the structure must match `colnames`. If `data` is a table or a dataset array, then the variable names in the table or dataset array must match `colnames`. If `data` is a structure, table, or dataset array, then specify each field or variable as a:

- Cell array
- Double vector of size m-by-1, where m is the number of rows to insert

For a `sqlite` object, the dataset array is not supported. Only `double`, `int64`, and `char` data types are supported.

Alternative Functionality

To export MATLAB data into a database, you can use the `datainsert` and `fastinsert` functions. For maximum performance, use `datainsert`.

Version History

Introduced before R2006a

R2022a: `insert` function will be removed

Warns starting in R2022a

The `insert` function will be removed in a future release. Use the `sqlwrite` function instead. Some differences between the workflows require updates to your code.

Update Code

In prior releases, you specified a cell array when exporting data from the MATLAB workspace into a database. For example:

```
colnames = {'month','salestotal','revenue'};
data = {'March',50,2000};
tablename = 'yearlysales';
insert(conn,tablename,colnames,data)
```

Now the `sqlwrite` function requires you to specify the data to export as a table.

```
colnames = {'month','salestotal','revenue'};
d = {'March',50,2000};
data = cell2table(d,'VariableNames',colnames);
tablename = 'yearlysales';
sqlwrite(conn,tablename,data)
```

See Also

`sqlwrite` | `database` | `commit` | `rollback` | `close`

Topics

"Insert Data into Database Table" on page 5-61
"Export Data Using Bulk Insert" on page 5-13
"Roll Back Data After Updating Record" on page 5-9
"Data Type Support" on page 1-3

External Websites

SQL Tutorial

insert

Add MATLAB data to SQLite database table

Note The `insert` function will be removed in a future release. Use the `sqlwrite` function instead. For details, see "Compatibility Considerations".

Syntax

`insert(conn,tablename,colnames,data)`

Description

`insert(conn,tablename,colnames,data)` exports data from the MATLAB workspace and inserts it into an existing database table by using the SQLite database connection `conn`. You can specify the database table name and column names, and specify the data to be inserted into the database.

Examples

Insert Table Record Using MATLAB® Interface to SQLite

Create a table in a new SQLite database file, and then insert a new row of data into the table.

Create the SQLite connection `conn` to the new SQLite database file `tutorial.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,'tutorial.db');

conn = sqlite(dbfile,'create');
```

Create the table `inventoryTable` using `exec`.

```
createInventoryTable = ['create table inventoryTable ' ...
    '(productNumber NUMERIC, Quantity NUMERIC, ' ...
    'Price NUMERIC, inventoryDate VARCHAR)'];

exec(conn,createInventoryTable)
```

`inventoryTable` is an empty table in `tutorial.db`.

Insert a row of data into `inventoryTable`.

```
colnames = {'productNumber','Quantity','Price','inventoryDate'};

insert(conn,'inventoryTable',colnames, ...
    {20,150,50.00,'11/3/2015 2:24:33 AM'})
```

Close the SQLite connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
sqlite object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: "employees"

Data Types: string | char

colnames — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table `tablename`.

Example: {'col1','col2','col3'}

Data Types: cell | string

data — Insert data
numeric matrix | structure | table | cell array

Insert data, specified as a numeric matrix, structure, table, or cell array.

Version History

Introduced in R2016a

R2022a: insert function will be removed
Not recommended starting in R2022a

The `insert` function will be removed in a future release. Use the `sqlwrite` function to import data. Some differences between the workflows might require updates to your code.

Update Code

Use the `sqlwrite` function with the `sqlite` object to export data from a SQLite database.

In prior releases, you exported data using the `insert` function. For example:

```
tablename = 'inventoryTable';
colnames = {'productNumber','Quantity','Price','inventoryDate'};
insert(conn,tablename,colnames, ...
    {20,150,50.00,'11/3/2015 2:24:33 AM'})
```

Now you can export data using the `sqlwrite` function.

```
tablename = "productTable";
data = table(30,500000,1000,25,"Rubik's Cube", ...
```

```
    'VariableNames',["productNumber" "stockNumber" ...
    "supplierNumber" "unitCost" "productDescription"]);
sqlwrite(conn,tablename,data)
```

See Also

`close` | `sqlite` | `exec` | `fetch`

Topics

"Import Data Using MATLAB Interface to SQLite" on page 5-32
"Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5

External Websites

SQL Tutorial

listDataSources

List all available data sources

Syntax

`list = listDataSources()`

Description

`list = listDataSources()` returns a list of all available data sources on the system. Specify a data source name using the `database` function to connect to a database at the command line. Or, in the Database Explorer app, click **Connect** in the **Connections** section, and then select a data source name from the list.

Examples

Retrieve All Data Sources

Retrieve a list of all data sources on the system.

```
list = listDataSources
```

```
list=2×3 table
            Name              DriverType            Vendor
    _____________________    __________    ______________________

    "MSSQLServerAuth"          "ODBC"      <missing>
    "MSSQLServerJDBCAuth"      "JDBC"      "Microsoft SQL Server"
```

`list` is a table with three variables for the data source name, driver type, and database vendor. The variable for the database vendor contains values for JDBC and native interfaces only.

Each row represents an existing data source on the system.

Output Arguments

`list` — List of data sources
table

List of data sources, returned as a table.

For ODBC interfaces, the `listDataSources` function retrieves data sources that you define using the ODBC Data Source Administrator dialog box, which you can open by using the `configureODBCDataSource` function.

For JDBC and native interfaces, the `listDataSources` function retrieves data sources that you define using the JDBC Data Source Configuration dialog box or the `databaseConnectionOptions` function at the command line.

Version History

Introduced in R2020b

See Also

Functions
`database` | `configureODBCDataSource` | `databaseConnectionOptions`

Apps
Database Explorer

Topics
"Connect to Database" on page 2-129
"Configure Driver and Data Source" on page 2-14

rollback

Namespace: database.odbc

Undo database changes

Syntax

rollback(conn)

Description

rollback(conn) reverses changes made to a database using datainsert, fastinsert, insert, or update via the database connection conn. The rollback function reverses all changes made since the last COMMIT or ROLLBACK operation. To use rollback, the AutoCommit flag for conn must be off.

Note If the database engine is not InnoDB, rollback does not roll back data in MySQL databases.

Examples

1. Ensure that the AutoCommit flag for connection conn is off by running:

```
conn.AutoCommit
ans =
    'off'
```

2. Insert data contained in exdata into the columns DEPTNO, DNAME, and LOC, in the table DEPT, for the data source conn.

```
datainsert(conn,'DEPT',...
{'DEPTNO';'DNAME';'LOC'},exdata)
```

3. Roll back the data exdata that you inserted into the database by running:

```
rollback(conn)
```

The database contains the original data present before running datainsert.

Tips

For ODBC connections, you can use the rollback function with the native ODBC interface. For details, see database.

Version History

Introduced before R2006a

See Also

commit | datainsert | insert | update | get | database

Topics

"Roll Back Data After Updating Record" on page 5-9
"Insert Data into Database Table" on page 5-61
"Replace Existing Data in Database" on page 5-12

rollback

Undo changes to SQLite database file

Syntax

```
rollback(conn)
```

Description

`rollback(conn)` reverses changes that you made to a database using functions such as `sqlwrite` with the MATLAB interface to SQLite. The `rollback` function reverses all changes made after the last `COMMIT` or `ROLLBACK` operation. To use this function, you must set the `AutoCommit` property of the `sqlite` object to `off`.

Examples

Reverse Changes Made to SQLite Database

Use the MATLAB® interface to SQLite to insert product data from MATLAB into a new table in an SQLite database. Then, reverse the changes made to the database.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Allow manual committing of changes to the database by setting the `AutoCommit` property to `off`.

```
conn.AutoCommit = "off";
```

Create a MATLAB table that contains data for two products. The data is stored in the `productTable` and `suppliers` tables.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new table named `toyTable`.

```
tablename = "toyTable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________
```

```
         30              5e+05             1000             25          "Rubik's Cube"
         40              6e+05             2000             30          "Doll House"
```

Reverse the changes made to the database.

```
rollback(conn)
```

Import and display the contents of the database table again. The results are empty.

```
rows = sqlread(conn,tablename)
```

```
rows = 

  0x5 empty table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________
```

Delete the new table to maintain the dataset.

```
sqlquery = "DROP TABLE toyTable";
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
sqlite object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

Version History

Introduced in R2022a

See Also

Objects
`sqlite`

Functions
`execute` | `fetch` | `sqlwrite` | `close`

Topics
"Insert Data into SQLite Database Table" on page 5-36
"Create Table and Add Column in SQLite Database" on page 5-38
"Delete Data from SQLite Database" on page 5-39
"Roll Back Data in SQLite Database" on page 5-41

executeSQLScript

Namespace: `database.odbc`

Execute SQL script on database

Syntax

```
results = executeSQLScript(conn,scriptfile)
results = executeSQLScript(conn,scriptfile,Name,Value)
```

Description

`results = executeSQLScript(conn,scriptfile)` uses the database connection `conn` to return a structure array that contains results as a table (by default) for each executed SQL `SELECT` statement in the SQL script file. For any non-`SELECT` SQL statements, the corresponding table is empty. The `executeSQLScript` function executes all SQL statements in the SQL script file.

`results = executeSQLScript(conn,scriptfile,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'DataReturnFormat','cellarray'` stores the results of an executed SQL statement as a cell array. The results are stored in the `Data` field of the structure array.

Examples

Execute SQL Script

Connect to a Microsoft® SQL Server® database. Then, run two SQL `SELECT` statements from the SQL script file `compare_sales.sql`, import the results, and perform simple sales data analysis. The file contains two SQL queries in order. The first SQL query retrieves sales of products from US suppliers and the second SQL query retrieves sales of products from foreign suppliers.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Execute the SQL script. The SQL script has two SQL queries that retrieve sales data from US and foreign suppliers, respectively.

```
scriptfile = 'compare_sales.sql';
results = executeSQLScript(conn,scriptfile)
```

```
results = 1×2 struct array with fields:
    SQLQuery
    Data
    Message
```

The `executeSQLScript` function returns a structure array that contains two tables in the `Data` field. The first table contains the results of executing the first SQL query in the SQL script file. The second table contains the results of executing the second SQL query.

Display the first eight rows of imported data for the second SQL query in the SQL script file. The data shows sales results from foreign suppliers.

```
data = head(results(2).Data)
```

```
data=8×6 table
    productDescription              supplierName                city       Jan_Sales    Feb_Sales
    __________________    ________________________________    __________    _________    _________

     'Victorian Doll'     'Wacky Widgets'                     'Adelaide'      1400         1100
     'Painting Set'       'Terrific Toys'                     'London'        3000         2400
     'Sail Boat'          'Incredible Machines'               'Dublin'        3000         2400
     'Slinky'             'Doll's Galore'                     'London'        3000         1500
     'Convertible'        'Incredible Machines'               'Dublin'        6000         3100
     'Hugsy'              'The Great Teddy Bear Company'      'Belfast'       1800         9700
     'Pancakes'           'Aunt Jemimas'                      'New York'      3100         9400
     'Shawl'              'Indian Export'                     'Mumbai'         235         1800
```

Retrieve the variable names in the table.

```
names = data.Properties.VariableNames
```

```
names = 1×6 cell array
    {'productDescription'}    {'supplierName'}    {'city'}    {'Jan_Sales'}    {'Feb_Sales'}
```

Determine the highest sales amount in January.

```
max(data.Jan_Sales)
```

```
ans = 6000
```

Close the database connection.

```
close(conn)
```

Execute SQL Script and Return Results as Structures

Connect to a Microsoft® SQL Server® database. Then, run two SQL `SELECT` statements from the SQL script file `compare_sales.sql`. Import the results from the SQL queries as structures and perform simple sales data analysis. The file contains two SQL queries in order. The first SQL query retrieves sales of products from US suppliers and the second SQL query retrieves sales of products from foreign suppliers.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Execute the SQL script. The SQL script has two SQL queries that retrieve sales data from US and foreign suppliers, respectively. Specify `structure` as the data return format for importing the query results.

```
scriptfile = 'compare_sales.sql';
results = executeSQLScript(conn,scriptfile, ...
    'DataReturnFormat','structure')
```

```
results = 1×2 struct array with fields:
    SQLQuery
    Data
    Message
```

The `executeSQLScript` function returns a structure array that contains two structures in the `Data` field. The first structure contains the results of executing the first SQL query in the SQL script file. The second structure contains the results of executing the second SQL query.

Display the imported data for the second SQL query in the SQL script file. The data contains sales results from foreign suppliers.

```
data = results(2).Data
```

```
data = struct with fields:
    productDescription: {9×1 cell}
          supplierName: {9×1 cell}
                  city: {9×1 cell}
             Jan_Sales: [9×1 double]
             Feb_Sales: [9×1 double]
             Mar_Sales: [9×1 double]
```

Determine the highest sales amount in January.

```
max(data.Jan_Sales)
```

```
ans = 6000
```

Close the database connection.

```
close(conn)
```

Input Arguments

`conn` — Database connection

`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

`scriptfile` — Name of SQL script file

character vector | string scalar

Name of SQL script file that contains one or more SQL statements to run, specified as a character vector or string scalar. The file must be a text file and can contain comments in addition to SQL queries. Start single-line comments with `--`. Enclose multiline comments in `/*...*/`.

The SQL script file can contain one or more SQL statements terminated by either a semicolon or the keyword `GO`. The following is an example of two SQL `SELECT` statements.

```
SELECT productDescription, supplierName
FROM suppliers A, productTable B
WHERE A.SupplierNumber = B.SupplierNumber;

SELECT supplierName, Country
FROM suppliers;
```

Example: `'C:\work\sql_file.sql'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = executeSQLScript(conn,scriptfile,'DataReturnFormat','numeric','ErrorHandling','store')` returns query results as a numeric matrix in the `Data` field of the `results` structure array and stores any error message in the `Message` field of `results`.

`DataReturnFormat` — Data return format

`'table'` (default) | `'cellarray'` | `'numeric'` | `'structure'`

Data return format, specified as the comma-separated pair consisting of `'DataReturnFormat'` and one of these values:

- `'table'`
- `'cellarray'`
- `'numeric'`
- `'structure'`

You can specify these values using character vectors or string scalars.

The `'DataReturnFormat'` name-value pair argument specifies the data type of the `Data` field in the `results` structure array.

Example: `'DataReturnFormat','structure'` returns a structure array that contains query results stored in structures.

`ErrorHandling` — Error handling
`'report'` (default) | `'store'`

Error handling, specified as the comma-separated pair consisting of `'ErrorHandling'` and one of these values:

- `'report'` — When an SQL statement fails to execute, stop execution of the remaining SQL statements in the SQL script file and display an error message at the command line.
- `'store'` — When an SQL statement fails to execute, store an error message in the `Message` field of the `results` structure array.

You can specify these values using character vectors or string scalars.

Example: `'ErrorHandling','report'` displays an error message at the command line.

Output Arguments

`results` — Query results
structure array

Query results from executed SQL statements in the SQL script file, returned as a structure array with these fields.

Field Name	Field Data Type	Field Description
`SQLQuery`	character vector	Stores the SQL statement or statements executed in the SQL script file.
`Data`	• table (default) • cell array • numeric matrix • structure	Stores the results of executed SQL `SELECT` statements. The `'DataReturnFormat'` name-value pair argument specifies the data type of the `Data` field. For non-`SELECT` SQL statements, the `Data` field is an empty double, which means the executed SQL query has no results.
`Message`	character vector	Stores an error message for the respective SQL statement that fails to execute. The `Message` field contains an error message only if you specify the `'ErrorHandling'` name-value pair argument with the value `'store'`.

The number of elements in the structure array is equal to the number of SQL statements in the SQL script file. `results(M)` contains the results from executing the `M`th SQL statement in the SQL script file. If the SQL statement returns query results, then the results are stored in `results(M).Data`.

For details about accessing structure arrays, see “Structure Arrays”.

Limitations

- Use the `executeSQLScript` function to import data into MATLAB, especially if you have long and complex SQL queries that are difficult to convert into MATLAB character vectors or string scalars. The `executeSQLScript` function does not support SQL scripts containing continuous PL/SQL blocks with `BEGIN` and `END`, such as stored procedure definitions or trigger definitions. However, `executeSQLScript` does support table definitions.
- An SQL script containing either of the following can produce unexpected results:
  - Apostrophes that are not escaped, including those in comments. For example, write the character vector `'Here's the code'` as `'Here''s the code'`.
  - Nested comments.
- An SQL script containing more than 25,000 characters causes the `executeSQLScript` function to return an error.

Version History

Introduced in R2019a

See Also

`database` | `close`

Topics

“Import Data from Database Table Using sqlread Function” on page 5-58
“Configure Driver and Data Source” on page 2-14
“Generate SQL Query and MATLAB Script” on page 4-20
“Data Import Using Database Explorer App or Command Line” on page 2-133

External Websites

SQL Tutorial

runsqlscript

Namespace: `database.odbc`

(To be removed) Run SQL script on database

Note The `runsqlscript` function will be removed in a future release. Use the `executeSQLScript` function instead. For details, see "Compatibility Considerations".

Syntax

```
results = runsqlscript(conn,scriptfile)
results = runsqlscript( ___ ,Name,Value)
```

Description

`results = runsqlscript(conn,scriptfile)` returns a `cursor` object array that contains a `cursor` object for each executed SQL command in the SQL script file `scriptfile` using the database connection. The `runsqlscript` function executes all SQL commands in the SQL script file.

`results = runsqlscript( ___ ,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'RowInc',5` returns results from the executed SQL statements in the SQL script file in increments of five rows at a time.

Examples

Run SQL Script

First, connect to the Microsoft® SQL Server® database. Then, run two SQL `SELECT` statements from a SQL script file. Perform simple sales data analysis. Close the database connection.

To find the SQL script file, navigate to `\toolbox\database\dbdemos\compare_sales.sql` in your MATLAB® root folder. Copy and paste the path into your current working folder.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Run the SQL script. The SQL script has two queries. When the SQL script executes, it returns two `cursor` objects that contain the imported data from each query in a `cursor` object array.

```
scriptfile = 'compare_sales.sql';

results = runsqlscript(conn,scriptfile)
```

```
results = 

  1×2 cursor array with properties:

    Data
    RowLimit
    SQLQuery
    Message
    Type
    Statement
    Position
```

Display the `cursor` object for the second query.

```
results(2)
```

```
ans = 

  cursor with properties:

         Data: [9×6 table]
     RowLimit: 0
     SQLQuery: 'select      productDescription, supplierName, city, January as Jan_Sales, Februar
      Message: []
         Type: 'ODBCCursor Object'
    Statement: [1×1 database.internal.ODBCStatementHandle]
```

Display the imported data for the second query.

```
data = results(2).Data
```

```
data =

  9×6 table

    productDescription            supplierName               city       Jan_Sales    Feb_Sales
    __________________    ______________________________    __________    _________    _________

    'Victorian Doll'      'Wacky Widgets'                   'Adelaide'    1400         1100
    'Painting Set'        'Terrific Toys'                   'London'      3000         2400
    'Sail Boat'           'Incredible Machines'             'Dublin'      3000         2400
    'Slinky'              'Doll's Galore'                   'London'      3000         1500
    'Convertible'         'Incredible Machines'             'Dublin'      6000         3100
    'Hugsy'               'The Great Teddy Bear Company'    'Belfast'     1800         9700
    'Pancakes'            'Aunt Jemimas'                    'New York'    3100         9400
    'Shawl'               'Indian Export'                   'Mumbai'       235         1800
```

```
    'Snacks'              'Indian Export'                     'Mumbai'       123         1700
```

Retrieve the column names for the second query.

```
names = columnnames(results(2))
```

```
names =

    ''productDescription','supplierName','city','Jan_Sales','Feb_Sales','Mar_Sales''
```

Determine the highest sales amount in January.

```
max(data.Jan_Sales)
```

```
ans =

        6000
```

Close the `cursor` object array and database connection.

```
close(results)
close(conn)
```

Run SQL Script in Row Increments

First, connect to the Microsoft® SQL Server® database. Then, run two SQL `SELECT` statements from a SQL script file. Import data in one-row increments. Perform simple sales data analysis. Close the database connection.

To find the SQL script file, navigate to `\toolbox\database\dbdemos\compare_sales.sql` in your MATLAB® root folder. Copy and paste the path into your current working folder.

Create an ODBC database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Run the SQL script and specify one-row increments. The SQL script has two queries. When the SQL script executes, it returns two `cursor` objects that contain the imported data from each query in a `cursor` object array.

```
results = runsqlscript(conn,'compare_sales.sql','RowInc',1)
```

```
results = 

  1×2 cursor array with properties:

    Data
    RowLimit
    SQLQuery
    Message
    Type
    Statement
    Position
```

Display the imported data for the second query.

```
results(2).Data
```

```
ans =

  1×6 table

    productDescription     supplierName        city       Jan_Sales    Feb_Sales    Mar_Sales
    __________________    _______________    __________    _________    _________    _________

    'Victorian Doll'      'Wacky Widgets'    'Adelaide'    1400         1100         981
```

Because of the one-row increment specification, only the first row of data is displayed.

Import the next row of data using the `fetch` function and display it.

```
curs = fetch(results(2),1);
curs.Data
```

```
ans =

  1×6 table

    productDescription     supplierName       city      Jan_Sales    Feb_Sales    Mar_Sales
    __________________    _______________    ________    _________    _________    _________

    'Painting Set'        'Terrific Toys'    'London'    3000         2400         1800
```

Determine the highest sales amount among the months of January, February, and March.

```
data = curs.Data;
max([data.Jan_Sales data.Feb_Sales data.Mar_Sales])
```

```
ans =

        3000
```

Close the `cursor` object array, `cursor` object, and database connection.

```
close(results)
close(curs)
close(conn)
```

Input Arguments

conn — Database connection

connection object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

scriptfile — SQL script file name

character vector | string scalar

SQL script file name that contains SQL statements to run, specified as a character vector or string scalar. The file must be a text file and can contain comments along with SQL queries. Start single-line comments with `--`. Enclose multiline comments in `/*...*/`.

Example: `'C:\work\sql_file.sql'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = runsqlscript(conn,scriptfile,'RowInc',3,'QTimeOut',60);`

RowInc — Row limit

`0` (default) | numeric scalar

Row limit indicating the number of rows to retrieve at a time, specified as the comma-separated pair consisting of `'RowInc'` and a positive numeric scalar. Use this name-value pair argument when importing large amounts of data. Importing data in increments helps reduce overall retrieval time.

By default, the `runsqlscript` function imports all rows of data from the executed SQL statements. The value `0` specifies to import all rows of data.

Example: `'RowInc',5`

Data Types: `double`

QTimeOut — Query timeout

`0` (default) | numeric scalar

Query timeout in seconds, specified as the comma-separated pair consisting of `'QTimeOut'` and a positive numeric scalar. By default, the `runsqlscript` function waits an unlimited number of seconds to execute SQL statements in the SQL script file. The value `0` specifies to wait an unlimited amount of time.

Example: `'QTimeOut',180`

Data Types: `double`

Output Arguments

`results` — Query results
`cursor` object array

Query results from executing the SQL commands in the SQL script file, returned as a `cursor` object array. The number of elements in `results` is equal to the number of batches on page 12-296 in the file `scriptfile`.

`results(M)` contains the results from executing the `M`th batch in the SQL script. If the batch returns a result set, then it is stored in `results(M).Data`.

Limitations

- Use `runsqlscript` to import data into MATLAB, especially if you have long and complex SQL queries that are difficult to convert into MATLAB character vectors or string scalars. `runsqlscript` is not designed to handle SQL scripts containing continuous PL/SQL blocks with `BEGIN` and `END`, such as stored procedure definitions or trigger definitions. However, table definitions do work.
- An SQL script containing any of the following can produce unexpected results:
  - Apostrophes that are not escaped, including the ones in comments. For example, write the character vector `'Here's the code'` as `'Here''s the code'`.
  - Nested comments.
- An SQL script containing more than 25,000 characters causes `runsqlscript` to return an error.

More About

Batch

One or more SQL statements terminated by either a semicolon or the keyword `GO`; for example:

```
SELECT productDescription, supplierName
FROM suppliers A, productTable B
WHERE A.SupplierNumber = B.SupplierNumber;

SELECT supplierName, Country
FROM suppliers;
```

Tips

- Any values assigned to `RowInc` or `QTimeOut` apply to all queries in the SQL script. For example, if `'RowInc'` is set to `5`, then all queries in the script return at most five rows in their respective query results.
- You can set preferences for the query results using the `setdbprefs` function. Preference settings apply to all queries in the SQL script. For example, if the `'DataReturnFormat'` is set to numeric, all query results return as numeric matrices.

Version History

Introduced in R2012a

R2022a: runsqlscript function will be removed

Warns starting in R2022a

The runsqlscript function will be removed in a future release. Use the executeSQLScript function instead. Some differences between the workflows might require updates to your code.

Update Code

In prior releases, the output argument of the runsqlscript function was a cursor array. For example:

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
scriptfile = 'compare_sales.sql';
results = runsqlscript(conn,scriptfile)


results =

  1×2 cursor array with properties:

    Data
    RowLimit
    SQLQuery
    Message
    Type
    Statement
    Position
```

Now the executeSQLScript function returns a structure array.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
scriptfile = 'compare_sales.sql';
results = executeSQLScript(conn,scriptfile)

results = 1×2 struct array with fields:
    SQLQuery
    Data
    Message
```

You can also change the data return format of the results in the structure array by using the 'DataReturnFormat' name-value pair argument. The executeSQLScript function ignores database preferences set by the setdbprefs function.

See Also

database | setdbprefs | fetch | close

Topics

“Import Data from Database Table Using sqlread Function” on page 5-58
“Configure Driver and Data Source” on page 2-14

“Generate SQL Query and MATLAB Script” on page 4-20
“Data Import Using Database Explorer App or Command Line” on page 2-133

runstoredprocedure

Namespace: `database.odbc`

Call stored procedure with and without input and output arguments

Syntax

```
results = runstoredprocedure(conn,spname)
results = runstoredprocedure(conn,spname,inputargs)
results = runstoredprocedure(conn,spname,inputargs,outputtypes)
```

Description

This function calls a stored procedure that has no input arguments, no output arguments, or any combination of input and output arguments. Define and instantiate this stored procedure in your database.

You can use this function if you connect to your database using a JDBC driver. For details, see "Connect to Database" on page 2-129. If you are using the native ODBC interface to connect to your database, use `execute` to call the stored procedure.

`results = runstoredprocedure(conn,spname)` calls the stored procedure `spname` using the database connection `conn`. `results` is a logical `1` if the stored procedure returns a data set. Otherwise, `results` is a logical `0`.

`results = runstoredprocedure(conn,spname,inputargs)` calls the stored procedure that accepts one or more input arguments `inputargs`.

`results = runstoredprocedure(conn,spname,inputargs,outputtypes)` calls the stored procedure that returns output arguments by specifying the output argument data types `outputtypes`. `results` is a cell array that contains one or more output arguments.

Examples

Call a Stored Procedure Without Input and Output Arguments

Define a stored procedure named `create_table` that creates a table named `test_table` by executing this code. This procedure has no input or output arguments. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE create_table

AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

CREATE TABLE test_table
```

```
    (
      CATEGORY_ID     INTEGER     IDENTITY PRIMARY KEY,
      CATEGORY_DESC   CHAR(50)    NOT NULL
      );

END
GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see “Connect to Database” on page 2-129. Then, call the stored procedure `create_table` using the database connection `conn`.

```
results = runstoredprocedure(conn,'create_table')
```

```
results =

   0
```

`results` returns 0 because calling `create_table` does not return a data set.

Check your database for a new table named `test_table`.

Close the database connection `conn`.

```
close(conn)
```

Call a Stored Procedure with Input Arguments

Define a stored procedure named `insert_data` that inserts a category description into a table named `test_create` by executing this code. This procedure has one input argument `data`. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE insert_data
    @data varchar(50)

AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

    INSERT INTO test_create (CATEGORY_DESC)
    VALUES (@data)
END
GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see “Connect to Database” on page 2-129. Then, call the stored procedure `insert_data` using the database connection `conn` with the category description `Apples` as the input argument.

```
inputarg = {'Apples'};

results = runstoredprocedure(conn,'insert_data',inputarg)
```

```
results =

   0
```

results returns 0 because calling insert_data does not return a data set.

The table test_create adds a row where the column CATEGORY_ID equals 1 and the column CATEGORY_DESCRIPTION equals Apples.

CATEGORY_ID is the primary key of the table test_create. This primary key increments automatically. CATEGORY_ID equals 1 when calling insert_data for the first time.

Close the database connection conn.

```
close(conn)
```

Call a Stored Procedure with Output Arguments

Define a stored procedure named maxDecVolume that selects the maximum sales volume in December by executing this code. This procedure has one output argument data and no input arguments. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE maxDecVolume
    @data int OUTPUT
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

     SELECT @data = max(December) FROM salesVolume
END

GO
```

Create a Microsoft SQL Server database connection conn using the JDBC driver. For details, see “Connect to Database” on page 2-129. Then, call the stored procedure using:

- Database connection conn
- Stored procedure maxDecVolume
- Empty brackets to denote no input arguments
- Numeric Java data type outputtype

```
outputtype = {java.sql.Types.NUMERIC};

results = runstoredprocedure(conn,'maxDecVolume',[],outputtype)

results =

    [1x1 java.math.BigDecimal]
```

results returns a cell array that contains the maximum sales volume as a Java decimal data type.

Display the value in results.

```
results{1}
```

```
ans =

35000
```

The maximum sales volume in December is 35,000.

Close the database connection `conn`.

```
close(conn)
```

Call a Stored Procedure with Input and Output Arguments

Define a stored procedure named `getSuppCount` that counts the number of suppliers for a specified city by executing this code. This procedure has one input argument `cityName` and one output argument `suppCount`. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE getSuppCount
    (@cityName varchar(20),
     @suppCount int OUTPUT)
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

    SELECT @suppCount = count(supplierNumber)
 FROM suppliers WHERE City = @cityName;

END
GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see “Connect to Database” on page 2-129. Then, call the stored procedure `getSuppCount` using the database connection `conn`. The input argument `inputarg` is a cell array containing the character vector `'New York'`. The output Java data type `outputtype` is numeric.

```
inputarg = {'New York'};
outputtype = {java.sql.Types.NUMERIC};

results = runstoredprocedure(conn,'getSuppCount',inputarg,outputtype)
```

```
results =

    [1x1 java.math.BigDecimal]
```

`results` is a cell array that contains the supplier count as a Java decimal data type.

Display the value in `results`.

```
results{1}
```

```
ans =

6.0000
```

There are six suppliers in New York.

Close the database connection `conn`.

```
close(conn)
```

Call a Stored Procedure with Multiple Input and Output Arguments

Define a stored procedure named `productsWithinUnitCost` that returns the product number and description for products that have a unit cost in a specified range by executing this code. This procedure has two input arguments `minUnitCost` and `maxUnitCost`. This procedure has two output arguments `productno` and `productdesc`. This code assumes you are using a Microsoft SQL Server database.

```
CREATE PROCEDURE productsWithinUnitCost
    (@minUnitCost INT,
    @maxUnitCost INT,
    @productno INT OUTPUT,
    @productdesc VARCHAR(50) OUTPUT)
AS
BEGIN
    -- SET NOCOUNT ON added to prevent extra result sets from
    -- interfering with SELECT statements.
    SET NOCOUNT ON;

 SELECT @productno = productNumber, @productdesc = productDescription
 FROM productTable
    WHERE unitCost > @minUnitCost AND unitCost < @maxUnitCost
END


GO
```

Create a Microsoft SQL Server database connection `conn` using the JDBC driver. For details, see “Connect to Database” on page 2-129. Then, call the stored procedure using:

- Database connection `conn`
- Stored procedure `productsWithinUnitCost`
- Input arguments `inputargs` to specify a unit cost between 19 and 21
- Output Java data types `outputtypes` to specify numeric and string data types for product number and description

```
inputargs = {19,21};
outputtypes = {java.sql.Types.NUMERIC,java.sql.Types.VARCHAR};

results = runstoredprocedure(conn,'productsWithinUnitCost',...
                             inputargs,outputtypes)
```

```
results =

    [1x1 java.math.BigDecimal]
    'Snacks'
```

`results` returns a cell array that contains the product number as a Java decimal data type and the product description as a string.

Display the product number in `results`.

```
results{1}
```

```
ans =

15
```

The product with product number 15 has a unit cost between 19 and 21.

Display the product description in `results`.

```
results{2}
```

```
ans =

Snacks
```

The product with product number 15 has the product description `Snacks`.

Here, the narrow unit cost range returns only one product. If the unit cost range is wider, then more than one product might satisfy this condition. To return a data set with numerous products, use `exec` and `fetch` to call this stored procedure. Otherwise, `runstoredprocedure` returns only the last row in the data set.

Close the database connection `conn`.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

spname — Stored procedure name
character vector

Stored procedure name, specified as a character vector that contains the name of the stored procedure that is defined and instantiated in your database.

Data Types: `char`

inputargs — Input arguments
cell array

Input arguments, specified as a cell array of one or more values for each input argument of the stored procedure. Input arguments can be only basic data types such as double, character vector, logical, and so on.

Data Types: `cell`

outputtypes — Output types
cell array

Output types, specified as a cell array of one or more Java data types for the output arguments of the stored procedure. Some JDBC drivers do not support all `java.sql.Types`. Consult your JDBC driver

documentation to find the supported types. Match them to the data types found in your stored procedure.

Example: `{java.sql.Types.NUMERIC}`

Data Types: `cell`

Output Arguments

`results` — Stored procedure results
logical | cell array

Stored procedure results, returned as a logical or cell array.

`runstoredprocedure` returns a logical `1` when calling the stored procedure returns a data set. Otherwise, `runstoredprocedure` returns a logical `0`. If the stored procedure returns a data set, use `exec` and `fetch` to call the stored procedure and retrieve the data set. For details, see “Call Stored Procedure That Returns Data” on page 5-17.

`runstoredprocedure` returns a cell array when you specify one or more output Java data types for the output arguments of the stored procedure. Use cell array indexing to retrieve the output argument values.

Version History

Introduced in R2006b

See Also

`database` | `exec` | `fetch` | `close`

Topics

“Call Stored Procedure That Returns Data” on page 5-17
“Connect to Database” on page 2-129

External Websites

SQL Tutorial

select

Namespace: `database.odbc`

Execute SQL `SELECT` statement and import data into MATLAB

Syntax

```
data = select(conn,selectquery)
data = select(conn,selectquery,Name,Value)
[data,metadata] = select(___)
```

Description

`data = select(conn,selectquery)` returns imported data from the database connection `conn` for the specified SQL `SELECT` statement `selectquery`.

`data = select(conn,selectquery,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'MaxRows',10` sets the maximum number of rows to return to 10 rows.

`[data,metadata] = select(___)` returns information about the imported data using any of the input argument combinations in the previous syntaxes. Use this information to change missing values in the imported data and view data types for each variable.

Examples

Import and Access Data Immediately

Import data from a database in one step using the `select` function. You can access data and perform immediate data analysis.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
      Gender VARCHAR(10),
      Age TINYINT,
      Location VARCHAR(300),
      Height SMALLINT,
      Weight SMALLINT,
      Smoker BIT,
      Systolic FLOAT,
      Diastolic NUMERIC,
      SelfAssessedHealthStatus VARCHAR(20))
```

This example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import all data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function. `data` is a table that contains the imported data.

```
selectquery = 'SELECT * FROM Patients';

data = select(conn,selectquery)
```

```
data =

  10×10 table

     LastName      Gender     Age              Location              Height    Weight    Smoker
    __________    ________    ___    ___________________________    ______    ______    ______

    'Smith'       'Male'      38     'Country General Hospital'     -32768       176    true
    'Johnson'     'Male'      43     'VA Hospital'                      69       163    false
    'Williams'    'Female'    38     ''                                 64       131    false
    'Jones'       'Female'     0     'VA Hospital'                      67       133    false
    'Broen'       'Female'    49     'Country General Hospital'         64       119    false
    'Davis'       'Female'    46     'St Mary's Medical Center'         68       142    false
    'Miller'      'Female'    33     'VA Hospital'                      64       142    true
    'Wilson'      'Male'      40     'VA Hospital'                  -32768       180    false
    'Moore'       'Male'      28     'St Mary's Medical Center'         68    -32768    false
    'Taylor'      'Female'    31     'Country General Hospital'         68       132    false
```

Determine the number of male patients by immediately accessing the data. Use the `count` function to find occurrences in the gender data of the character vector that represents a male. Determine the total number of occurrences.

```
males = count(data.Gender,'Male');
sum(males)
```

```
ans =

     4
```

Close the database connection.

```
close(conn)
```

Limit Number of Rows in Imported Data

Import a limited number of rows from a database in one step using the `select` function. Database Toolbox™ imports the data using MATLAB® numeric data types that correspond to data types in the database table. After importing data, you can access data and perform immediate data analysis.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
      Gender VARCHAR(10),
      Age TINYINT,
      Location VARCHAR(300),
      Height SMALLINT,
      Weight SMALLINT,
      Smoker BIT,
      Systolic FLOAT,
      Diastolic NUMERIC,
      SelfAssessedHealthStatus VARCHAR(20))
```

Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function. Limit the number of imported rows using the name-value pair argument `'MaxRows'`.

`data` is a table. The MATLAB® data types in the table correspond to the data types in the database. Here, `Age` has data type `uint8` that corresponds to `TINYINT` in the table definition.

`metadata` is a table that contains additional information about each variable in `data`.

- `VariableType` -- MATLAB® data type
- `MissingValue` -- `NULL` value representation
- `MissingRows` -- Vector of row indices that contain a missing value

```
selectquery = 'SELECT * FROM Patients';

[data,metadata] = select(conn,selectquery,'MaxRows',5)
```

```
data =

  5×10 table

     LastName      Gender     Age            Location             Height    Weight    Smoker
    __________    ________    ___    ___________________________    ______    ______    ______

    'Smith'       'Male'      38     'Country General Hospital'    -32768    176       true
    'Johnson'     'Male'      43     'VA Hospital'                     69    163       false
    'Williams'    'Female'    38     ''                                64    131       false
    'Jones'       'Female'     0     'VA Hospital'                     67    133       false
    'Broen'       'Female'    49     'Country General Hospital'        64    119       false


metadata =
```

```
  10×3 table

                                VariableType    MissingValue    MissingRows
                                ____________    ____________    ____________

    LastName                    'char'          ''              [0×1 double]
    Gender                      'char'          ''              [0×1 double]
    Age                         'uint8'         [     0]        [         4]
    Location                    'char'          ''              [0×1 double]
    Height                      'int16'         [-32768]        [         1]
    Weight                      'int16'         [-32768]        [0×1 double]
    Smoker                      'logical'       [     0]        [0×1 double]
    Systolic                    'single'        [   NaN]        [         2]
    Diastolic                   'double'        [   NaN]        [0×1 double]
    SelfAssessedHealthStatus    'char'          ''              [0×1 double]
```

Determine the number of male patients by immediately accessing the data. Use the `count` function to find occurrences in the gender data of the character vector that represents a male. Determine the total number of occurrences.

```
males = count(data.Gender,'Male');
sum(males)
```

```
ans =

     2
```

Close the database connection.

```
close(conn)
```

View Information About Imported Data

Import data from a database in one step using the `select` function. Database Toolbox™ imports the data using MATLAB® numeric data types that correspond to data types in the database table. You can view data type information in the imported data. You can also access data and perform immediate data analysis.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
      Gender VARCHAR(10),
      Age TINYINT,
      Location VARCHAR(300),
      Height SMALLINT,
      Weight SMALLINT,
      Smoker BIT,
      Systolic FLOAT,
      Diastolic NUMERIC,
      SelfAssessedHealthStatus VARCHAR(20))
```

Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import all data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function.

`data` is a table. The MATLAB® data types in the table correspond to the data types in the database. Here, `Age` has the MATLAB® data type `uint8` that corresponds to `TINYINT` in the table definition.

`metadata` is a table that contains additional information about each variable in `data`.

- `VariableType` -- MATLAB® data type
- `MissingValue` -- Null value representation
- `MissingRows` -- Vector of row indices that contain a missing value

```
selectquery = 'SELECT * FROM Patients';

[data,metadata] = select(conn,selectquery)
```

```
data =

  10×10 table

     LastName       Gender      Age              Location              Height    Weight    Smoker
    ___________    ________    ___    _____________________________    ______    ______    ______

    'Smith'        'Male'      38     'Country General Hospital'       -32768       176    true
    'Johnson'      'Male'      43     'VA Hospital'                        69       163    false
    'Williams'     'Female'    38     ''                                   64       131    false
    'Jones'        'Female'     0     'VA Hospital'                        67       133    false
    'Broen'        'Female'    49     'Country General Hospital'           64       119    false
    'Davis'        'Female'    46     'St Mary's Medical Center'           68       142    false
    'Miller'       'Female'    33     'VA Hospital'                        64       142    true
    'Wilson'       'Male'      40     'VA Hospital'                    -32768       180    false
    'Moore'        'Male'      28     'St Mary's Medical Center'           68    -32768    false
    'Taylor'       'Female'    31     'Country General Hospital'           68       132    false


metadata =

  10×3 table

                                VariableType    MissingValue    MissingRows
                                ____________    ____________    ____________

    LastName                    'char'          ''              [0×1 double]
    Gender                      'char'          ''              [0×1 double]
    Age                         'uint8'         [     0]        [         4]
    Location                    'char'          ''              [0×1 double]
    Height                      'int16'         [-32768]        [2×1 double]
```

```
    Weight                      'int16'         [-32768]        [         9]
    Smoker                      'logical'       [     0]        [0×1 double]
    Systolic                    'single'        [   NaN]        [2×1 double]
    Diastolic                   'double'        [   NaN]        [         6]
    SelfAssessedHealthStatus    'char'          ''              [0×1 double]
```

View data types of each variable in the table.

```
metadata.VariableType
```

```
ans =

  10×1 cell array

    'char'
    'char'
    'uint8'
    'char'
    'int16'
    'int16'
    'logical'
    'single'
    'double'
    'char'
```

Determine the number of male patients by immediately accessing the data. Use the `count` function to find occurrences in the gender data of the character vector that represents a male. Determine the total number of occurrences.

```
males = count(data.Gender,'Male');
sum(males)
```

```
ans =

     4
```

Close the database connection.

```
close(conn)
```

Change Missing Values in Imported Data Using for Loop

Import data from a database in one step using the `select` function. During import, the `select` function sets default values for missing data in each row. Use the information about the imported data to change the default values.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
```

```
    Gender VARCHAR(10),
    Age TINYINT,
    Location VARCHAR(300),
    Height SMALLINT,
    Weight SMALLINT,
    Smoker BIT,
    Systolic FLOAT,
    Diastolic NUMERIC,
    SelfAssessedHealthStatus VARCHAR(20))
```

Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import all data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function.

`data` is a table that contains the imported data.

`metadata` is a table that contains additional information about each variable in `data`.

- `VariableType` -- MATLAB® data type
- `MissingValue` -- `NULL` value representation
- `MissingRows` -- Vector of row indices that indicate the location of missing values

```
selectquery = 'SELECT * FROM Patients';

[data,metadata] = select(conn,selectquery)
```

```
data =

  10×10 table array

    LastName      Gender     Age              Location              Height    Weight    Smoker
   __________    ________    ___    ____________________________    ______    ______    ______

   'Smith'       'Male'      38     'Country General Hospital'      -32768       176    true
   'Johnson'     'Male'      43     'VA Hospital'                       69       163    false
   'Williams'    'Female'    38     ''                                  64       131    false
   'Jones'       'Female'     0     'VA Hospital'                       67       133    false
   'Broen'       'Female'    49     'Country General Hospital'          64       119    false
   'Davis'       'Female'    46     'St Mary's Medical Center'          68       142    false
   'Miller'      'Female'    33     'VA Hospital'                       64       142    true
   'Wilson'      'Male'      40     'VA Hospital'                   -32768       180    false
   'Moore'       'Male'      28     'St Mary's Medical Center'          68    -32768    false
   'Taylor'      'Female'    31     'Country General Hospital'          68       132    false


metadata =

  10×3 table array
```

```
                              VariableType    MissingValue     MissingRows 
                              ____________    ____________    _____________

    LastName                  'char'          ''              [0×1 double]
    Gender                    'char'          ''              [0×1 double]
    Age                       'uint8'         [     0]        [          4]
    Location                  'char'          ''              [0×1 double]
    Height                    'int16'         [-32768]        [2×1 double]
    Weight                    'int16'         [-32768]        [          9]
    Smoker                    'logical'       [     0]        [0×1 double]
    Systolic                  'single'        [   NaN]        [2×1 double]
    Diastolic                 'double'        [   NaN]        [          6]
    SelfAssessedHealthStatus  'char'          ''              [0×1 double]
```

Retrieve indices that indicate the location of missing values in the `Height` variable using the `metadata` output argument.

```
values = metadata.MissingRows{'Height'}
```

```
values =

     1
     8
```

Change the default value for missing data from `-32768` to `0` using a for loop. Access the imported data using the indices.

```
for i = 1:length(values)
    data.Height(values(i)) = 0;
end
```

View the imported data.

```
data.Height
```

```
ans =

  10×1 int16 column vector

    0
   69
   64
   67
   64
   68
   64
    0
   68
   68
```

Missing values appear as `0`.

Close the database connection.

```
close(conn)
```

Change Missing Values in Imported Data Using Vector Indexing

Import data from a database in one step using the `select` function. During import, the `select` function sets default values for missing data in each row. Use the information about the imported data to change default values by indexing into the vector.

The code assumes that you have a database table `Patients` stored on a Microsoft® SQL Server® database. This table contains patient data in 10 columns and rows. The table definition is:

```
CREATE TABLE Patients(
      LastName VARCHAR(50),
      Gender VARCHAR(10),
      Age TINYINT,
      Location VARCHAR(300),
      Height SMALLINT,
      Weight SMALLINT,
      Smoker BIT,
      Systolic FLOAT,
      Diastolic NUMERIC,
      SelfAssessedHealthStatus VARCHAR(20))
```

Here, connect to a Microsoft® SQL Server® Version 11.00.2100 database using the Microsoft® SQL Server® Driver 11.00.5058.

Create a database connection to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Import all data from the `Patients` table by executing the SQL `SELECT` statement using the `select` function.

`data` is a table that contains the imported data.

`metadata` is a table that contains additional information about each variable in `data`.

- `VariableType` -- MATLAB® data type
- `MissingValue` -- `NULL` value representation
- `MissingRows` -- Vector of row indices that indicate the location of missing values

```
selectquery = 'SELECT * FROM Patients';

[data,metadata] = select(conn,selectquery)


data = 

  10×10 table array

    LastName      Gender     Age              Location               Height    Weight    Smoker
   __________    ________    ___    _________________________    ______    ______    ______
```

```
    'Smith'       'Male'      38     'Country General Hospital'    -32768        176    true
    'Johnson'     'Male'      43     'VA Hospital'                     69        163    false
    'Williams'    'Female'    38     ''                                64        131    false
    'Jones'       'Female'     0     'VA Hospital'                     67        133    false
    'Broen'       'Female'    49     'Country General Hospital'        64        119    false
    'Davis'       'Female'    46     'St Mary's Medical Center'        68        142    false
    'Miller'      'Female'    33     'VA Hospital'                     64        142    true
    'Wilson'      'Male'      40     'VA Hospital'                 -32768        180    false
    'Moore'       'Male'      28     'St Mary's Medical Center'        68     -32768    false
    'Taylor'      'Female'    31     'Country General Hospital'        68        132    false


metadata =

  10×3 table array

                                VariableType    MissingValue    MissingRows
                                ____________    ____________    ____________

    LastName                    'char'          ''              [0×1 double]
    Gender                      'char'          ''              [0×1 double]
    Age                         'uint8'         [     0]        [           4]
    Location                    'char'          ''              [0×1 double]
    Height                      'int16'         [-32768]        [2×1 double]
    Weight                      'int16'         [-32768]        [           9]
    Smoker                      'logical'       [     0]        [0×1 double]
    Systolic                    'single'        [   NaN]        [2×1 double]
    Diastolic                   'double'        [   NaN]        [           6]
    SelfAssessedHealthStatus    'char'          ''              [0×1 double]
```

Retrieve indices that indicate the location of missing values in the `Height` variable using the `metadata` output argument.

```
values = metadata(5,3)
valuesindex = values.MissingRows{1}
```

```
values =

  table

              MissingRows
              ____________

    Height    [2×1 double]


valuesindex =

     1
     8
```

Change the default value for missing data from `-32768` to `0` using vector indexing.

```
data.Height(valuesindex) = 0;
```

View the imported data.

```
data.Height
```

```
ans =

  10×1 int16 column vector

    0
   69
   64
   67
   64
   68
   64
    0
   68
   68
```

Missing values appear as `0`.

Close the database connection.

```
close(conn)
```

Input Arguments

`conn` — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

`selectquery` — SQL SELECT statement
character vector | string

SQL `SELECT` statement, specified as a character vector or string. The `select` function only executes SQL `SELECT` statements. To execute other SQL statements, use the `exec` function.

Example: `'SELECT * FROM inventoryTable'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `'MaxRows',100,'QueryTimeOut',5` returns 100 rows of data and waits 5 seconds to execute the SQL `SELECT` statement.

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of 'MaxRows' and a positive numeric scalar. By default, the select function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: 'MaxRows',10

Data Types: double

QueryTimeOut — SQL query timeout
positive numeric scalar

SQL query timeout, specified as the comma-separated pair consisting of 'QueryTimeOut' and a positive numeric scalar. By default, the select function ignores the timeout value. Use this name-value pair argument to specify the number of seconds to wait for executing the SQL query selectquery.

Example: 'QueryTimeOut',15

Output Arguments

data — Imported data
table

Imported data, returned as a table. The rows of the table correspond to the rows of data returned from the executed SQL query selectquery. The variable names of the table specify the columns in the SQL query.

The select function returns date or time data as character vectors in the table. This function returns text as character vectors or a cell array of character vectors. Strings are not supported in the table.

If no data to import exists, then data is an empty table.

metadata — Information about imported data
table

Information about imported data, returned as a table. The row names of metadata are variable names in data. This function stores each variable name in the metadata table as a cell array. metadata has these variable names:

- VariableType — Data types of each variable in data
- MissingValue — Representation of missing value for each variable in data
- MissingRows — Vector of row indices that indicate locations of missing values for each variable in data

This table shows how MATLAB represents NULL values in the database by default after data import.

Database Data Type	Default NULL Value
SIGNED TINYINT	-128
UNSIGNED TINYINT	0
SIGNED SMALLINT	-32768
UNSIGNED SMALLINT	0
SIGNED INT	-2147483648

Database Data Type	Default NULL Value
UNSIGNED INT	0
SIGNED BIGINT	-9223372036854775808
UNSIGNED BIGINT	0
REAL	NaN
FLOAT	NaN
DOUBLE	NaN
DECIMAL	NaN
NUMERIC	NaN
Boolean	false
Date, time, or text	''

To change the NULL value representation in the imported data, replace the default value by looping through the imported data or using vector indexing.

Limitations

- You cannot customize missing values in the output argument data using the select function. Index into the imported data using the metadata output argument instead.
- The output argument data does not support cell and struct data types. The select function only supports table.

Alternative Functionality

Use the exec and fetch functions for full functionality when importing data. For differences between the select function and this alternative, see “Data Import Using Database Explorer App or Command Line” on page 2-133.

Version History

Introduced in R2017a

See Also

exec | fetch | database | close | count

Topics

“Data Import Using Database Explorer App or Command Line” on page 2-133
“Data Import Memory Management” on page 5-20
“Import Data from Database Table Using sqlread Function” on page 5-58

External Websites

SQL Tutorial

setdbprefs

(Not recommended) Set preferences for retrieval format, errors, NULLs, and more

---

Note The `setdbprefs` function is not recommended. For details about functionality to use instead, see “Compatibility Considerations”.

Syntax

```
setdbprefs
v = setdbprefs
setdbprefs(preference)

setdbprefs(preference,value)
setdbprefs(s)
```

Description

`setdbprefs` returns current values for database preferences.

`v = setdbprefs` returns current values to the structure `v`.

`setdbprefs(preference)` returns the current value for the specified `preference`.

`setdbprefs(preference,value)` sets the specified `preference` to `value`. After you set database preferences, they are retained across MATLAB sessions.

`setdbprefs(s)` sets preferences specified in the structure `s` to values that you specify.

Examples

Display Current Values

Display all database preferences and their current values.

```
setdbprefs
```

```
ans =

  struct with fields:

    DataReturnFormat: 'table'
       ErrorHandling: 'store'
      NullNumberRead: 'NaN'
     NullNumberWrite: 'NaN'
      NullStringRead: 'null'
     NullStringWrite: 'null'
```

Display the current value for the specified database preference.

```
setdbprefs('ErrorHandling')
```

```
ans =

    'report'
```

Change Preference Setting

Set a database preference to a different value. Change the display of errors in MATLAB by modifying the database error handling preference.

Specify the `store` format for the `ErrorHandling` preference.

```
setdbprefs('ErrorHandling','store')
```

When you execute the `database` function, Database Toolbox stores any generated errors in the `Message` property of the returned `connection` object.

Establish the connection `conn` to a MySQL database with the user name `username` and an invalid password.

```
conn = database('MySQL','username','invalid');
```

Access the error message in the `Message` property of the `connection` object.

```
conn.Message
```

```
ans =

    'ODBC Driver Error: [MySQL][ODBC 5.3(a) Driver]Access denied for user 'username'@'servername
```

Specify the `report` format for the `ErrorHandling` preference.

```
setdbprefs('ErrorHandling','report')
```

Connect to the database using the invalid password again. With the `ErrorHandling` preference set to `report`, the error generated by running the `database` function appears immediately in the Command Window.

```
conn = database('MySQL','username','invalid')
```

```
Error using database (line 156)
ODBC Driver Error: [MySQL][ODBC 5.3(a) Driver]Access denied for user
'username'@'servername' (using password: YES)
```

Assign Values to Structure

Assign values for specific preferences in a structure so you can change multiple database preferences simultaneously.

Assign values for preferences to fields in the structure `s`.

```
s.ErrorHandling = 'report';
s.NullStringRead = 'null';
s
```

```
s =

  struct with fields:

       ErrorHandling: 'report'
      NullStringRead: 'null'
```

Set preferences using the values in `s`.

```
setdbprefs(s)
```

Run `setdbprefs` to check your database preference settings.

```
setdbprefs
```

```
ans =

  struct with fields:

    DataReturnFormat: 'table'
       ErrorHandling: 'report'
      NullNumberRead: 'NaN'
     NullNumberWrite: 'NaN'
      NullStringRead: 'null'
     NullStringWrite: 'null'
```

Return Values to Structure

Assign values for all database preferences to `s`.

```
s = setdbprefs
```

```
s =

  struct with fields:

    DataReturnFormat: 'table'
       ErrorHandling: 'report'
      NullNumberRead: 'NaN'
     NullNumberWrite: 'NaN'
      NullStringRead: 'null'
     NullStringWrite: 'null'
```

Save Preferences

Save your database preferences to the MAT-file to use them in future MATLAB sessions.

Assign the preferences to the variable `ImportData` and save them to a MAT-file `ImportDataPrefs` in your current folder.

```
ImportData = setdbprefs;
save ImportDataPrefs.mat ImportData
```

Load the data and restore the preferences.

```
load ImportDataPrefs.mat
setdbprefs(ImportData)
```

Input Arguments

preference — Database preference
character vector | cell array

Database preference, specified as a character vector or cell array. To set multiple database preferences, enter the preference values in a cell array of character vectors. Then, match the order with the corresponding values in the `value` argument.

You can specify database preferences for error handling and importing `NULL` strings from a database into MATLAB.

- `'ErrorHandling'` — Specify how to handle errors when importing data. Set this parameter before you execute the `database` function. To specify displaying errors in the Command Window, enter `setdbprefs('ErrorHandling','report')`. Otherwise, you can access the error message in the `Message` property of the `connection` object.
- `NULL` data — Specify how to import `NULL` strings into the MATLAB workspace. To import `NULL` strings as the character vector `'null'`, enter `setdbprefs('NullStringRead','null')`. Set this parameter before running `fetch`.

Example: `'ErrorHandling'`

Example: `{'ErrorHandling';'NullStringRead'}`

Data Types: `char`

value — Database preference value
character vector | cell array

Database preference value, specified as a character vector or cell array. To set multiple database preferences, enter the preference values in a cell array of character vectors. Then, match the order with the corresponding preferences in the `preference` argument.

Example: `'NaN'`

Example: `{'numeric';'NaN'}`

Data Types: `char`

s — Database preferences
structure

Database preferences, specified as a structure that includes all the preferences you specify.

Data Types: `struct`

Output Arguments

v — Database preferences
structure

Database preferences, returned as a structure containing database preference settings and values.

Version History

Introduced before R2006a

R2019a: `setdbprefs` function is not recommended

Not recommended starting in R2019a

The `setdbprefs` function is not recommended. Use the following replacement functionality to specify the data return format, error handling, and missing data. Some differences between the workflows might require updates to your code.

- Data return format — For the `'DataReturnFormat'` database preference, these values are not recommended:
  - `'numeric'`
  - `'cellarray'`
  - `'structure'`
- Error handling — The `'ErrorHandling'` database preference is not recommended.
- Missing data — The `'NullNumberWrite'`, `'NullStringWrite'`, and `'NullNumberRead'` database preferences for handling `NULL` data values are not recommended.

There are no plans to remove the `setdbprefs` function at this time.

Update Code

To set the data return format in prior releases, you specified returning imported data as a numeric matrix by setting the `'DataReturnFormat'` database preference to the value `'numeric'`. For example:

```
setdbprefs('DataReturnFormat','numeric')
results = fetch(conn,sqlquery);
```

Now you can set the same value by using the `'DataReturnFormat'` name-value pair argument of the `fetch` function.

```
results = fetch(conn,sqlquery,'DataReturnFormat','numeric');
```

Or, you can customize import options.

```
opts = databaseImportOptions(conn,tablename);
varnames = "quantity";
opts = setoptions(opts,varnames,'Type','int64');
```

To specify error handling in prior releases, you set the `'ErrorHandling'` database preference to the value `'report'` or `'store'` by using the `setdbprefs` function. For example:

```
setdbprefs('ErrorHandling','store')
```

Now you specify error handling by using the `'ErrorHandling'` name-value pair argument of the `database` function or the `'ErrorHandling'` name-value pair argument of the `executeSQLScript` function.

```
conn = database(datasource,username,password,'ErrorHandling','store');
```

To specify the handling of missing data in prior releases, you set the 'NullNumberWrite' database preference to a specific value, for example. This table shows database preference settings that are not recommended and the functionality you can use instead.

Discouraged Functionality	Recommended Replacement
`setdbprefs('NullNumberWrite','NaN')`	`data` input argument of `sqlwrite`
`setdbprefs('NullStringWrite','null')`	`data` input argument of `sqlwrite`
`setdbprefs('NullNumberRead','0')`	`SQLImportOptions` object

See Also

`clear` | `fetch` | `getdatasources` | `database` | `close`

splitsqlquery

Split SQL query using paging

Syntax

```
querybasket = splitsqlquery(conn,sqlquery)
querybasket = splitsqlquery(conn,sqlquery,'SplitSize',splitsize)
```

Description

`querybasket = splitsqlquery(conn,sqlquery)` splits an SQL query into a basket of multiple SQL queries. By default, each SQL query in the basket returns 100,000 rows in a batch. The resulting number of SQL queries in the basket depends on the size of the original SQL query results.

`querybasket = splitsqlquery(conn,sqlquery,'SplitSize',splitsize)` specifies a custom batch size for the number of rows returned by each SQL query in the basket.

Examples

Access Large Data from SQL Query Using Database Toolbox™

Determine the minimum arrival delay using a large set of flight data stored in a database. Access the database in a serial MATLAB® environment.

Using the `splitsqlquery` function, you can split the original SQL query into multiple SQL page queries. Then, you can access large data in chunks by using the `fetch` function.

To run this example, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Define an SQL query to select all columns from the `airlinesmall` table, which contains 123,523 rows and 29 columns.

```
sqlquery = 'SELECT * FROM airlinesmall';
```

Split the original SQL query into multiple page queries and display them.

```
querybasket = splitsqlquery(conn,sqlquery)
```

```
querybasket =
```

```
  2×1 string array

    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 0 ROWS FETCH NEXT 100000
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 100000 ROWS FETCH NEXT 23
```

The query basket contains the page queries in a string array. The `splitsqlquery` function splits the queries using the default number of rows (100,000).

Define the `airlinesdata` variable.

```
airlinesdata = [];
```

Define the minimum arrival delay `minArrDelay` variable.

```
minArrDelay = [];
```

Execute the SQL page queries in `querybasket` by using a `for` loop, and import the data in chunks. Execute SQL page queries in the query basket, and import large data using the `fetch` function. Find and store the local minimum arrival delay for each chunk.

```
for i = 1: length(querybasket)

    local_airlinesdata = fetch(conn,querybasket(i));

    local_minArrDelay = min(local_airlinesdata.ArrDelay);

    minArrDelay = [minArrDelay; local_minArrDelay];

end
```

Find the minimum arrival delay from all the stored delays.

```
minArrDelay = min(minArrDelay)

minArrDelay =

   -64
```

Close the database connection.

```
close(conn)
```

Access Large Data from SQL Query Using Database Toolbox and Parallel Computing Toolbox

Determine the minimum arrival delay using a large set of flight data stored in a database. Access the database using a parallel pool.

To initialize a parallel pool with a JDBC database connection, you must configure a JDBC data source. For more information, see the `configureJDBCDataSource` function.

Using the `splitsqlquery` function, you can split the original SQL query into multiple SQL page queries. Then, you can access large data in chunks by executing each SQL page query on a separate worker in the pool.

When you import large data, the performance depends on the SQL query, amount of data, machine specifications, and type of data analysis. To manage the performance, use the `splitsize` input argument of the `splitsqlquery` function.

If you have a MATLAB® Parallel Server™ license, then use the `parpool (Parallel Computing Toolbox)` function with the cluster profile of your choice instead of the `gcp (Parallel Computing Toolbox)` function.

Create a database connection to the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
conn = database(datasource,username,password);
```

Define an SQL query to select all columns from the `airlinesmall` table, which contains 123,523 rows and 29 columns.

```
sqlquery = 'SELECT * FROM airlinesmall';
```

Split the original SQL query into multiple page queries and display them. Specify a split size of 10,000 rows.

```
splitsize = 10000;
querybasket = splitsqlquery(conn,sqlquery,'SplitSize',splitsize)
```

```
querybasket = 

  13×1 string array

    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 0 ROWS FETCH NEXT 10000 R
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 10000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 20000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 30000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 40000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 50000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 60000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 70000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 80000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 90000 ROWS FETCH NEXT 100
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 100000 ROWS FETCH NEXT 10
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 110000 ROWS FETCH NEXT 10
    " SELECT * FROM (SELECT * FROM airlinesmall) temp ORDER BY 1 OFFSET 120000 ROWS FETCH NEXT 35
```

The query basket contains the page queries in a string array. Each SQL query in the basket, except the last one, returns 10,000 rows.

Close the database connection.

```
close(conn)
```

Start the parallel pool.

```
pool = gcp;
```

```
Starting parallel pool (parpool) using the 'local' profile ...
Connected to the parallel pool (number of workers: 6).
```

Initialize the parallel pool using the JDBC data source.

```
c = createConnectionForPool(pool,datasource,username,password);
```

Define the `airlinesdata` variable.

```
airlinesdata = [];
```

Define the minimum arrival delay `minArrDelay` variable.

```
minArrDelay = [];
```

Use the `parfor` function to parallelize data access using the query basket.

For each worker:

- Retrieve the database connection object.
- Execute the SQL page query from the query basket and import data locally.
- Find the local minimum arrival delay.
- Store the local minimum arrival delay.

```
parfor i = 1: length(querybasket)

    conn = c.Value;

    local_airlinesdata = fetch(conn,querybasket(i));

    local_minArrDelay = min(local_airlinesdata.ArrDelay);

    minArrDelay = [minArrDelay; local_minArrDelay];

end
```

Find the minimum arrival delay using the stored delays from each worker.

```
minArrDelay = min(minArrDelay)
```

```
minArrDelay =

   -64
```

Close the parallel pool.

```
delete(pool)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as a `connection` object created with the `database` function, `connection` object created with the `mysql` function, `connection` object created with the `postgresql` function, or `sqlite` object.

Create a parallelizable `databaseDatastore` object by first creating a parallel pool constant. You can use the `getSecret` function to retrieve your user credentials when you create this constant.

Example: `conn = parallel.pool.Constant(@()postgresql(getsecret("PostgreSQL.username"),getsecret("Postgresql.password"),"Server","localhost","DatabaseName","toy_store"),@close);`

`sqlquery` — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar.

For information about the SQL query language, see the SQL Tutorial.

Example: `SELECT * FROM invoice` selects all columns and rows from the `invoice` table.

Data Types: `char` | `string`

`splitsize` — SQL query split size
`100000` (default) | numeric scalar

SQL query split size, specified as a numeric scalar. Specify this number to split an SQL query into a custom number of rows for each batch.

If the total number of rows returned from the original SQL query is less than 100,000 (the default), then the `splitsqlquery` function returns the original SQL query. Use this input argument to specify a smaller number of rows in a batch.

Data Types: `double`

Output Arguments

`querybasket` — SQL query basket
string array

SQL query basket, returned as a string array. Each SQL query in the basket is returned as a string scalar in the string array.

You can execute each SQL query in the basket using the `fetch` function. Or, you can run a parallel pool and assign each SQL query to a worker for execution.

Limitations

- The `splitsqlquery` function supports these databases only:
  - Microsoft SQL Server 2012 and later
  - Oracle
  - MySQL
  - PostgreSQL

  - SQLite
  - Amazon Redshift®
  - Amazon Aurora®
  - Google® Cloud SQL that runs an instance of MySQL or PostgreSQL
  - MariaDB

  If the `connection` object uses an unsupported database, the `splitsqlquery` function displays a warning and returns the original SQL query.
- The `splitsqlquery` function does not support the MATLAB interface to SQLite.

Version History

Introduced in R2017b

See Also

`fetch` | `database` | `close` | `javaaddpath` | `addAttachedFiles` | `parpool` | `parfevalOnAll` | `parallel.pool.Constant`

Topics

"Analyze Large Data in Database Using Tall Arrays" on page 5-30

External Websites

SQL Tutorial

createConnectionForPool

Initialize parallel pool using database connection

Syntax

```
c = createConnectionForPool(pool,datasource,username,password)
```

Description

`c = createConnectionForPool(pool,datasource,username,password)` initializes a parallel pool by creating a database connection on each worker in the pool using a data source, user name, and password.

Note If you use an ODBC data source for the database connection, each worker in the pool must have the required ODBC driver installed and a configured ODBC data source. Otherwise, an error occurs when you import data from the database.

Examples

Initialize Parallel Pool with ODBC Database Connection

Using an ODBC database connection, access a database using a parallel pool (requires Parallel Computing Toolbox™). Import data from multiple SQL queries in parallel.

Each worker in the pool has the ODBC driver installed. Also, each worker has a configured ODBC data source. For more information, see the `configureODBCDataSource` function.

Start the parallel pool.

```
pool = gcp;
```

```
Starting parallel pool (parpool) using the 'local' profile ...
Connected to the parallel pool (number of workers: 6).
```

Initialize the parallel pool using an ODBC data source. This data source configures an ODBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MS SQL Server Auth";
username = "";
password = "";
c = createConnectionForPool(pool,datasource,username,password);
```

Define the SQL queries.

```
sqlqueries = ["SELECT * FROM invoice" ...
    "SELECT * FROM inventorytable" ...
    "SELECT * FROM producttable"];
```

Parallelize data access using the query basket by calling the `parfor` function.

For each worker, retrieve the database connection object, execute the SQL queries, and import data locally.

```
parfor i = 1:length(sqlqueries)

    conn = c.Value;

    results = fetch(conn,sqlqueries(i));

    allresults{i} = results;

end
```

Display the results for all queries. The cell array contains three tables, one for each set of query results.

```
allresults
```

```
allresults = 1×3 cell array
    {10×5 table}    {13×4 table}    {15×5 table}
```

Close the parallel pool.

```
delete(pool);
```

Initialize Parallel Pool with JDBC Database Connection

Using a JDBC database connection, access a database using a parallel pool (requires Parallel Computing Toolbox™). Import data from multiple SQL queries in parallel.

To initialize a parallel pool with a JDBC database connection, you must configure a JDBC data source. For more information, see the `databaseConnectionOptions` function.

Start the parallel pool.

```
pool = gcp;
```

```
Starting parallel pool (parpool) using the 'local' profile ...
Connected to the parallel pool (number of workers: 6).
```

Initialize the parallel pool using the JDBC data source `MSSQLServerJDBCAuth`. This data source configures a JDBC driver to a Microsoft® SQL Server® database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MSSQLServerJDBCAuth";
username = "";
password = "";
c = createConnectionForPool(pool,datasource,username,password);
```

Define the SQL queries.

```
sqlqueries = ["SELECT * FROM invoice" ...
    "SELECT * FROM inventorytable" ...
    "SELECT * FROM producttable"];
```

Parallelize data access using the query basket by calling the `parfor` function.

For each worker, retrieve the database connection object, execute the SQL queries, and import data locally.

```
parfor i = 1:length(sqlqueries)

    conn = c.Value;

    results = fetch(conn,sqlqueries(i));

    allresults{i} = results;

end
```

Display the results for all queries. The cell array contains three tables, one for each set of query results.

```
allresults
```

```
allresults = 1×3 cell array
    {10×5 table}    {13×4 table}    {15×5 table}
```

Close the parallel pool.

```
delete(pool);
```

Input Arguments

`pool` — Parallel pool
`parallel.Pool` object

Parallel pool, specified as a `parallel.Pool` object.

`datasource` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing data source.

Example: `"myDataSource"`

Data Types: `char` | `string`

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

Output Arguments

`c` — `parallel.pool.Constant`
`parallel.pool.Constant` object

`parallel.pool.Constant`, specified as a `parallel.pool.Constant` object. The Value property of the `parallel.pool.Constant` object is available only on workers.

Version History

Introduced in R2019a

See Also

`database` | `splitsqlquery`

Topics

"Configure Driver and Data Source" on page 2-14

sqlite

SQLite connection

Description

The `sqlite` function creates an `sqlite` object. You can use this object to connect to an SQLite database file using the MATLAB interface to SQLite. The MATLAB interface to SQLite enables you to work with SQLite database files without installing and administering a database or driver. For details, see “Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5.

Creation

Syntax

```
conn = sqlite(dbfile)
conn = sqlite(dbfile,mode)
```

Description

`conn = sqlite(dbfile)` connects to an existing SQLite database file.

`conn = sqlite(dbfile,mode)` connects to an existing database file or creates and connects to a new database file, depending on the mode type.

Input Arguments

`dbfile` — SQLite database file
character vector | string scalar

SQLite database file, specified as a character vector or string scalar. You can use the database file to store data and import and export it to MATLAB.

Data Types: `char` | `string`

`mode` — SQLite database file mode
`"connect"` (default) | `"readonly"` | `"create"`

SQLite database file mode, specified as one of these values.

Value	Description
`"connect"`	Connect to an existing SQLite database file.
`"readonly"`	Create a read-only connection to an existing SQLite database file.
`"create"`	Create and connect to a new SQLite database file.

The file mode determines whether you connect to an existing SQLite database file or create a new one. For existing database files, the file mode determines whether the database connection is read-only and sets the IsReadOnly property. You can specify the file mode as a string scalar or character vector.

Properties

`Database` — SQLite database file name
character vector

This property is read-only.

SQLite database file name, specified as a character vector that contains the full path to the SQLite database file.

The `dbfile` input argument sets this property.

Example: `'C:\tutorial.db'`

Data Types: `char`

`IsOpen` — Database connection indicator
`0` (default) | `1`

This property is read-only.

Database connection indicator, specified as a logical `0` when the database connection is closed or invalid, or a logical `1` when the database connection is open. This property is hidden from the display.

`IsReadOnly` — Read-only database file indicator
`0` (default) | `1`

This property is read-only.

Read-only database file indicator, specified as a logical `0` when the SQLite database file can be modified, or a logical `1` when the database file is read-only.

Data Types: `logical`

`AutoCommit` — Flag to autocommit transactions
`'on'` (default) | `'off'`

Flag to autocommit transactions, specified as one of these values:

- `'on'` — Database transactions are automatically committed to the database.
- `'off'` — Database transactions must be committed to the database manually.

Object Functions

SQLite Database Connection

isopen Determine if SQLite connection is open
close Close SQLite connection

Import Data into MATLAB

sqlread	Import data into MATLAB from SQLite database table
fetch	Import data into MATLAB workspace using SQLite connection

Export Data from MATLAB

sqlwrite	Insert MATLAB data into SQLite database table

Database Operations

commit	Make changes to SQLite database file permanent
execute	Execute SQL statement using SQLite database connection
rollback	Undo changes to SQLite database file
sqlupdate	Update rows in SQLite database table

Examples

Create SQLite Connection to Existing Database File

Create an SQLite connection to the MATLAB® interface to SQLite using the existing database file `tutorial.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,"tutorial.db");
conn = sqlite(dbfile)
```

```
conn = 
  sqlite with properties:

      Database: 'C:\TEMP\Bdoc24a_2528353_7604\ib462BFE\6\tp8e4029f8\database-ex96650978\tutorial
    IsReadOnly: 0
    AutoCommit: 'on'
```

`conn` is an `sqlite` object with these properties:

- `Database` — SQLite database file name.
- `IsOpen` — SQLite connection is open.
- `IsReadOnly` — SQLite connection is writable.

To import data from the database file, you can use the `fetch` function.

Close the SQLite connection.

```
close(conn)
```

Create SQLite Connection Using New Database File

Create an SQLite connection to the MATLAB® interface to SQLite using a new database file named `mysqlite.db`. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,"mysqlite.db");
conn = sqlite(dbfile,"create")
```

```
conn = 
  sqlite with properties:

      Database: 'C:\TEMP\Bdoc24a_2528353_7604\ib462BFE\6\tp8e4029f8\database-ex61952421\mysqlite
    IsReadOnly: 0
    AutoCommit: 'on'
```

conn is an sqlite object with these properties:

- Database — SQLite database file name.
- IsOpen — SQLite connection is open.
- IsReadOnly — SQLite connection is writable.

To insert data into the database file, use the sqlwrite function.

Close the SQLite connection.

```
close(conn)
```

Create Read-Only SQLite Connection

Create a read-only SQLite connection to the MATLAB® interface to SQLite using the existing database file tutorial.db. Specify the file name in the current folder.

```
dbfile = fullfile(pwd,"tutorial.db");
conn = sqlite(dbfile,"readonly")
```

```
conn = 
  sqlite with properties:

      Database: 'C:\TEMP\Bdoc24a_2528353_7604\ib462BFE\6\tp8e4029f8\database-ex41829813\tutorial
    IsReadOnly: 1
    AutoCommit: 'on'
```

conn is an sqlite object with these properties:

- Database — SQLite database file name.
- IsOpen — SQLite connection is open.
- IsReadOnly — SQLite connection is read-only.

To import data from the database file, you can use the fetch function.

Close the SQLite connection.

```
close(conn)
```

Alternative Functionality

Instead of the sqlite object, the connection object enables you to connect to various relational databases using ODBC and JDBC drivers that you install and administer. You can create the

`connection` object by using the `database` function. To use the JDBC driver, close the SQLite connection and create a database connection using the URL string. For details, see these topics depending on your platform:

- "SQLite JDBC for Windows" on page 2-65
- "SQLite JDBC for macOS" on page 2-118
- "SQLite JDBC for Linux" on page 2-122

Version History

Introduced in R2016a

See Also

Topics

"Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5
"Import Data Using MATLAB Interface to SQLite" on page 5-32
"Insert Data into SQLite Database Table" on page 5-36
"Deploy MATLAB Interface to SQLite Database Application with MATLAB Compiler" on page 5-43

close

Close SQLite connection

Syntax

`close(conn)`

Description

`close(conn)` closes the SQLite connection by using the MATLAB interface to SQLite.

Note The SQLite connection object remains open until you close it using the `close` function. Always close this object when you finish using it.

Examples

Close SQLite Connection Object

Create an SQLite connection using the MATLAB® interface to SQLite and the existing database file `tutorial.db`, which is in the current folder.

```
dbfile = fullfile(pwd,"tutorial.db");
conn = sqlite(dbfile);
```

To import data from the database file, use the `fetch` function.

Close the SQLite connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

Version History

Introduced in R2016a

See Also

Objects
`sqlite`

Functions
`sqlread` | `fetch` | `sqlwrite`

Topics
"Interact with Data in SQLite Database Using MATLAB Interface to SQLite" on page 2-5
"Import Data Using MATLAB Interface to SQLite" on page 5-32
"Insert Data into SQLite Database Table" on page 5-36
"Create Table and Add Column in SQLite Database" on page 5-38

fetch

Import data into MATLAB workspace using SQLite connection

Syntax

```
results = fetch(conn,sqlquery)
results = fetch(conn,sqlquery,Name=Value)
```

Description

`results = fetch(conn,sqlquery)` returns all rows of data from an SQLite database file immediately after executing the SQL statement `sqlquery` by using the SQLite connection `conn` of the MATLAB interface to SQLite.

`results = fetch(conn,sqlquery,Name=Value)` specifies additional options using one or more name-value arguments. For example, `MaxRows=5` imports five rows of data.

Examples

Import Data from Database Table in SQLite Database File

Import all rows of data from a database table in an SQLite database file into MATLAB®. Determine the highest unit cost among products in the table. Then, use a row filter to import only the data for products with a unit cost less than 15.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = 'tutorial.db';
conn = sqlite(dbfile);
```

Import all the data from `productTable`. The `results` output argument contains the imported data as a table.

```
sqlquery = 'SELECT * FROM productTable';
results = fetch(conn,sqlquery)
```

```
results=15×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9            125970            1003            13       "Victorian Doll"
          8            212569            1001             5       "Train Set"
          7            389123            1007            16       "Engine Kit"
          2            400314            1002             9       "Painting Set"
          4            400339            1008            21       "Space Cruiser"
          1            400345            1001            14       "Building Blocks"
          5            400455            1005             3       "Tin Soldier"
          6            400876            1004             8       "Sail Boat"
          3            400999            1009            17       "Slinky"
```

```
    10          888652         1006         24       "Teddy Bear"
    11          408143         1004         11       "Convertible"
    12          210456         1010         22       "Hugsy"
    13          470816         1012         16       "Pancakes"
    14          510099         1011         19       "Shawl"
    15          899752         1011         20       "Snacks"
```

Determine the highest unit cost of the products. Access the variable in the table for the unit cost data, and then find the maximum cost.

```
max(results.unitCost)
```

```
ans = int64
    24
```

Now, import the data using a row filter. The filter condition is that `unitCost` must be less than 15.

```
rf = rowfilter("unitCost");
rf = rf.unitCost < 15;
results = fetch(conn,sqlquery,"RowFilter",rf)
```

```
results=7×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9            125970            1003            13       "Victorian Doll"
          8            212569            1001             5       "Train Set"
          2            400314            1002             9       "Painting Set"
          1            400345            1001            14       "Building Blocks"
          5            400455            1005             3       "Tin Soldier"
          6            400876            1004             8       "Sail Boat"
         11            408143            1004            11       "Convertible"
```

Close the SQLite connection.

```
close(conn)
```

Limit Number of Rows in Imported Data

Use the MATLAB® interface to SQLite to import a limited number of rows into MATLAB from a database table in an SQLite database file. Then, determine the highest unit cost among products in the table.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Import five rows of data from `productTable` by using the `MaxRows` name-value argument. `results` contains five rows of imported data as a table.

```
sqlquery = "SELECT * FROM productTable";
results = fetch(conn,sqlquery,MaxRows=5)
```

```
results=5×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9            125970            1003            13        "Victorian Doll"
          8            212569            1001             5        "Train Set"
          7            389123            1007            16        "Engine Kit"
          2            400314            1002             9        "Painting Set"
          4            400339            1008            21        "Space Cruiser"
```

Determine the highest unit cost for the limited number of products. Access the variable in the table for the unit cost data, and then find the maximum cost.

```
data = results.unitCost;
max(data)
```

```
ans = int64
    21
```

Close the SQLite connection.

```
close(conn)
```

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Input Arguments

conn — SQLite database connection

sqlite object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

sqlquery — SQL statement

character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. For information about the SQL query language, see the SQL Tutorial.

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Example: `fetch(conn,sqlquery,MaxRows=5)` imports five rows of data.

MaxRows — Maximum number of rows to return

positive numeric scalar

Maximum number of rows to return, specified as a positive numeric scalar. By default, the `fetch` function returns all rows from the executed SQL query. Use this name-value argument to limit the number of rows imported into MATLAB.

Example: `MaxRows=10`

Data Types: `double`

`VariableNamingRule` — Variable naming rule
`"preserve"` (default) | `"modify"`

Variable naming rule, specified as one of these values:

- `"preserve"` — Preserve most variable names when the `fetch` function imports data.
- `"modify"` — Remove non-ASCII characters from variable names when the `fetch` function imports data.

Example: `VariableNamingRule="modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; fetch(conn,sqlquery,"RowFilter",rf)`

Output Arguments

`results` — Result data
table

Result data, returned as a table. The result data contains all rows of data from the executed SQL statement.

The `fetch` function converts SQLite data types to MATLAB data types and represents NULL values accordingly.

SQLite Data Type	MATLAB Data Type	MATLAB Null Value Representation
• REAL • DOUBLE • FLOAT • NUMERIC • INT • TINYINT • SMALLINT • MEDIUMINT • BIGINT	double	double(NaN)
• CHAR • VARCHAR	string	<missing>

SQLite Data Type	MATLAB Data Type	MATLAB Null Value Representation
• DATE • DATETIME	string	<missing>
• BLOB	*N* x 1 uint8 vector	0 x 1 uint8 vector
• BOOLEAN	int64	Not available

Version History

Introduced in R2016a

R2023a: Selectively import rows of data based on filter condition

You can use the RowFilter name-value argument to selectively import rows of data from a database table.

R2022a: fetch function returns table

Behavior changed in R2022a

In prior releases, the fetch function returned the results output argument as a cell array. In R2022a, the fetch function returns the results output argument as a table. Use the table2cell function to convert the data type back to a cell array, or adjust your code to accept the new data type.

See Also

Objects
sqlite

Functions
close | execute | sqlwrite

Topics
“Interact with Data in SQLite Database Using MATLAB Interface to SQLite” on page 2-5
“Import Data Using MATLAB Interface to SQLite” on page 5-32
“Insert Data into SQLite Database Table” on page 5-36

External Websites
SQL Tutorial
SQLite Home Page

update

Namespace: `database.odbc`

Replace data in database table with MATLAB data

Syntax

`update(conn,tablename,colnames,data,whereclause)`

Description

`update(conn,tablename,colnames,data,whereclause)` exports the MATLAB variable `data` in its current format into the database table `tablename` using the database connection `conn`. You can use the SQL `WHERE` statement to specify which existing records in the database to replace.

Examples

Update Existing Record Using Cell Array

Connect to a Microsoft Access database and store the data that you are updating in a cell array. Then, update one column of data in the database table. Close the database connection.

Create the database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable`, which contains these columns:

- `productnumber`
- `quantity`
- `price`
- `inventorydate`

Import all the data from `inventorytable` as a cell array by using `conn`, and display the first three rows of imported data.

```
sqlquery = 'SELECT * FROM inventorytable';
results = fetch(conn,sqlquery,'DataReturnFormat','cellarray');
results(1:3,:)
```

```
ans =

  3×4 cell array

    {[1]}    {[1700]}    {[15]}    {'2014-09-23 09:3…'}
    {[2]}    {[1200]}    {[ 9]}    {'2014-07-08 22:5…'}
    {[3]}    {[ 356]}    {[17]}    {'2014-05-14 07:1…'}
```

Define a cell array containing the name of the column that you are updating.

```
colnames = {'quantity'};
```

Define a cell array containing the new data, `2000`.

```
data = {2000};
```

Update the column `quantity` in `inventorytable` for the product with `productnumber` equal to `1`.

```
tablename = 'inventorytable';
whereclause = 'WHERE productnumber = 1';

update(conn,tablename,colnames,data,whereclause)
```

Import the data again and view the updated contents in `inventorytable`.

```
results = fetch(conn,sqlquery,'DataReturnFormat','cellarray');
results(1:3,:)
```

```
ans =

  3×4 cell array

    {[1]}    {[2000]}    {[15]}    {'2014-09-23 09:3…'}
    {[2]}    {[1200]}    {[ 9]}    {'2014-07-08 22:5…'}
    {[3]}    {[ 356]}    {[17]}    {'2014-05-14 07:1…'}
```

In the `inventorytable` data, the product with the product number equal to `1` has an updated quantity of `2000` units.

Close the database connection.

```
close(conn)
```

Update Existing Record Using Table

Connect to a Microsoft Access database and store the data that you are updating as a table. Then, update multiple columns of data in the database table. Close the database connection.

Create the database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable`, which contains these columns:

- `productnumber`
- `quantity`
- `price`
- `inventorydate`

Import all the data from `inventorytable` by using `conn`, and display a few rows of the imported data.

```
sqlquery = 'SELECT * FROM inventorytable';
results = fetch(conn,sqlquery);
head(results)
```

```
ans =

  8×4 table

    productnumber    quantity    price         inventorydate
    _____________    ________    _____    ___________________________

          1            1700       20      '2014-09-23 09:38:34.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
          5            9000        3      '2012-09-14 15:00:25.000'
          6            4540        8      '2013-12-25 19:45:00.000'
          7            6034       16      '2014-08-06 08:38:00.000'
          8            8350        5      '2011-06-18 11:45:35.000'
```

Define a cell array containing the names of the columns that you are updating in `inventorytable`.

```
colnames = {'price','inventorydate'};
```

Define a table that contains the new data. Update the price to $15 and set the inventory timestamp to `'2014-12-01 08:50:15.000'`.

```
data = table(15,{'2014-12-01 08:50:15.000'}, ...
    'VariableNames',{'price','inventorydate'});
```

Update the columns `price` and `inventorydate` in the table `inventorytable` for the product number equal to `1`.

```
tablename = 'inventorytable';
whereclause = 'WHERE productnumber = 1';

update(conn,tablename,colnames,data,whereclause)
```

Import the data again and view the updated contents in `inventorytable`.

```
results = fetch(conn,sqlquery);
head(results)
```

```
ans =

  8×4 table

    productnumber    quantity    price         inventorydate
    _____________    ________    _____    ___________________________

          1            1700       15      '2014-12-01 08:50:15.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
          5            9000        3      '2012-09-14 15:00:25.000'
          6            4540        8      '2013-12-25 19:45:00.000'
          7            6034       16      '2014-08-06 08:38:00.000'
          8            8350        5      '2011-06-18 11:45:35.000'
```

The product with the product number equal to `1` has an updated price of $15 and timestamp of `'2014-12-01 08:50:15.000'`.

Close the database connection.

```
close(conn)
```

Update Multiple Records with Multiple Conditions

Connect to a Microsoft Access database and store the data that you are updating in a cell array. Then, update multiple records of data in the table by using multiple `WHERE` clauses. Close the database connection.

Create the database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable`, which contains these columns:

- `productnumber`
- `quantity`
- `price`
- `inventorydate`

Import all the data from `inventorytable` by using `conn`, and display the first few rows of imported data.

```
sqlquery = 'SELECT * FROM inventorytable';
results = fetch(conn,sqlquery);
head(results)
```

```
ans =

  8×4 table

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _________________________

          1            1700       20      '2014-12-01 08:50:15.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
          5            9000        3      '2012-09-14 15:00:25.000'
          6            4540        8      '2013-12-25 19:45:00.000'
          7            6034       16      '2014-08-06 08:38:00.000'
          8            8350        5      '2011-06-18 11:45:35.000'
```

Define a cell array containing the name of the column that you are updating.

```
colnames = {'quantity'};
```

Define a cell array containing the new data. Update the quantities for two products.

```
A = 10000;    % new quantity for product number 5
B = 5000;     % new quantity for product number 8

data = {A;B}; % cell array with the new quantities
```

Update the column `quantity` in `inventorytable` for the products with product numbers equal to `5` and `8`. Create a cell array `whereclause` that contains two `WHERE` clauses, one for each product.

```
tablename = 'inventorytable';
whereclause = {'WHERE productnumber = 5';'WHERE productnumber = 8'};

update(conn,tablename,colnames,data,whereclause)
```

Import the data again and view the updated contents in `inventorytable`.

```
results = fetch(conn,sqlquery);
head(results)
```

```
ans =

  8×4 table

    productnumber    quantity    price           inventorydate
    _____________    ________    _____    _________________________

          1            1700       20      '2014-12-01 08:50:15.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
          5           10000        3      '2012-09-14 15:00:25.000'
          6            4540        8      '2013-12-25 19:45:00.000'
          7            6034       16      '2014-08-06 08:38:00.000'
          8            5000        5      '2011-06-18 11:45:35.000'
```

The product with the product number equal to `5` has an updated quantity of `10000` units. The product with the product number equal to `8` has an updated quantity of `5000` units.

Close the database connection.

```
close(conn)
```

Update Multiple Columns with Multiple Conditions

Connect to a Microsoft Access database and store the data that you are updating in a cell array. Then, update multiple columns of data in the table by using multiple `WHERE` clauses. Close the database connection.

Create the database connection `conn` to the Microsoft Access database. This code assumes that you are connecting to a data source named `dbdemo` with a blank user name and password.

```
conn = database('dbdemo','','');
```

This database contains the table `inventorytable`, which contains these columns:

- `productnumber`
- `quantity`
- `price`
- `inventorydate`

Import all the data from `inventorytable` by using `conn`, and display the first few rows of imported data.

```
sqlquery = 'SELECT * FROM inventorytable';
results = fetch(conn,sqlquery);
head(results)

ans =

  8×4 table

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _________________________

          1            1700       20      '2014-12-01 08:50:15.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
          5            9000        3      '2012-09-14 15:00:25.000'
          6            4540        8      '2013-12-25 19:45:00.000'
          7            6034       16      '2014-08-06 08:38:00.000'
          8            8350        5      '2011-06-18 11:45:35.000'
```

Define a cell array containing the names of the columns that you are updating.

```
colnames = {'quantity','price'};
```

Define a cell array containing the new data. Update the quantities and prices for two products.

```
% new quantities and prices for product numbers 5 and 8
% are separated by a semicolon in the cell array
data = {10000,5.5;9000,10};
```

Update the columns `quantity` and `price` in `inventorytable` for the products with product numbers equal to `5` and `8`. Create a cell array `whereclause` that contains two `WHERE` clauses, one for each product.

```
tablename = 'inventorytable';
whereclause = {'WHERE productnumber = 5';'WHERE productnumber = 8'};

update(conn,tablename,colnames,data,whereclause)
```

Import the data again and view the updated contents in `inventorytable`.

```
results = fetch(conn,sqlquery);
head(results)

ans =

  8×4 table

    productnumber    quantity    price          inventorydate
    _____________    ________    _____    _________________________

          1            1700       20      '2014-12-01 08:50:15.000'
          2            1200        9      '2014-07-08 22:50:45.000'
          3             356       17      '2014-05-14 07:14:28.000'
          4            2580       21      '2013-06-08 14:24:33.000'
          5           10000        6      '2012-09-14 15:00:25.000'
          6            4540        8      '2013-12-25 19:45:00.000'
          7            6034       16      '2014-08-06 08:38:00.000'
          8            9000       10      '2011-06-18 11:45:35.000'
```

The product with the product number equal to 5 has an updated quantity of 10000 units and price equal to 6, rounded to the nearest number. The product with the product number equal to 8 has an updated quantity of 9000 units and price equal to 10.

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
connection object

Database connection, specified as an ODBC connection object or JDBC connection object created using the database function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: "employees"

Data Types: string | char

colnames — Database table column names
cell array of character vectors | string array

Database table column names, specified as a cell array of one or more character vectors or a string array to denote the columns in the existing database table tablename.

Example: {'col1','col2','col3'}

Data Types: cell | string

data — Update data
cell array | numeric matrix | table | structure | dataset

Update data, specified as a cell array, numeric matrix, table, structure, or dataset array.

If you are connecting to a database using a JDBC driver, convert the update data to a supported format before running update. If data contains MATLAB dates, times, or timestamps, use this formatting:

- Dates must be character vectors of the form yyyy-mm-dd.
- Times must be character vectors of the form HH:MM:SS.
- Timestamps must be character vectors of the form yyyy-mm-dd HH:MM:SS.FFF.

The database preference settings NullNumberWrite and NullStringWrite do not apply to this function. If data contains null entries and NaNs, convert these entries to an empty value ''.

- If data is a structure, then field names in the structure must match colnames.
- If data is a table or a dataset array, then the variable names in the table or dataset array must match colnames.

`whereclause` — SQL `WHERE` clause
character vector | cell array of character vectors | string scalar | string array

SQL `WHERE` clause, specified as a character vector or string scalar for one condition or a cell array of character vectors or string array for multiple conditions.

Example: `'WHERE producttable.productnumber = 1'`

Data Types: `char` | `cell` | `string`

Tips

- The value of the `AutoCommit` property in the `connection` object determines whether `update` automatically commits the data to the database.
  - To view the `AutoCommit` value, access it using the `connection` object; for example, `conn.AutoCommit`.
  - To set the `AutoCommit` value, use the corresponding name-value pair argument in the `database` function.
  - To commit the data to the database, use the `commit` function or issue an SQL `COMMIT` statement using the `exec` function.
  - To roll back the data, use `rollback` or issue an SQL `ROLLBACK` statement using the `exec` function.
- You can use `datainsert` to add new rows instead of replacing existing data.
- To update multiple records, the number of SQL `WHERE` clauses in `whereclause` must match the number of records in `data`.
- If the order of records in your database is not constant, then you can use values of column names to identify records.
- If this error message appears when your database table is open in edit mode:

  ```
  [Vendor][ODBC Product Driver] The database engine could
  not lock table 'TableName' because it is already in use
  by another person or process.
  ```

  Then, close the table and rerun the `update` function.
- Running the same update operation again can cause this error message to appear.

  ```
  ??? Error using ==> database.update
  Error:Commit/Rollback Problems
  ```

Version History

Introduced before R2006a

See Also

`commit` | `database` | `datainsert` | `rollback` | `get` | `close`

Topics

"Replace Existing Data in Database" on page 5-12
"Roll Back Data After Updating Record" on page 5-9
"Import Data from Database Table Using sqlread Function" on page 5-58

"Data Type Support" on page 1-3

External Websites
SQL Tutorial

sqlfind

Namespace: `database.odbc`

Find information about all table types in database

Syntax

```
data = sqlfind(conn,pattern)
data = sqlfind(conn,pattern,Name,Value)
```

Description

`data = sqlfind(conn,pattern)` returns information about all the "Table Types" on page 12-361 in a database where the specified character pattern appears in the name of a table type. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM information_schema.tables`.

`data = sqlfind(conn,pattern,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Catalog','cat'` finds all table types in the `'cat'` catalog.

Examples

Find Information About Table Types in Database

Use an ODBC connection to find information about all database table types in a Microsoft® SQL Server® database.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Find information about all table types in the database.

```
data = sqlfind(conn,'');
```

Display information about the first three table types.

```
data(1:3,:)
```

```
ans =

  3×5 table

      Catalog              Schema                     Table                 Columns        Type
    ___________    ____________________    _____________________    ___________    ______

    'toy_store'    'INFORMATION_SCHEMA'    'CHECK_CONSTRAINTS'      {1×4  cell}    'VIEW'
    'toy_store'    'INFORMATION_SCHEMA'    'COLUMNS'                {1×23 cell}    'VIEW'
    'toy_store'    'INFORMATION_SCHEMA'    'COLUMN_DOMAIN_USAGE'    {1×7  cell}    'VIEW'
```

`data` contains these variables:

- Catalog name
- Schema name
- Table name
- Columns in the table type
- Table type

Close the database connection.

```
close(conn)
```

Find Information About Table

Use an ODBC connection to find information about a database table in a Microsoft® SQL Server® database.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Find information about any tables that contain the pattern `product` in the table name. The `sqlfind` function returns information about the table `productTable`.

```
pattern = 'product';
data = sqlfind(conn,pattern)
```

```
data =
```

```
  1×5 table

     Catalog       Schema        Table           Columns       Type
    ___________    ______    ______________    ___________    _______

    'toy_store'    'dbo'     'productTable'    {1×5 cell}    'TABLE'
```

`data` contains these variables:

- Catalog name
- Schema name
- Table name
- Columns in the database table
- Table type

Display the column names in `productTable`.

```
data.Columns{:}
```

```
ans =

  1×5 cell array

  Columns 1 through 4

    {'productNumber'}    {'stockNumber'}    {'supplierNumber'}    {'unitCost'}

  Column 5

    {'productDescript…'}
```

Close the database connection.

```
close(conn)
```

Find Information About Table Types in Catalog and Schema

Use an ODBC connection to find information about all database table types in a Microsoft® SQL Server® database. Specify the database catalog and schema to search.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =
```

```
    []
```

Find information about all table types in the `toy_store` database catalog and the `dbo` database schema. Use the `'Catalog'` name-value pair argument to specify the catalog. Use the `'Schema'` name-value pair argument to specify the schema.

`data` is a table that contains information about all the table types in the specified catalog and schema.

```
data = sqlfind(conn,'','Catalog','toy_store','Schema','dbo');
```

Display the first eight table types.

```
head(data)
```

```
ans =

  8×5 table

      Catalog      Schema          Table             Columns       Type  
    ___________    ______    __________________    __________    _______

    'toy_store'    'dbo'     'DS17111713025590'    {1×5 cell}    'TABLE'
    'toy_store'    'dbo'     'DS17111713025699'    {1×4 cell}    'TABLE'
    'toy_store'    'dbo'     'DS22121715025751'    {1×5 cell}    'TABLE'
    'toy_store'    'dbo'     'DS22121715025879'    {1×4 cell}    'TABLE'
    'toy_store'    'dbo'     'DS22121715052820'    {1×5 cell}    'TABLE'
    'toy_store'    'dbo'     'DS22121715052941'    {1×4 cell}    'TABLE'
    'toy_store'    'dbo'     'DS26121710493780'    {1×5 cell}    'TABLE'
    'toy_store'    'dbo'     'DS26121710493818'    {1×4 cell}    'TABLE'
```

`data` contains these variables:

- Catalog name
- Schema name
- Table name
- Columns in the database table
- Table type

Display the column names in the fourth table type.

```
data.Columns{4}
```

```
ans =

  1×4 cell array

    {'productNumber'}    {'Quantity'}    {'Price'}    {'inventoryDate'}
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

`pattern` — Pattern
character vector | string scalar

Pattern, specified as a character vector or string scalar. The `sqlfind` function searches for this text in the names of the tables types in a database.

Example: `"inventory"`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlfind(conn,pattern,'Catalog','toy_store','Schema','dbo')` returns information about table types, stored in the specified catalog and schema, that match the name of the table type with the specified pattern.

`Catalog` — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`Schema` — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

Output Arguments

`data` — Table type information
table

Table type information, returned as a table that contains information for table types, where the table type name partially or fully matches the text in `pattern`. The returned table has these variables.

Variable	Description	Variable Data Type
`Catalog`	Catalog name where the database table type is stored	Cell array of character vectors
`Schema`	Schema name where the database table type is stored	
`Table`	Database table name	
`Columns`	Column names in the database table type	
`Type`	Database table type	

More About

Table Types

Table types are a subset of database objects, which store or reference data.

The `sqlfind` function recognizes these table types in a database:

- Table
- View
- System table
- System view
- Synonym
- Global temporary table
- Local temporary table

Version History

Introduced in R2018a

See Also

`sqlread` | `sqlinnerjoin` | `database` | `close`

Topics

"Retrieve Database Metadata" on page 5-64
"Import Data from Database Table Using sqlread Function" on page 5-58

sqlinnerjoin

Namespace: `database.odbc`

Inner join between two database tables

Syntax

```
data = sqlinnerjoin(conn,lefttable,righttable)
data = sqlinnerjoin(conn,lefttable,righttable,Name,Value)
```

Description

`data = sqlinnerjoin(conn,lefttable,righttable)` returns a table resulting from an inner join between the left and right database tables. This function matches rows using all shared columns, or keys, in both database tables. The inner join retains only the rows that match between the two tables. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM lefttable,righttable INNER JOIN lefttable.key = righttable.key`.

`data = sqlinnerjoin(conn,lefttable,righttable,Name,Value)` uses additional options specified by one or more name-value arguments. For example, specify `Keys = "productNumber"` to use the `productNumber` column as a key for joining the two database tables.

Examples

Join Two Database Tables

Use an ODBC connection to import product data from an inner join between two Microsoft® SQL Server® database tables into MATLAB®.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables.

`data` is a table that contains the matched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable);
```

Display the first three rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       'Building Blocks'         1001
          2          4.0031e+05          1002             9       'Painting Set'            1002
          3            4.01e+05          1009            17       'Slinky'                  1009
```

Close the database connection.

```
close(conn)
```

Join Two Database Tables in Catalog and Schema

Use an ODBC connection to import product data from an inner join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the database catalog and schema where the tables are stored.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. Specify the `toy_store` catalog and the `dbo` schema for both the left and right tables. Use the `'LeftCatalog'` and `'LeftSchema'` name-

value pair arguments for the left table, and the `'RightCatalog'` and `'RightSchema'` name-value pair arguments for the right table.

`data` is a table that contains the matched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable,'LeftCatalog','toy_store', ...
    'LeftSchema','dbo','RightCatalog','toy_store','RightSchema','dbo');
```

Display the first three rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       'Building Blocks'          1001
          2          4.0031e+05          1002             9       'Painting Set'             1002
          3            4.01e+05          1009            17       'Slinky'                   1009
```

Close the database connection.

```
close(conn)
```

Specify Key for Joining Two Database Tables

Use an ODBC connection to import joined product data from two Microsoft® SQL Server® database tables into MATLAB®. Specify the key to use for joining the tables.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. Specify the key, or shared column, between the tables using the `'Keys'` name-value pair argument.

`data` is a table that contains the matched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable,'Keys','supplierNumber');
```

Display the first three rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       'Building Blocks'         1001
          2          4.0031e+05          1002             9       'Painting Set'            1002
          3            4.01e+05          1009            17       'Slinky'                  1009
```

Close the database connection.

```
close(conn)
```

Join Data Using Left and Right Keys

Use an ODBC connection to import employee data from an inner join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the left and right keys for the join.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `employees` and `departments`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `employees` and `departments`, to find the managers for particular departments. The `employees` table is the left table of the join, and the `departments` table is the right table of the join. Here, the column names of the keys are different. Specify the `MANAGER_ID` key in the left table using the `'LeftKeys'` name-value pair argument. Specify the `DEPT_MANAGER_ID` key in the right table using the `'RightKeys'` name-value pair argument.

`data` is a table that contains the matched rows from the two tables.

```
lefttable = 'employees';
righttable = 'departments';
data = sqlinnerjoin(conn,lefttable,righttable,'LeftKeys','MANAGER_ID', ...
    'RightKeys','DEPT_MANAGER_ID');
```

Display the first three rows of joined data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×15 table

    EMPLOYEE_ID    FIRST_NAME    LAST_NAME      EMAIL        PHONE_NUMBER            HIRE_DATE
    ___________    __________    _________    __________    ______________    ___________________

        101         'Neena'      'Kochhar'    'NKOCHHAR'    '515.123.4568'    '2005-09-21 00:00:0
        102         'Lex'        'De Haan'    'LDEHAAN'     '515.123.4569'    '2001-01-13 00:00:0
        104         'Bruce'      'Ernst'      'BERNST'      '590.423.4568'    '2007-05-21 00:00:0
```

Close the database connection.

```
close(conn)
```

Limit Number of Rows in Joined Data

Use an ODBC connection to import joined product data from two Microsoft® SQL Server® database tables into MATLAB®. Specify the number of rows to return.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. Specify the number of rows to return using the `'MaxRows'` name-value pair argument.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable,'MaxRows',3)
```

```
data =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       'Building Blocks'          1001
          2          4.0031e+05          1002             9       'Painting Set'             1002
          8          2.1257e+05          1001             5       'Train Set'                1001
```

`data` is a table that contains three of the matched rows from the two tables. The columns from the right table appear to the right of the columns from the left table.

Close the database connection.

```
close(conn)
```

Preserve Variable Names in Joined Data

Import joined product data from two Microsoft® SQL Server® database tables into MATLAB® by using an ODBC connection. One of the tables contains a variable name with a non-ASCII character. When importing data, preserve the names of all the variables.

Create an ODBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MSSQLServerAuth";
conn = database(datasource,"","");
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Add a column to the database table `productTable`. The column name contains a non-ASCII character.

```
sqlquery = "ALTER TABLE productTable ADD tamaño varchar(30)";
execute(conn,sqlquery)
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. Specify the number of rows to return using the `'MaxRows'` name-value pair argument.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlinnerjoin(conn,lefttable,righttable,'MaxRows',3)
```

```
data=3×11 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription      tama_c
    _____________    ___________    ______________    ________    ___________________    _______

          1          4.0035e+05          1001            14       {'Building Blocks'}    {0×0 cha
          2          4.0031e+05          1002             9       {'Painting Set'   }    {0×0 cha
          8          2.1257e+05          1001             5       {'Train Set'      }    {0×0 cha
```

`data` is a table that contains three of the matched rows from the two tables. The `sqlinnerjoin` function converts the name of the new variable into ASCII characters.

Preserve the name of the variable that contains the non-ASCII character by specifying the `VariableNamingRule` name-value pair argument. Import the data again.

```
data = sqlinnerjoin(conn,lefttable,righttable,'MaxRows',3, ...
    'VariableNamingRule',"preserve")
```

```
data=3×11 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription      tamañc
    _____________    ___________    ______________    ________    ___________________    _______

          1          4.0035e+05          1001            14       {'Building Blocks'}    {0×0 cha
          2          4.0031e+05          1002             9       {'Painting Set'   }    {0×0 cha
          8          2.1257e+05          1001             5       {'Train Set'      }    {0×0 cha
```

The `sqlinnerjoin` function preserves the non-ASCII character in the variable name.

Close the database connection.

```
close(conn)
```

Filter Rows in Joined Data

Use an ODBC connection to import product data from an inner join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the row filter condition to use for joining the tables.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join the two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. The table `data` contains the matched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlinnerjoin(conn,lefttable,righttable);
```

Display the first five rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription    Supplie
    _____________    ___________    ______________    ________    __________________    _______

          1          4.0034e+05          1001            14       {'Building Blocks'}       10(
          2          4.0031e+05          1002             9       {'Painting Set'   }       10(
          3            4.01e+05          1009            17       {'Slinky'         }       10(
          4          4.0034e+05          1008            21       {'Space Cruiser'  }       10(
          5          4.0046e+05          1005             3       {'Tin Soldier'    }       10(
```

Join the same tables, but this time use a row filter. The filter condition is that `unitCost` must be less than 15. Again, display the first five rows of matched data.

```
rf = rowfilter("unitCost");
rf = rf.unitCost < 15;
data = sqlinnerjoin(conn,lefttable,righttable,"RowFilter",rf);
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription    Supplie
    _____________    ___________    ______________    ________    __________________    _______

          1          4.0034e+05          1001            14       {'Building Blocks'}       10(
          2          4.0031e+05          1002             9       {'Painting Set'   }       10(
          5          4.0046e+05          1005             3       {'Tin Soldier'    }       10(
          6          4.0088e+05          1004             8       {'Sail Boat'      }       10(
          8          2.1257e+05          1001             5       {'Train Set'      }       10(
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

`lefttable` — Left table
character vector | string scalar

Left table, specified as a character vector or string scalar. Specify the name of the database table on the left side of the join.

Example: `'inventoryTable'`

Data Types: `char` | `string`

righttable — Right table
character vector | string scalar

Right table, specified as a character vector or string scalar. Specify the name of the database table on the right side of the join.

Example: 'productTable'

Data Types: char | string

Name-Value Pair Arguments

Specify optional pairs of arguments as Name1=Value1,...,NameN=ValueN, where Name is the argument name and Value is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose Name *in quotes.*

Example: data = sqlinnerjoin(conn,lefttable,righttable,'LeftCatalog','toy_store','LeftSchema','dbo','RightCatalog','toy_shop','RightSchema','toys','MaxRows',5) performs an inner join between left and right tables by specifying the catalog and schema for both tables and returns five matched rows.

LeftCatalog — Left catalog
character vector | string scalar

Left catalog, specified as the comma-separated pair consisting of 'LeftCatalog' and a character vector or string scalar. Specify the database catalog name where the left table of the join is stored.

Example: 'LeftCatalog','toy_store'

Data Types: char | string

RightCatalog — Right catalog
character vector | string scalar

Right catalog, specified as the comma-separated pair consisting of 'RightCatalog' and a character vector or string scalar. Specify the database catalog name where the right table of the join is stored.

Example: 'RightCatalog','toy_store'

Data Types: char | string

LeftSchema — Left schema
character vector | string scalar

Left schema, specified as the comma-separated pair consisting of 'LeftSchema' and a character vector or string scalar. Specify the database schema name where the left table of the join is stored.

Example: 'LeftSchema','dbo'

Data Types: char | string

RightSchema — Right schema
character vector | string scalar

Right schema, specified as the comma-separated pair consisting of 'RightSchema' and a character vector or string scalar. Specify the database schema name where the right table of the join is stored.

Example: 'RightSchema','dbo'

Data Types: char | string

Keys — Keys
character vector | string scalar | cell array of character vectors | string array

Keys, specified as the comma-separated pair consisting of 'Keys' and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. Use this name-value pair argument to identify the shared keys (columns) between the two tables to join.

You cannot use this name-value pair argument with the 'LeftKeys' and 'RightKeys' name-value pair arguments.

Example: 'Keys','MANAGER_ID'

Data Types: char | string | cell

LeftKeys — Left keys
character vector | string scalar | cell array of character vectors | string array

Left keys, specified as the comma-separated pair consisting of 'LeftKeys' and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the left table for the join to the right table.

Use this name-value pair argument with the 'RightKeys' name-value pair argument. Both arguments must specify the same number of keys. The sqlinnerjoin function pairs the values of the keys based on their order.

Example: 'LeftKeys',["productNumber" "Price"],'RightKeys',["productNumber" "Price"]

Data Types: char | string | cell

RightKeys — Right keys
character vector | string scalar | cell array of character vectors | string array

Right keys, specified as the comma-separated pair consisting of 'RightKeys' and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the right table for the join to the left table.

Use this name-value pair argument with the 'LeftKeys' name-value pair argument. Both arguments must specify the same number of keys. The sqlinnerjoin function pairs the values of the keys based on their order.

Example: 'LeftKeys',["productIdentifier" "Cost"],'RightKeys',["productNumber" "Price"]

Data Types: char | string | cell

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of 'MaxRows' and a positive numeric scalar. By default, the sqlinnerjoin function returns all rows from the

executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: 'MaxRows',10

Data Types: double

VariableNamingRule — Variable naming rule
"modify" (default) | "preserve"

Variable naming rule, specified as the comma-separated pair consisting of 'VariableNamingRule' and one of these values:

- "modify" — Remove non-ASCII characters from variable names when the sqlinnerjoin function imports data.
- "preserve" — Preserve most variable names when the sqlinnerjoin function imports data. For details, see the Limitations section.

Example: 'VariableNamingRule',"modify"

Data Types: string

RowFilter — Row filter condition
<unconstrained> (default) | matlab.io.RowFilter object

Row filter condition, specified as a matlab.io.RowFilter object.

Example: rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlinnerjoin(conn,lefttable,righttable,"RowFilter",rf)

Output Arguments

data — Joined data
table

Joined data, returned as a table that contains the matched rows from the join of the left and right tables. data also contains a variable for each column in the left and right tables.

For columns that have numeric data types in the database table, the variable data types in data are double by default. For columns that have text, date, time, or timestamp data types in the database table, the variable data types are cell arrays of character vectors by default.

If the column names are shared between the joined database tables and have the same case, then the sqlinnerjoin function adds a unique suffix to the corresponding variable names in data.

Limitations

The name-value argument VariableNamingRule has these limitations:

- The sqlinnerjoin function returns an error if you specify the VariableNamingRule name-value argument with the SQLImportOptions object opts.
- When the VariableNamingRule name-value argument is set to the value "modify":
  - The variable names Properties, RowNames, and VariableNames are reserved identifiers for the table data type.

- The length of each variable name must be less than the number returned by `namelengthmax`.

Version History

Introduced in R2018a

R2023a: Selectively join data based on filter condition

You can use the `RowFilter` when joining data from database tables.

See Also

`sqlfind` | `sqlread` | `sqlouterjoin` | `database` | `close`

Topics

"Join Tables Using Command Line" on page 5-57
"Importing Data Common Errors" on page 3-3

sqlouterjoin

Namespace: `database.odbc`

Outer join between two database tables

Syntax

```
data = sqlouterjoin(conn,lefttable,righttable)
data = sqlouterjoin(conn,lefttable,righttable,Name,Value)
```

Description

`data = sqlouterjoin(conn,lefttable,righttable)` returns a table resulting from an outer join between the left and right database tables. This function matches rows using all shared columns, or keys, in both database tables. The outer join retains the matched and unmatched rows between the two tables. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM lefttable,righttable OUTER JOIN lefttable.key = righttable.key`.

`data = sqlouterjoin(conn,lefttable,righttable,Name,Value)` uses additional options specified by one or more name-value arguments. For example, specify `Keys = "productNumber"` to use the `productNumber` column as a key for joining the two database tables.

Examples

Join Two Database Tables

Use an ODBC connection to import product data from an outer join between two Microsoft® SQL Server® database tables into MATLAB®.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables.

`data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable);
```

Display the first three rows of joined data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       'Building Blocks'         1001
          2          4.0031e+05          1002             9       'Painting Set'            1002
          3            4.01e+05          1009            17       'Slinky'                  1009
```

Close the database connection.

```
close(conn)
```

Join Two Database Tables in Catalog and Schema

Use an ODBC connection to import product data from an outer join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the database catalog and schema where the tables are stored.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables. Specify the `toy_store` catalog and the `dbo` schema for both the left and right tables. Use the `'LeftCatalog'` and `'LeftSchema'` name-

value pair arguments for the left table, and the 'RightCatalog' and 'RightSchema' name-value pair arguments for the right table.

data is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable,'LeftCatalog','toy_store', ...
    'LeftSchema','dbo','RightCatalog','toy_store','RightSchema','dbo');
```

Display the first three rows of joined data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05         1001             14       'Building Blocks'         1001
          2          4.0031e+05         1002              9       'Painting Set'            1002
          3            4.01e+05         1009             17       'Slinky'                  1009
```

Close the database connection.

```
close(conn)
```

Specify Key for Joining Two Database Tables

Use an ODBC connection to import joined product data from two Microsoft® SQL Server® database tables into MATLAB®. Specify the key to use for joining the tables.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables productTable and suppliers.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the Message property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, productTable and suppliers. The productTable table is the left table of the join, and the suppliers table is the right table of the join. Specify the key, or shared column, between the tables using the 'Keys' name-value pair argument.

`data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable,'Keys','supplierNumber');
```

Display the first three rows of joined data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,3)
```

```
ans =

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       'Building Blocks'        1001
          2          4.0031e+05          1002             9       'Painting Set'           1002
          3            4.01e+05          1009            17       'Slinky'                 1009
```

Close the database connection.

```
close(conn)
```

Join Data Using Left and Right Keys

Use an ODBC connection to import employee data from an outer join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the left and right keys for the join.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `employees` and `departments`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `employees` and `departments`, to find the managers for particular departments. The `employees` table is the left table of the join, and the `departments` table is the right table of the join. Here, the column names of the keys are different. Specify the `MANAGER_ID` key in the left table using the `'LeftKeys'` name-value pair argument. Specify the `DEPT_MANAGER_ID` key in the right table using the `'RightKeys'` name-value pair argument.

`data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = 'employees';
righttable = 'departments';
data = sqlouterjoin(conn,lefttable,righttable,'LeftKeys','MANAGER_ID', ...
    'RightKeys','DEPT_MANAGER_ID');
```

Display the last three unmatched rows of joined data. Display the last five variables of the joined data.

```
tail(data(:,end-4:end),3)
```

```
ans =

  3×5 table

    DEPARTMENT_ID    DEPARTMENT_ID_1     DEPARTMENT_NAME     DEPT_MANAGER_ID    LOCATION_ID
    _____________    _______________    _________________    _______________    ___________

         NaN               230          'IT Helpdesk'              NaN             1700
         NaN                40          'Human Resources'          203             2400
         NaN                10          'Administration'           200             1700
```

Close the database connection.

```
close(conn)
```

Create Right Join Using Left and Right Keys

Use an ODBC connection to import joined employee data from two Microsoft® SQL Server® database tables into MATLAB®. Create a right join and specify the left and right keys for the join.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `employees` and `departments`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `employees` and `departments`, to find the managers for particular departments. The `employees` table is the left table of the join, and the `departments` table is the right table of the join. Here, the column names of the keys are different. Specify the `MANAGER_ID` key in the left table using the `'LeftKeys'` name-value pair argument. Specify the `DEPT_MANAGER_ID` key in the right table using the `'RightKeys'` name-value pair argument. Create a right join using the `'Type'` name-value pair argument.

```
lefttable = 'employees';
righttable = 'departments';
data = sqlouterjoin(conn,lefttable,righttable,'LeftKeys','MANAGER_ID', ...
    'RightKeys','DEPT_MANAGER_ID','Type','right');
```

`data` is a table that contains the matched rows from the two tables and the unmatched rows from the right table only.

Display the last three unmatched rows of joined data. Display the last five variables of the joined data.

```
tail(data(:,end-4:end),3)
```

```
ans =

  3×5 table

    DEPARTMENT_ID    DEPARTMENT_ID_1    DEPARTMENT_NAME    DEPT_MANAGER_ID    LOCATION_ID
    _____________    _______________    _______________    _______________    ___________

         NaN               250          'Retail Sales'           NaN             1700
         NaN               260          'Recruiting'             NaN             1700
         NaN               270          'Payroll'                NaN             1700
```

Close the database connection.

```
close(conn)
```

Limit Number of Rows in Joined Data

Use an ODBC connection to import joined product data from two Microsoft® SQL Server® database tables into MATLAB®. Specify the number of rows to return.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables. Specify the number of rows to return using the `'MaxRows'` name-value pair argument.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable,'MaxRows',3)
```

```
data = 

  3×10 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          7          3.8912e+05          1007            16        'Engine Kit'              1007
          8          2.1257e+05          1001             5        'Train Set'               1001
          9          1.2597e+05          1003            13        'Victorian Doll'          1003
```

data is a table that contains three of the matched and unmatched rows from the two tables. The columns from the right table appear to the right of the columns from the left table.

Close the database connection.

```
close(conn)
```

Preserve Variable Names in Joined Data

Import joined product data from two Microsoft® SQL Server® database tables into MATLAB® by using an ODBC connection. One of the tables contains a variable name with a non-ASCII character. When importing data, preserve the names of all the variables.

Create an ODBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the tables productTable and suppliers.

```
datasource = "MSSQLServerAuth";
conn = database(datasource,"","");
```

Check the database connection. If the Message property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Add a column to the database table productTable. The column name contains a non-ASCII character.

```
sqlquery = "ALTER TABLE productTable ADD tamaño varchar(30)";
execute(conn,sqlquery)
```

Join two database tables, productTable and suppliers. The productTable table is the left table of the join, and the suppliers table is the right table of the join. The sqlouterjoin function automatically detects the shared column between the tables. Specify the number of rows to return using the 'MaxRows' name-value pair argument.

```
lefttable = 'productTable';
righttable = 'suppliers';
data = sqlouterjoin(conn,lefttable,righttable,'MaxRows',3)
```

```
data=3×11 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription     tama_o
    _____________    ___________    ______________    ________    __________________    ________

          7          3.8912e+05          1007            16       {'Engine Kit'    }    {0×0 char
          8          2.1257e+05          1001             5       {'Train Set'     }    {0×0 char
          9          1.2597e+05          1003            13       {'Victorian Doll'}    {0×0 char
```

`data` is a table that contains three of the matched rows from the two tables. The `sqlouterjoin` function converts the name of the new variable into ASCII characters.

Preserve the name of the variable that contains the non-ASCII character by specifying the `VariableNamingRule` name-value pair argument. Import the data again.

```
data = sqlouterjoin(conn,lefttable,righttable,'MaxRows',3, ...
    'VariableNamingRule',"preserve")
```

```
data=3×11 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription     tamaño
    _____________    ___________    ______________    ________    __________________    ________

          7          3.8912e+05          1007            16       {'Engine Kit'    }    {0×0 char
          8          2.1257e+05          1001             5       {'Train Set'     }    {0×0 char
          9          1.2597e+05          1003            13       {'Victorian Doll'}    {0×0 char
```

The `sqlouterjoin` function preserves the non-ASCII character in the variable name.

Close the database connection.

```
close(conn)
```

Filter Rows in Joined Data

Use an ODBC connection to import product data from an outer join between two Microsoft® SQL Server® database tables into MATLAB®. Specify the row filter condition to use for joining the tables.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Join the two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables. The table `data` contains the matched and unmatched rows from the two tables..

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlouterjoin(conn,lefttable,righttable);
```

Display the first five rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription     Supplie
    _____________    ___________    ______________    ________    ___________________    _______

          1          4.0034e+05          1001            14       {'Building Blocks'}       100
          2          4.0031e+05          1002             9       {'Painting Set'   }       100
          3            4.01e+05          1009            17       {'Slinky'         }       100
          4          4.0034e+05          1008            21       {'Space Cruiser'  }       100
          5          4.0046e+05          1005             3       {'Tin Soldier'    }       100
```

Join the same tables, but this time use a row filter. The filter condition is that `unitCost` must be less than 15. Again, display the first five rows of matched data.

```
rf = rowfilter("unitCost");
rf = rf.unitCost < 15;
data = sqlouterjoin(conn,lefttable,righttable,"RowFilter",rf);
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription     Supplie
    _____________    ___________    ______________    ________    ___________________    _______

          1          4.0034e+05          1001            14       {'Building Blocks'}       100
          2          4.0031e+05          1002             9       {'Painting Set'   }       100
          5          4.0046e+05          1005             3       {'Tin Soldier'    }       100
          6          4.0088e+05          1004             8       {'Sail Boat'      }       100
          8          2.1257e+05          1001             5       {'Train Set'      }       100
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

`lefttable` — Left table
character vector | string scalar

Left table, specified as a character vector or string scalar. Specify the name of the database table on the left side of the join.

Example: `'inventoryTable'`

Data Types: `char` | `string`

`righttable` — Right table

character vector | string scalar

Right table, specified as a character vector or string scalar. Specify the name of the database table on the right side of the join.

Example: `'productTable'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlouterjoin(conn,lefttable,righttable,'Type','left','MaxRows',5)` performs an outer left join between left and right tables and returns five rows of the joined data.

`LeftCatalog` — Left catalog

character vector | string scalar

Left catalog, specified as the comma-separated pair consisting of `'LeftCatalog'` and a character vector or string scalar. Specify the database catalog name where the left table of the join is stored.

Example: `'LeftCatalog','toy_store'`

Data Types: `char` | `string`

`RightCatalog` — Right catalog

character vector | string scalar

Right catalog, specified as the comma-separated pair consisting of `'RightCatalog'` and a character vector or string scalar. Specify the database catalog name where the right table of the join is stored.

Example: `'RightCatalog','toy_store'`

Data Types: `char` | `string`

`LeftSchema` — Left schema

character vector | string scalar

Left schema, specified as the comma-separated pair consisting of `'LeftSchema'` and a character vector or string scalar. Specify the database schema name where the left table of the join is stored.

Example: `'LeftSchema','dbo'`

Data Types: `char` | `string`

`RightSchema` — Right schema

character vector | string scalar

Right schema, specified as the comma-separated pair consisting of `'RightSchema'` and a character vector or string scalar. Specify the database schema name where the right table of the join is stored.

Example: `'RightSchema','dbo'`

Data Types: `char` | `string`

`Keys` — Keys
character vector | string scalar | cell array of character vectors | string array

Keys, specified as the comma-separated pair consisting of `'Keys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. Use this name-value pair argument to identify the shared keys (columns) between the two tables to join.

You cannot use this name-value pair argument with the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.

Example: `'Keys','MANAGER_ID'`

Data Types: `char` | `string` | `cell`

`LeftKeys` — Left keys
character vector | string scalar | cell array of character vectors | string array

Left keys, specified as the comma-separated pair consisting of `'LeftKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the left table for the join to the right table.

Use this name-value pair argument with the `'RightKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlouterjoin` function pairs the values of the keys based on their order.

Example: `'LeftKeys',["productNumber" "Price"],'RightKeys',["productNumber" "Price"]`

Data Types: `char` | `string` | `cell`

`RightKeys` — Right keys
character vector | string scalar | cell array of character vectors | string array

Right keys, specified as the comma-separated pair consisting of `'RightKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the right table for the join to the left table.

Use this name-value pair argument with the `'LeftKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlouterjoin` function pairs the values of the keys based on their order.

Example: `'LeftKeys',["productIdentifier" "Cost"],'RightKeys',["productNumber" "Price"]`

Data Types: `char` | `string` | `cell`

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `sqlouterjoin` function returns all rows from the

executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

Type — Outer join type
`'full'` (default) | `'left'` | `'right'`

Outer join type, specified as the comma-separated pair consisting of `'Type'` and one of these values:

- `'full'` — A full join retrieves records that have matching values in the selected column of both tables, and unmatched records from both the left and right tables.
- `'left'` — A left join retrieves records that have matching values in the selected column of both tables, and unmatched records from the left table only.
- `'right'` — A right join retrieves records that have matching values in the selected column of both tables, and unmatched records from the right table only.

You can specify these values as a character vector or string scalar.

Not all databases support all join types. For an unsupported database, you must use the `sqlread` function to import data from both tables into MATLAB. Then, use the `outerjoin` function to join tables in the MATLAB workspace.

Example: `'Type','left'`

VariableNamingRule — Variable naming rule
`"modify"` (default) | `"preserve"`

Variable naming rule, specified as the comma-separated pair consisting of `'VariableNamingRule'` and one of these values:

- `"modify"` — Remove non-ASCII characters from variable names when the `sqlouterjoin` function imports data.
- `"preserve"` — Preserve most variable names when the `sqlouterjoin` function imports data. For details, see the Limitations section.

Example: `'VariableNamingRule',"modify"`

Data Types: `string`

RowFilter — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlouterjoin(conn,lefttable,righttable,"RowFilter",rf)`

Output Arguments

data — Joined data
table

Joined data, returned as a table that contains rows matched by keys in the left and right database tables and the retained unmatched rows. `data` also contains a variable for each column in the left and right tables.

By default, the variable data types are `double` for columns that have `numeric` data types in the database table. For any text, `date`, `time`, or `timestamp` data types in the database table, the variable data type is a cell array of character vectors by default.

If the column names are shared between the joined database tables and have the same case, then the `outerjoin` function adds a unique suffix to the corresponding variable names in `data`.

The variables in `data` that correspond to columns in the left table contain `NULL` values when no matched rows exist in the right database table. Similarly, the variables that correspond to columns in the right table contain `NULL` values when no matched rows exist in the left database table.

Limitations

The name-value argument `VariableNamingRule` has these limitations:

- The `sqlouterjoin` function returns an error if you specify the `VariableNamingRule` name-value argument with the `SQLImportOptions` object `opts`.
- When the `VariableNamingRule` name-value argument is set to the value `"modify"`:
  - The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.
  - The length of each variable name must be less than the number returned by `namelengthmax`.

Version History

Introduced in R2018a

R2023a: Selectively join data based on filter condition

You can use the `RowFilter` when joining data from database tables.

See Also

`sqlfind` | `sqlread` | `sqlinnerjoin` | `database` | `close`

Topics

"Join Tables Using Command Line" on page 5-57
"Importing Data Common Errors" on page 3-3

sqlread

Namespace: `database.odbc`

Import data into MATLAB from database table

Syntax

```
data = sqlread(conn,tablename)
data = sqlread(conn,tablename,opts)
data = sqlread( ___ ,Name,Value)
[data,metadata] = sqlread( ___ )
```

Description

`data = sqlread(conn,tablename)` returns a table by importing data into MATLAB from a database table. Executing this function is the equivalent of writing a `SELECT * FROM tablename` SQL statement in ANSI SQL.

`data = sqlread(conn,tablename,opts)` customizes options for importing data from a database table using the `SQLImportOptions` object.

`data = sqlread( ___ ,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, specify `Catalog = "cat"` to import data from a database table stored in the `"cat"` catalog.

`[data,metadata] = sqlread( ___ )` also returns the `metadata` table, which contains metadata information about the imported data.

Examples

Import Data from Database Table

Use an ODBC connection to import product data from a database table into MATLAB® using a Microsoft® SQL Server® database. Then, perform a simple data analysis.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =
```

```
[]
```

Import data from the database table `productTable`. The `sqlread` function returns a MATLAB® table that contains the product data.

```
tablename = 'productTable';
data = sqlread(conn,tablename);
```

Display the first five products.

```
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       {'Victorian Doll'}
          8          2.1257e+05          1001             5       {'Train Set'     }
          7          3.8912e+05          1007            16       {'Engine Kit'    }
          2          4.0031e+05          1002             9       {'Painting Set'  }
          4          4.0034e+05          1008            21       {'Space Cruiser' }
```

Now, import the data using a row filter. The filter condition is that `unitCost` must be less than 15.

```
rf = rowfilter("unitCost");
rf = rf.unitCost < 15;
data = sqlread(conn,tablename,"RowFilter",rf);
```

Again, display the first five products.

```
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    ___________________

          9          1.2597e+05          1003            13       {'Victorian Doll' }
          8          2.1257e+05          1001             5       {'Train Set'      }
          2          4.0031e+05          1002             9       {'Painting Set'   }
          1          4.0034e+05          1001            14       {'Building Blocks'}
          5          4.0046e+05          1005             3       {'Tin Soldier'    }
```

Close the database connection.

```
close(conn)
```

Import Data from Database Table Using Import Options

Customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
               VariableTypes: {'char', 'char', 'double' ... and 7 more}
       SelectedVariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
                  FillValues: {'', '',  NaN  ... and 7 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 10 VariableOptions
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |      (2) |      (3) |        (4) |      (5) |      (6) |      (7) |
         Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smoker' |
         Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'double' |
  MissingRule:     'fill' |   'fill' |   'fill' |     'fill' |   'fill' |   'fill' |   'fill' |
    FillValue:         '' |       '' |      NaN |         '' |      NaN |      NaN |      NaN |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker` variables using the `setoptions` function. Because the `Gender`, `Location`, and `SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `logical`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'Smoker','Type','logical');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                           (1) |            (2) |       (3) |                          (4)
         Name:        'Gender' |     'Location' |  'Smoker' | 'SelfAssessedHealthStatus'
         Type: 'categorical' | 'categorical' | 'logical' |              'categorical'
  MissingRule:          'fill' |         'fill' |    'fill' |                     'fill'
    FillValue:   <undefined> |   <undefined> |         0 |                <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts);
tail(data)
```

```
      LastName       Gender    Age              Location              Height    Weight    Smoker
    _____________    ______    ___    _________________________    ______    ______    ______

    {'Foster'   }    Female    30     St. Mary's Medical Center      70        124     false 
    {'Gonzales' }    Male      48     County General Hospital        71        174     false 
    {'Bryant'   }    Female    48     County General Hospital        66        134     false 
    {'Alexander'}    Male      25     County General Hospital        69        171     true  
    {'Russell'  }    Male      44     VA Hospital                    69        188     true  
    {'Griffin'  }    Male      49     County General Hospital        70        186     false 
    {'Diaz'     }    Male      45     County General Hospital        68        172     true  
    {'Hayes'    }    Male      48     County General Hospital        66        177     false 
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    LastName: 100×1 cell array of character vectors

    Gender: 100×1 categorical

        Values:

            Female      53   
            Male        47   

    Age: 100×1 double

        Values:

            Min         25   
            Median      39   
```

```
        Max          50

Location: 100×1 categorical

    Values:

        County General Hospital         39
        St. Mary s Medical Center       24
        VA Hospital                     37

Height: 100×1 double

    Values:

        Min          60
        Median       67
        Max          72

Weight: 100×1 double

    Values:

        Min           111
        Median      142.5
        Max           202

Smoker: 100×1 logical

    Values:

        True        34
        False       66

Systolic: 100×1 double

    Values:

        Min         109
        Median      122
        Max         138

Diastolic: 100×1 double

    Values:

        Min            68
        Median       81.5
        Max            99

SelfAssessedHealthStatus: 100×1 categorical

    Values:

        Excellent       34
        Fair            15
        Good            40
        Poor            11
```

Now set the filter condition to import only data for patients older than 40 years and not taller than 68 inches.

```
opts.RowFilter = opts.RowFilter.Age > 40 & opts.RowFilter.Height <= 68
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
               VariableTypes: {'char', 'categorical', 'double' ... and 7 more}
       SelectedVariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
                  FillValues: {'',  <undefined>,  NaN  ... and 7 more }
                   RowFilter: Age > 40 & Height <= 68

             VariableOptions: Show all 10 VariableOptions
```

Again, import the `patients` database table using the `sqlread` function, and display a summary of the imported data.

```
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    LastName: 24×1 cell array of character vectors

    Gender: 24×1 categorical

        Values:

            Female       17
            Male          7

    Age: 24×1 double

        Values:

            Min           41
            Median      45.5
            Max           50

    Location: 24×1 categorical

        Values:

            County General Hospital         13
            St. Mary s Medical Center        5
            VA Hospital                      6

    Height: 24×1 double

        Values:

            Min          62
```

```
        Median       66
        Max          68

    Weight: 24×1 double

        Values:

            Min         119
            Median      137
            Max         194

    Smoker: 24×1 logical

        Values:

            True          8
            False        16

    Systolic: 24×1 double

        Values:

            Min           114
            Median      121.5
            Max           138

    Diastolic: 24×1 double

        Values:

            Min            68
            Median       81.5
            Max            96

    SelfAssessedHealthStatus: 24×1 categorical

        Values:

            Excellent        7
            Fair             3
            Good            10
            Poor             4
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Import Data from Database Table in Specific Schema

Use an ODBC connection to import product data from a database table into MATLAB® using a Microsoft® SQL Server® database. Specify the schema where the database table is stored. Then, sort and filter the rows in the imported data and perform a simple data analysis.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import data from the table `productTable`. Specify the database schema `dbo`. The `data` table contains the product data.

```
tablename = 'productTable';
data = sqlread(conn,tablename,'Schema','dbo');
```

Display the first few products.

```
data(1:3,:)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        'Victorian Doll'
          8          2.1257e+05          1001             5        'Train Set'
          7          3.8912e+05          1007            16        'Engine Kit'
```

Display the first few product descriptions.

```
data.productDescription(1:3)
```

```
ans =

  3×1 cell array

    {'Victorian Doll'}
    {'Train Set'     }
    {'Engine Kit'    }
```

Sort the rows in `data` by the product description column in alphabetical order.

```
column = 'productDescription';
data = sortrows(data,column);
```

Display the first few product descriptions after sorting.

```
data.productDescription(1:3)
```

```
ans =

  3×1 cell array

    {'Building Blocks'}
    {'Convertible'    }
    {'Engine Kit'     }
```

Close the database connection.

```
close(conn)
```

Import Specific Number of Rows from Database Table

Use an ODBC connection to import product data from a database table into MATLAB® using a Microsoft® SQL Server® database. Specify the maximum number of rows to import from the database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Import data from the table `productTable`. Import only three rows of data from the database table. The `data` table contains the product data.

```
tablename = 'productTable';
data = sqlread(conn,tablename,'MaxRows',3)
```

```
data =

  3×5 table
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        'Victorian Doll'
          8          2.1257e+05          1001             5        'Train Set'
          7          3.8912e+05          1007            16        'Engine Kit'
```

Close the database connection.

```
close(conn)
```

Preserve Variable Names When Importing Data

Import product data from a Microsoft® SQL Server® database table into MATLAB® by using an ODBC connection. The table contains a variable name with a non-ASCII character. When importing data, preserve the names of all the variables.

Create an ODBC database connection to an SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = "MSSQLServerAuth";
conn = database(datasource,"","");
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Add a column to the database table `productTable`. The column name contains a non-ASCII character.

```
sqlquery = "ALTER TABLE productTable ADD tamaño varchar(30)";
execute(conn,sqlquery)
```

Import data from the database table `productTable`. The `sqlread` function returns a MATLAB table that contains the product data. Display the first three rows of the data in the table.

```
tablename = "productTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
ans=3×6 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription      tama_o
    _____________    ___________    ______________    ________    __________________    ________

          9          1.2597e+05          1003            13       {'Victorian Doll'}    {0×0 char
          8          2.1257e+05          1001             5       {'Train Set'     }    {0×0 char
          7          3.8912e+05          1007            16       {'Engine Kit'    }    {0×0 char
```

The `sqlread` function converts the name of the new variable into ASCII characters.

Preserve the name of the variable that contains the non-ASCII character by specifying the `VariableNamingRule` name-value pair argument. Import the data again.

```
data = sqlread(conn,tablename, ...
    'VariableNamingRule',"preserve");
head(data,3)
```

```
ans=3×6 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription      tamaño
    _____________    ___________    ______________    ________    __________________    _________

          9          1.2597e+05          1003            13       {'Victorian Doll'}    {0×0 char
          8          2.1257e+05          1001             5       {'Train Set'     }    {0×0 char
          7          3.8912e+05          1007            16       {'Engine Kit'    }    {0×0 char
```

The `sqlread` function preserves the non-ASCII character in the variable name.

Close the database connection.

```
close(conn)
```

Retrieve Metadata Information About Imported Data

Retrieve metadata information when importing data from a database table. Import data using the `sqlread` function and explore the metadata information by using dot notation.

This example uses the `outages.csv` file, which contains outage data. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MS SQL Server Auth";
conn = database(datasource,"","");
```

Load outage information into the MATLAB® workspace.

```
outages = readtable("outages.csv");
```

Create the `outages` database table using the outage information.

```
tablename = "outages";
sqlwrite(conn,tablename,outages)
```

Import the data into the MATLAB workspace and return metadata information about the imported data.

```
[data,metadata] = sqlread(conn,tablename);
```

View the names of the variables in the imported data.

```
metadata.Properties.RowNames
```

```
ans = 6×1 cell array
    {'Region'         }
```

```
    {'OutageTime'     }
    {'Loss'           }
    {'Customers'      }
    {'RestorationTime'}
    {'Cause'          }
```

View the data type of each variable in the imported data.

```
metadata.VariableType
```

```
ans = 6×1 cell array
    {'char'  }
    {'char'  }
    {'double'}
    {'double'}
    {'char'  }
    {'char'  }
```

View the missing data value for each variable in the imported data.

```
metadata.FillValue
```

```
ans = 6×1 cell array
    {0×0 char}
    {0×0 char}
    {[   NaN]}
    {[   NaN]}
    {0×0 char}
    {0×0 char}
```

View the indices of the missing data for each variable in the imported data.

```
metadata.MissingRows
```

```
ans = 6×1 cell array
    {  0×1 double}
    {  0×1 double}
    {604×1 double}
    {328×1 double}
    { 29×1 double}
    {  0×1 double}
```

Display the first eight rows of the imported data that contain missing restoration time. `data` contains restoration time in the fifth variable. Use the numeric indices to find the rows with missing data.

```
index = metadata.MissingRows{5,1};
nullrestoration = data(index,:);
head(nullrestoration)
```

```
ans=8×6 table
      Region              OutageTime              Loss      Customers     RestorationTime
    ____________    ___________________________    ______    ___________    _______________    _______

    'SouthEast'     '2003-01-23 00:49:00.000'     530.14    2.1204e+05          ''             'winte
    'NorthEast'     '2004-09-18 05:54:00.000'          0             0          ''             'equip
```

```
    'MidWest'      '2002-04-20 16:46:00.000'     23141           NaN          ''            'unkno
    'NorthEast'    '2004-09-16 19:42:00.000'      4718           NaN          ''            'unkno
    'SouthEast'    '2005-09-14 15:45:00.000'    1839.2    3.4144e+05          ''            'sever
    'SouthEast'    '2004-08-17 17:34:00.000'     624.1    1.7879e+05          ''            'sever
    'SouthEast'    '2006-01-28 23:13:00.000'    498.78           NaN          ''            'energ
    'West'         '2003-06-20 18:22:00.000'         0             0          ''            'energ
```

Delete the `outages` database table using the `execute` function.

```
sqlstr = "DROP TABLE ";
sqlquery = strcat(sqlstr,tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
connection object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: "employees"

Data Types: string | char

opts — Database import options
SQLImportOptions object

Database import options, specified as an `SQLImportOptions` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlread(conn,'inventoryTable','Catalog','toy_store','Schema','dbo','MaxRows',5)` imports five rows of data from the database table `inventoryTable` stored in the `toy_store` catalog and the `dbo` schema.

Catalog — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`Schema` — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `sqlread` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

`VariableNamingRule` — Variable naming rule
`"modify"` (default) | `"preserve"`

Variable naming rule, specified as the comma-separated pair consisting of `'VariableNamingRule'` and one of these values:

- `"modify"` — Remove non-ASCII characters from variable names when the `sqlread` function imports data.
- `"preserve"` — Preserve most variable names when the `sqlread` function imports data. For details, see the Limitations section.

Example: `'VariableNamingRule',"modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlread(conn,tablename,"RowFilter",rf)`

Output Arguments

`data` — Imported data
table

Imported data, returned as a table. The rows of the table correspond to the rows in the database table tablename. The variables in the table correspond to each column in the database table. For columns that have numeric data types in the database table, the variable data types in data are double by default. For columns that have text, date, time, or timestamp data types in the database table, the variable data types are cell arrays of character vectors by default.

If the database table contains no data to import, then data is an empty table.

metadata — Metadata information
table

Metadata information, returned as a table with these variables.

Variable Name	Variable Description	Variable Data Type
VariableType	Data type of each variable in the imported data	Cell array of character vectors
FillValue	Value of missing data for each variable in the imported data	Cell array of missing data values
MissingRows	Indices for each occurrence of missing data in each variable of the imported data	Cell array of numeric indices

By default, the sqlread function imports text data as a character vector and numeric data as a double. FillValue is an empty character array (for text data) or NaN (for numeric data) by default. To change the missing data value to another value, use the SQLImportOptions object.

The RowNames property of the metadata table contains the names of the variables in the imported data.

Limitations

- The sqlread function returns an error when you use the VariableNamingRule name-value argument with the SQLImportOptions object opts.
- When the VariableNamingRule name-value pair argument is set to the value "modify":
  - The variable names Properties, RowNames, and VariableNames are reserved identifiers for the table data type.
  - The length of each variable name must be less than the number returned by namelengthmax.
- The sqlread function returns an error if you specify the RowFilter name-value argument with the SQLImportOptions object opts. It is ambiguous which of the RowFilter object to use in this case, especially if the filter conditions are different.

Version History

Introduced in R2018a

R2023a: Selectively import rows of data based on filter condition

You can use the RowFilter name-value argument to selectively import rows of data from a database table.

See Also

Functions

`sqlfind` | `select` | `fetch` | `sqlinnerjoin` | `sqlouterjoin` | `database` | `close` | `databaseImportOptions` | `setoptions` | `getoptions` | `reset` | `execute` | `sqlupdate`

Topics

"Import Data from Database Table Using sqlread Function" on page 5-58
"Customize Options for Importing Data from Database into MATLAB" on page 5-67
"Data Import Memory Management" on page 5-20
"Importing Data Common Errors" on page 3-3

sqlupdate

Namespace: database.odbc

Update rows in database table

Syntax

```
sqlupdate(conn,tablename,data,filter)
sqlupdate( ___ ,Name,Value)
```

Description

`sqlupdate(conn,tablename,data,filter)` updates rows in the database table (`tablename`) with the rows from the MATLAB table (`data`) based on filter conditions (`filter`).

`sqlupdate( ___ ,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, `Catalog = "cat"` updates data from a database table stored in the `"cat"` catalog.

Examples

Update Database Rows

Update database rows based on filter conditions specified with row filters.

This example uses the `patients.xls` file, which contains the columns `LastName`, `Gender`, `Age`, `Location`, `Height`, `Weight`, `Smoker`, `Systolic`, `Diastolic`, and `SelfAssessedHealthStatus`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Use the SQL `ALTER` statement to add the column `HighRisk` to the table `patients`.

```
sqlquery = 'ALTER TABLE patients ADD HighRisk bit';
execute(conn,sqlquery)
```

Import the patients database table using the sqlread function, and return metadata information about the imported data.

```
[data,metadata] = sqlread(conn,tablename);
```

Display the first 10 rows of the table. In MATLAB, all the values in the HighRisk column appear as false.

```
head(data,10)
```

```
      LastName         Gender       Age              Location               Height    Weight    Smo
    _____________    __________    ___    _____________________________    ______    ______    ___

    {'Smith'   }    {'Male'  }    38     {'County General Hospital'  }      71        176       1
    {'Johnson' }    {'Male'  }    43     {'VA Hospital'              }      69        163       0
    {'Williams'}    {'Female'}    38     {'St. Mary's Medical Center'}      64        131       0
    {'Jones'   }    {'Female'}    40     {'VA Hospital'              }      67        133       0
    {'Brown'   }    {'Female'}    49     {'County General Hospital'  }      64        119       0
    {'Davis'   }    {'Female'}    46     {'St. Mary's Medical Center'}      68        142       0
    {'Miller'  }    {'Female'}    33     {'VA Hospital'              }      64        142       1
    {'Wilson'  }    {'Male'  }    40     {'VA Hospital'              }      68        180       0
    {'Moore'   }    {'Male'  }    28     {'St. Mary's Medical Center'}      68        183       0
    {'Taylor'  }    {'Female'}    31     {'County General Hospital'  }      66        132       0
```

Displaying the metadata shows that the values are NULL (missing elements) in the database.

```
metadata
```

```
metadata=11×3 table
                                VariableType    FillValue      MissingRows  
                                ____________    __________    ______________

    LastName                    {'char'   }     {0×0 char}    {  0×1 double}
    Gender                      {'char'   }     {0×0 char}    {  0×1 double}
    Age                         {'double' }     {[   NaN]}    {  0×1 double}
    Location                    {'char'   }     {0×0 char}    {  0×1 double}
    Height                      {'double' }     {[   NaN]}    {  0×1 double}
    Weight                      {'double' }     {[   NaN]}    {  0×1 double}
    Smoker                      {'double' }     {[   NaN]}    {  0×1 double}
    Systolic                    {'double' }     {[   NaN]}    {  0×1 double}
    Diastolic                   {'double' }     {[   NaN]}    {  0×1 double}
    SelfAssessedHealthStatus    {'char'   }     {0×0 char}    {  0×1 double}
    HighRisk                    {'logical'}     {[     0]}    {100×1 double}
```

Now, identify patients who are considered high risk for developing some hypothetical health issue based on their age and their smoker status. First, create a table containing the new data to write to the database. This table requires only 1 (true) and 0 (false) values.

```
t = table([1;0],VariableNames="HighRisk");
head(t)
```

```
    HighRisk
    ________

       1    
       0    
```

Create a row filter using the filter condition that a patient must be older than 35 years and a smoker to be considered high-risk.

```
rf = rowfilter(["Age","Smoker"]);
rf = rf.Age > 35 & rf.Smoker == 1
```

```
rf = 
  RowFilter with constraints:

    Age > 35 & Smoker == 1

  VariableNames: Age, Smoker
```

Update the `HighRisk` column using this filter to set the values to `1` (`true`) and using the `~rf` value of the filter to set the value to `0` (`false`).

```
sqlupdate(conn,"patients",t,{rf;~rf});
```

Again, import the `patients` database table using the `sqlread` function, and display the first 10 rows.

```
data = sqlread(conn,tablename);
head(data,10)
```

```
      LastName        Gender      Age              Location               Height    Weight    Smo
    ____________    __________    ___    _____________________________    ______    ______    ___

    {'Smith'   }    {'Male'  }    38     {'County General Hospital'  }      71       176      1
    {'Johnson' }    {'Male'  }    43     {'VA Hospital'              }      69       163      (
    {'Williams'}    {'Female'}    38     {'St. Mary's Medical Center'}      64       131      (
    {'Jones'   }    {'Female'}    40     {'VA Hospital'              }      67       133      (
    {'Brown'   }    {'Female'}    49     {'County General Hospital'  }      64       119      (
    {'Davis'   }    {'Female'}    46     {'St. Mary's Medical Center'}      68       142      (
    {'Miller'  }    {'Female'}    33     {'VA Hospital'              }      64       142      1
    {'Wilson'  }    {'Male'  }    40     {'VA Hospital'              }      68       180      (
    {'Moore'   }    {'Male'  }    28     {'St. Mary's Medical Center'}      68       183      (
    {'Taylor'  }    {'Female'}    31     {'County General Hospital'  }      66       132      (
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: "employees"

Data Types: string | char

data — Updated data
MATLAB table

Updated data, specified as a MATLAB table. The table can contain one or more rows with updated data. The names of the variables in the table must be a subset of the column names of the database table.

Example: data = table([1;0],"VariableNames","NewName")

Data Types: table

filter — Row filter condition
matlab.io.RowFilter object | cell array of matlab.io.RowFilter objects

Row filter condition, specified as a matlab.io.RowFilter object or cell array of matlab.io.RowFilter objects. Filters determine which database rows sqlupdate must update with which data. If multiple database rows match a filter, sqlupdate updates them with the same data. If a single database row matches multiple filters, its final state matches the data corresponding to the last matching filter.

Example: rf = rowfilter("productnumber"); rf = rf.productnumber <= 5;

Name-Value Pair Arguments

Specify optional pairs of arguments as Name1=Value1,...,NameN=ValueN, where Name is the argument name and Value is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose Name *in quotes.*

Example: sqlupdate(conn,'inventoryTable',data,rf,Catalog = "toy_store",Schema = "dbo") updates the database inventoryTable stored in the toy_store catalog and the dbo schema.

Catalog — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: Catalog = "toy_store"

Data Types: string | char

Schema — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

Version History

Introduced in R2023a

See Also

`sqlread` | `sqlfind` | `select` | `fetch` | `sqlinnerjoin` | `sqlouterjoin` | `database` | `close` | `databaseImportOptions` | `setoptions` | `getoptions` | `reset`

sqlupdate

Update rows in SQLite database table

Syntax

```
sqlupdate(conn,tablename,data,filter)
sqlupdate( ___ ,Name,Value)
```

Description

`sqlupdate(conn,tablename,data,filter)` updates rows in the SQLite database table (`tablename`) with the rows from the MATLAB table (`data`) based on filter conditions (`filter`).

`sqlupdate( ___ ,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, `Catalog = "cat"` updates data from a database table stored in the `"cat"` catalog.

Examples

Update Database Rows

Update rows in the database table in the SQLite database file based on filter conditions specified with row filters.

Create the SQLite connection to the existing SQLite database file `inventory.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "inventory.db";
conn = sqlite(dbfile);
```

Import all the data from `productTable`. The `results` output argument contains the imported data as a table. Display the first 10 rows of the table.

```
tablename = "productTable";
results = sqlread(conn,tablename);
head(results,10)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9            125970            1003            13       "Victorian Doll"
          8            212569            1001             5       "Train Set"
          7            389123            1007            16       "Engine Kit"
          2            400314            1002             9       "Painting Set"
          4            400339            1008            21       "Space Cruiser"
          1            400345            1001            14       "Building Blocks"
          5            400455            1005             3       "Tin Soldier"
          6            400876            1004             8       "Sail Boat"
          3            400999            1009            17       "Slinky"
         10            888652            1006            24       "Teddy Bear"
```

Use the SQL ALTER statement to add the column Recall to the table.

```
sqlquery = strcat("ALTER TABLE productTable ADD COLUMN Recall INTEGER DEFAULT 0");
execute(conn,sqlquery)
```

Now, identify products being recalled. First, create a table containing the new data to write to the database. This table requires only 1 (true) and 0 (false) values.

```
t = table([1;0],VariableNames="Recall");
head(t)
```

```
    Recall
    ______

      1
      0
```

Create a row filter using the filter condition that a supplier number must be either 1001 or greater than 1005 and the stock number must be greater than 400,000.

```
rf = rowfilter(["supplierNumber","stockNumber"]);
rf = (rf.supplierNumber == 1001 | rf.supplierNumber > 1005) & rf.stockNumber > 400000
```

```
rf = 
  RowFilter with constraints:

    (supplierNumber == 1001 | supplierNumber > 1005) & stockNumber > 400000

  VariableNames: supplierNumber, stockNumber
```

Update the Recall column using this filter to set the values to 1 (true) and using the ~rf value of the filter to set the value to 0 (false).

```
sqlupdate(conn,"productTable",t,{rf;~rf});
```

Again, import the data from productTable and display the first 10 rows.

```
results = sqlread(conn,tablename);
head(results,10)
```

productNumber	stockNumber	supplierNumber	unitCost	productDescription	Recall
9	125970	1003	13	"Victorian Doll"	0
8	212569	1001	5	"Train Set"	0
7	389123	1007	16	"Engine Kit"	0
2	400314	1002	9	"Painting Set"	0
4	400339	1008	21	"Space Cruiser"	1
1	400345	1001	14	"Building Blocks"	1
5	400455	1005	3	"Tin Soldier"	0
6	400876	1004	8	"Sail Boat"	0
3	400999	1009	17	"Slinky"	1
10	888652	1006	24	"Teddy Bear"	1

Use the SQL ALTER statement to remove the Recall column from the table.

```
sqlquery = strcat("ALTER TABLE productTable DROP COLUMN Recall");
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection

sqlite object

SQLite database connection, specified as an sqlite object created using the sqlite function.

tablename — Database table name

string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: "employees"

Data Types: string | char

data — Updated data

MATLAB table

Updated data, specified as a MATLAB table. The table can contain one or more rows with updated data. The names of the variables in the table must be a subset of the column names of the database table.

Example: data = table([1;0],"VariableNames","NewName")

Data Types: table

filter — Row filter condition

matlab.io.RowFilter object | cell array of matlab.io.RowFilter objects

Row filter condition, specified as a matlab.io.RowFilter object or a cell array of matlab.io.RowFilter objects. Filters determine which database rows sqlupdate must update with which data. If multiple database rows match a filter, sqlupdate updates them with the same data. If a single database row matches multiple filters, its final state matches the data corresponding to the last matching filter.

Example: rf = rowfilter("productnumber"); rf = rf.productnumber <= 5;

Name-Value Pair Arguments

Specify optional pairs of arguments as Name1=Value1,...,NameN=ValueN, where Name is the argument name and Value is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose Name *in quotes.*

Example: sqlupdate(conn,'inventoryTable',data,rf,Catalog = "toy_store",Schema = "dbo") updates the database inventoryTable stored in the toy_store catalog and the dbo schema.

Catalog — Database catalog name

string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`Schema` — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

Version History

Introduced in R2023a

See Also

`sqlite` | `fetch` | `sqlwrite` | `close` | `sqlread`

sqlread

Import data into MATLAB from SQLite database table

Syntax

```
data = sqlread(conn,tablename)
data = sqlread(conn,tablename,Name=Value)
```

Description

`data = sqlread(conn,tablename)` returns a table by importing data into MATLAB from a database table with the MATLAB interface to SQLite. Executing this function is the equivalent of writing a `SELECT * FROM tablename` SQL statement in ANSI SQL.

`data = sqlread(conn,tablename,Name=Value)` specifies additional options using one or more name-value arguments. For example, `MaxRows=5` imports five rows of data.

Examples

Import Data from Database Table in SQLite Database File

Import all rows of data from a database table in an SQLite database file into MATLAB. Determine the highest unit cost among products in the table. Then, use the `sqlread` function with a filter to import only the data for products with a unit cost less than 15.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Import all the data from `productTable`. The `results` output argument contains the imported data as a table.

```
tablename = "productTable";
results = sqlread(conn,tablename)
```

```
results=15×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9            125970            1003            13       "Victorian Doll"
          8            212569            1001             5       "Train Set"
          7            389123            1007            16       "Engine Kit"
          2            400314            1002             9       "Painting Set"
          4            400339            1008            21       "Space Cruiser"
          1            400345            1001            14       "Building Blocks"
          5            400455            1005             3       "Tin Soldier"
          6            400876            1004             8       "Sail Boat"
          3            400999            1009            17       "Slinky"
```

```
     10          888652         1006         24       "Teddy Bear"
     11          408143         1004         11       "Convertible"
     12          210456         1010         22       "Hugsy"
     13          470816         1012         16       "Pancakes"
     14          510099         1011         19       "Shawl"
     15          899752         1011         20       "Snacks"
```

Determine the highest unit cost of the products. Access unit cost data using the variable of the `results` table. `data` is a vector that contains numeric unit costs. Find the maximum unit cost.

```
data = results.unitCost;
max(data)
```

```
ans = int64
    24
```

Now, import the data using a row filter. The filter condition is that `unitCost` must be less than 15.

```
rf = rowfilter("unitCost");
rf = rf.unitCost < 15;
results = sqlread(conn,tablename,"RowFilter",rf)
```

```
results=7×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9            125970            1003            13       "Victorian Doll"
          8            212569            1001             5       "Train Set"
          2            400314            1002             9       "Painting Set"
          1            400345            1001            14       "Building Blocks"
          5            400455            1005             3       "Tin Soldier"
          6            400876            1004             8       "Sail Boat"
         11            408143            1004            11       "Convertible"
```

Close the SQLite connection.

```
close(conn)
```

Import Specific Number of Rows from Database Table

Use the `sqlread` function of the MATLAB® interface to SQLite to import a limited number of rows of data into MATLAB from a database table in an SQLite database file.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Import data from the table `productTable`. Import only three rows of data from the database table. The `data` table contains the product data.

```
tablename = "productTable";
data = sqlread(conn,tablename,MaxRows=3)
```

```
data=3×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9            125970            1003            13        "Victorian Doll"  
          8            212569            1001             5        "Train Set"       
          7            389123            1007            16        "Engine Kit"      
```

Close the SQLite connection.

```
close(conn)
```

Remove Non-ASCII Characters in Variable Names When Importing Data

Import product data from an SQLite database table into MATLAB® by using the MATLAB interface to SQLite. The table contains a variable name with a non-ASCII character. When importing data, remove non-ASCII characters from the names of all the variables.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Rename the `unitCost` column in the database table `productTable` to `tamaño`. The column name contains a non-ASCII character.

```
sqlquery = "ALTER TABLE productTable RENAME COLUMN unitCost TO tamaño";
execute(conn,sqlquery)
```

Import data from the database table `productTable`. The `sqlread` function returns a MATLAB table that contains the product data. Display the first three rows of the data in the table.

```
tablename = "productTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
    productNumber    stockNumber    supplierNumber    tamaño    productDescription
    _____________    ___________    ______________    ______    __________________

          9            125970            1003           13       "Victorian Doll"  
          8            212569            1001            5       "Train Set"       
          7            389123            1007           16       "Engine Kit"      
```

The `sqlread` function preserves non-ASCII characters in the name of the variable by default.

Remove the non-ASCII character in the name of the variable by specifying the `VariableNamingRule` name-value argument. Import the data again.

```
data = sqlread(conn,tablename, ...
    VariableNamingRule="modify");
head(data,3)
```

```
    productNumber    stockNumber    supplierNumber    tama_o    productDescription
    _____________    ___________    ______________    ______    __________________
```

```
    9        125970       1003       13      "Victorian Doll"
    8        212569       1001        5      "Train Set"
    7        389123       1007       16      "Engine Kit"
```

The `sqlread` function removes the non-ASCII character in the variable name.

Rename the `tamaño` column in the database table `productTable` back to `unitCost`.

```
sqlquery = "ALTER TABLE productTable RENAME COLUMN tamaño TO unitCost";
execute(conn,sqlquery)
```

Close the SQLite connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Example: `data = sqlread(conn,"inventoryTable",MaxRows=5)` imports five rows of data from the database table `inventoryTable`.

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as a positive numeric scalar. By default, the `sqlread` function returns all rows from the executed SQL query. Use this name-value argument to limit the number of rows imported into MATLAB.

Example: `MaxRows=10`

Data Types: `double`

VariableNamingRule — Variable naming rule
`"preserve"` (default) | `"modify"`

Variable naming rule, specified as one of these values:

- `"preserve"` — Preserve most variable names when the `sqlread` function imports data.
- `"modify"` — Remove non-ASCII characters from variable names when the `sqlread` function imports data.

Example: `VariableNamingRule="modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlread(conn,tablename,"RowFilter",rf)`

Output Arguments

`data` — Result data
table

Result data, returned as a table. The result data contains all rows of data from the executed SQL statement.

The `sqlread` function converts SQLite data types to MATLAB data types and represents NULL values accordingly.

SQLite Data Type	MATLAB Data Type	MATLAB Null Value Representation
• `REAL` • `DOUBLE` • `FLOAT` • `NUMERIC` • `INT` • `TINYINT` • `SMALLINT` • `MEDIUMINT` • `BIGINT`	`double`	`double(NaN)`
• `CHAR` • `VARCHAR`	`string`	`<missing>`
• `DATE` • `DATETIME`	`string`	`<missing>`
• `BLOB`	*N* x 1 `uint8` vector	0 x 1 `uint8` vector
• `BOOLEAN`	`int64`	Not available

Version History

Introduced in R2022a

R2023a: Selectively import rows of data based on filter condition

You can use the `RowFilter` name-value argument to selectively import rows of data from a database table.

See Also

Objects
`sqlite`

Functions
`fetch` | `sqlwrite` | `close`

Topics
"Import Data Using MATLAB Interface to SQLite" on page 5-32
"Insert Data into SQLite Database Table" on page 5-36

sqlwrite

Namespace: `database.odbc`

Insert MATLAB data into database table

Syntax

```
sqlwrite(conn,tablename,data)
sqlwrite(conn,tablename,data,Name,Value)
```

Description

`sqlwrite(conn,tablename,data)` inserts data from a MATLAB table into a database table. If the table exists in the database, this function appends the data in the MATLAB table as rows in the existing database table. If the table does not exist in the database, this function creates a table with the specified table name and then inserts the data as rows in the new table. This syntax is the equivalent of executing SQL statements that contain the `CREATE TABLE` and `INSERT INTO` ANSI SQL syntaxes.

`sqlwrite(conn,tablename,data,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Catalog','toy_store'` inserts data into a database table that is located in the database catalog named `toy_store`.

Examples

Append Data into Existing Table

Use an ODBC connection to append product data from a MATLAB® table into an existing table in a Microsoft® SQL Server® database.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

To view the existing database table `productTable` before appending data, import its contents into MATLAB and display the last few rows.

```
tablename = 'productTable';
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17           'Pancakes'
         14           5.101e+05          1011            19           'Shawl'
         15          8.9975e+05          1011            20           'Snacks'
```

Create a MATLAB table that contains the data for one product.

```
data = table(30,500000,1000,25,"Rubik's Cube", ...
    'VariableNames',{'productNumber' 'stockNumber' ...
    'supplierNumber' 'unitCost' 'productDescription'});
```

Append the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans =

  4×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17         'Pancakes'
         14           5.101e+05          1011            19         'Shawl'
         15          8.9975e+05          1011            20         'Snacks'
         30               5e+05          1000            25         'Rubik's Cube'
```

Close the database connection.

```
close(conn)
```

Insert Data into New Table

Use an ODBC connection to insert product data from MATLAB® into a new table in a Microsoft® SQL Server® database.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',{'productNumber' ...
    'stockNumber' 'supplierNumber' 'unitCost' 'productDescription'});
```

Insert the product data into a new database table `toyTable`.

```
tablename = 'toyTable';
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows =

  2×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30             5e+05            1000            25         'Rubik's Cube'
         40             6e+05            2000            30         'Doll House'
```

Close the database connection.

```
close(conn)
```

Specify Column Types When Inserting Data into New Table

Use an ODBC connection to insert product data from MATLAB® into a new table in a Microsoft® SQL Server® database. Specify the data types of the columns in the new database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',{'productNumber' ...
    'stockNumber' 'supplierNumber' 'unitCost' 'productDescription'});
```

Insert the product data into a new database table `toyTable`. Use the `'ColumnType'` name-value pair argument and a string array to specify the data types of all the columns in the database table.

```
tablename = 'toyTable';
coltypes = ["numeric" "numeric" "numeric" "numeric" "varchar(255)"];
sqlwrite(conn,tablename,data,'ColumnType',coltypes)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows =

  2×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30             5e+05            1000            25         'Rubik's Cube'
         40             6e+05            2000            30         'Doll House'
```

Close the database connection.

```
close(conn)
```

Insert Cell Array into Table

Use an ODBC connection to insert product data from MATLAB® into a new table in a Microsoft® SQL Server® database. Insert data stored as a cell array into the new database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a cell array that contains data for two products.

```
c = {30,500000,1000,25,"Rubik's Cube";40,600000,2000,30,"Doll House"};
```

Convert the cell array to a MATLAB table by specifying the column names.

```
colnames = {'productNumber' 'stockNumber' 'supplierNumber' 'unitCost' ...
    'productDescription'};
data = cell2table(c,'VariableNames',colnames);
```

Insert the product data into a new database table `toyTable`.

```
tablename = 'toyTable';
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows =

  2×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30            5e+05             1000            25         'Rubik's Cube'
         40            6e+05             2000            30         'Doll House'
```

Close the database connection.

```
close(conn)
```

Insert Structure into Table

Use an ODBC connection to insert product data from MATLAB® into a new table in a Microsoft® SQL Server® database. Insert data stored as a structure into the new database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a structure array that contains data for two products.

```
s(1).productNumber = 30;
s(1).stockNumber = 500000;
s(1).supplierNumber = 1000;
s(1).unitCost = 25;
s(1).productDescription = "Rubik's Cube";

s(2).productNumber = 40;
s(2).stockNumber = 600000;
s(2).supplierNumber = 2000;
s(2).unitCost = 30;
s(2).productDescription = "Doll House";
```

Convert the structure to a MATLAB table.

```
data = struct2table(s);
```

Insert the product data into a new database table `toyTable`.

```
tablename = 'toyTable';
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows =

  2×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30            5e+05             1000            25          'Rubik's Cube'
         40            6e+05             2000            30          'Doll House'
```

Close the database connection.

```
close(conn)
```

Insert Numeric Array into Table

Use an ODBC connection to insert sales volume data from MATLAB® into an existing table in a Microsoft® SQL Server® database. Insert data stored as a numeric array into the existing database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the `salesVolume` table.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message


ans =

     []
```

Create a numeric array that contains monthly sales volume data for a specific stock number. Specify the column names for the existing database table `salesVolume`.

```
n = [100000 1000 0 2000 500 3000 450 600 700 750 1450 0 0];
colnames = {'StockNumber' 'January' 'February' 'March' 'April' 'May' ...
    'June' 'July' 'August' 'September' 'October' 'November' 'December'};
```

Convert the numeric array to a MATLAB table.

```
data = array2table(n,'VariableNames',colnames);
```

Insert the sales volume data into the database table `salesVolume`.

```
tablename = 'salesVolume';
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the last three rows. The results contain a new row for the inserted sales volume data.

```
rows = sqlread(conn,tablename);
tail(rows,3)


ans =

  3×13 table

    StockNumber    January    February    March    April    May     June    July    August    Sep
    ___________    _______    ________    _____    _____    ____    ____    ____    ______    ___

     5.101e+05       235        1800      1040      900      750    700     400      350
    8.9975e+05       123        1700       823      701      689    621     545      421
         1e+05      1000           0      2000      500     3000    450     600      700
```

Close the database connection.

```
close(conn)
```

Insert Date Number into Table

Use an ODBC connection to insert inventory data from MATLAB® into an existing table in a Microsoft® SQL Server® database. Insert a date stored as a date number into the existing database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `inventoryTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a numeric array that contains inventory data for a specific product, including the date number `731011`. Specify the column names for the existing database table `inventoryTable`.

```
n = [25 1000 50 731011];
colnames = {'productNumber' 'Quantity' 'Price' 'inventoryDate'};
```

Convert the numeric array to a MATLAB table.

```
data = array2table(n,'VariableNames',colnames);
```

Convert the date value in the inventory data to a `datetime` array. The `sqlwrite` function does not accept date numbers as a valid data type for insertion.

```
n = data.inventoryDate;
data.inventoryDate = datetime(n,'ConvertFrom','datenum');
```

Import the contents of the database table `inventoryTable` into MATLAB and display the last few rows.

```
tablename = 'inventoryTable';
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×4 table

    productNumber    Quantity    Price          inventoryDate        
    _____________    ________    _____    _________________________
```

```
        11               567        11       '2012-09-11 00:30:24.000'
        12              1278        22       '2010-10-29 18:17:47.000'
        13              1700        17       '2009-05-24 10:58:59.000'
```

Insert the inventory data into the database table `inventoryTable`. Specify the schema where the table is stored by using the `'Schema'` name-value pair argument.

```
sqlwrite(conn,tablename,data,'Schema','dbo')
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted inventory data.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans =

  4×4 table

    productNumber    Quantity    Price          inventoryDate
    _____________    ________    _____    _________________________

        11               567        11       '2012-09-11 00:30:24.000'
        12              1278        22       '2010-10-29 18:17:47.000'
        13              1700        17       '2009-05-24 10:58:59.000'
        25              1000        50       '2001-06-09 00:00:00.000'
```

Close the database connection.

```
close(conn)
```

Insert `NULL` Number into Table

Use an ODBC connection to insert sales volume data from MATLAB® into an existing table in a Microsoft® SQL Server® database. Insert `NULL` numbers into the existing database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `salesVolume`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a numeric array that contains monthly sales volume data for a specific stock number, and includes a NULL number. The value Inf indicates a NULL value. Specify the column names for the existing database table salesVolume.

```
n = [100000 Inf 0 2000 500 3000 450 600 700 750 1450 0 0];
colnames = {'StockNumber' 'January' 'February' 'March' 'April' 'May' ...
    'June' 'July' 'August' 'September' 'October' 'November' 'December'};
```

Convert the numeric array to a MATLAB table.

```
data = array2table(n,'VariableNames',colnames);
```

Convert the Inf value in the January variable to NaN. The sqlwrite function does not accept Inf values as valid missing data for insertion.

```
data.January = NaN;
```

Import the contents of the database table salesVolume into MATLAB and display the last few rows.

```
tablename = 'salesVolume';
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×13 table

    StockNumber    January    February    March    April    May     June    July    August    Se
    ___________    _______    ________    _____    _____    ____    ____    ____    ______    __

    4.7082e+05      3100        9400      1540     1500     1350    1190    900      867
     5.101e+05       235        1800      1040      900      750     700    400      350
    8.9975e+05       123        1700       823      701      689     621    545      421
```

Insert the sales volume data into the database table salesVolume.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted sales volume data.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans =

  4×13 table

    StockNumber    January    February    March    April    May     June    July    August    Se
    ___________    _______    ________    _____    _____    ____    ____    ____    ______    __

    4.7082e+05      3100        9400      1540     1500     1350    1190    900      867
     5.101e+05       235        1800      1040      900      750     700    400      350
    8.9975e+05       123        1700       823      701      689     621    545      421
         1e+05       NaN           0      2000      500     3000     450    600      700
```

Close the database connection.

```
close(conn)
```

Insert NULL String into Table

Use an ODBC connection to insert product data from MATLAB® into an existing table in a Microsoft® SQL Server® database. Insert a `NULL` string into the existing database table.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `productTable`.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Check the database connection. If the `Message` property is empty, then the connection is successful.

```
conn.Message
```

```
ans =

     []
```

Create a MATLAB table that contains data for one product and includes a `NULL` value in the `productDescription` variable.

```
data = table([30],[500000],[1000],[25], ...
    ["null"],'VariableNames',{'productNumber' ...
    'stockNumber' 'supplierNumber' 'unitCost' 'productDescription'});
```

Convert the `null` value in the `productDescription` variable to `""`. The `sqlwrite` function does not accept `null` values as valid missing data for insertion.

```
data.productDescription(1) = "";
```

Import the contents of the existing database table `productTable` into MATLAB and display the last few rows.

```
tablename = 'productTable';
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans =

  3×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17           'Pancakes'
         14           5.101e+05          1011            19           'Shawl'
         15          8.9975e+05          1011            20           'Snacks'
```

Insert the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans =

  4×5 table

    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13          4.7082e+05          1012            17           'Pancakes'
         14           5.101e+05          1011            19           'Shawl'
         15          8.9975e+05          1011            20           'Snacks'
         30               5e+05          1000            25           ''
```

Close the database connection.

```
close(conn)
```

Insert Partial Data into Table

Use an ODBC connection to insert two columns of inventory data from MATLAB® into an existing table with a few columns in a Microsoft® SQL Server® database. After the insertion of data, the database table contains the data in the first two columns. The other columns have blank entries for the inserted rows of data.

Create an ODBC connection to a SQL Server database with Windows® authentication. Specify a blank user name and password. The database contains the table `inventoryTable` with inventory data.

```
datasource = "MS SQL Server Auth";
conn = database(datasource,"","");
```

Create a table with two columns of data for the product number and quantity. This data represents two products to insert.

```
data = table([14;15],[350;400],'VariableNames',["productNumber" "Quantity"]);
```

Insert the inventory data into the database table `inventoryTable`. This table contains four columns: product number, quantity, price, and inventory date. In this case, the product number and quantity for each product to insert are known but the price and inventory date are unknown.

```
tablename = "inventoryTable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the last few rows. The results contain two new rows for the inserted inventory data. The `sqlwrite` function inserts blank entries for the last two columns.

```
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price         inventoryDate
    _____________    ________    _____    _______________________

         13            1700      14.5     {'2009-05-24 10:58:59'}
         14             350       NaN     {0×0 char             }
         15             400       NaN     {0×0 char             }
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

data — Data to insert
table

Data to insert into a database table, specified as a table.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of numeric arrays
- Cell array of character vectors
- String array
- Datetime array
- Duration array
- Logical array

- Cell array of logical arrays

The numeric array can contain these data types:

- `int8`
- `uint8`
- `int16`
- `uint16`
- `int32`
- `uint32`
- `int64`
- `uint64`
- `single`
- `double`

For date and time data, supported formats are:

- Date — `'yyyy-MM-dd'`
- Time — `'hh:mm:ss'`
- Timestamp — `'yyyy-MM-dd HH:mm:ss'`

If the date and time data is specified in an invalid format, then the `sqlwrite` function automatically converts the data to a supported format.

If the cell array of character vectors or string array is specified in an invalid format, then the `sqlwrite` function enables the database driver to check the format. If the format is unexpected, then the database driver throws an error.

You can insert data in an existing database table or a new database table. The data types of variables in `data` vary depending on whether the database table exists. For valid data types, see "Data Types for Existing Table" on page 12-0 and "Data Types for New Table" on page 12-0.

Note The `sqlwrite` function supports only the `table` data type for the `data` input argument. To insert data stored in a structure, cell array, or numeric matrix, convert the data to a `table` by using the `struct2table`, `cell2table`, and `array2table` functions, respectively.

The `sqlwrite` function does not support the database preferences `NullNumberWrite` and `NullStringWrite`. To insert missing data, see "Accepted Missing Data" on page 12-0.

Example: `table([10;20],{'M';'F'})`

Data Types for Existing Table

The variable names of the MATLAB table must match the column names in the database table. The `sqlwrite` function is case-sensitive.

When you insert data into a database table, use the data types shown in the following table to ensure that the data has the correct data type. This table matches the valid data types of the MATLAB table variable to the data types of the database column. For example, when you insert data into a database

column that has the BOOLEAN data type, ensure that the corresponding variable in the MATLAB table is a logical array or cell array of logical arrays.

Data Type of MATLAB Table Variable	Data Type of Existing Database Column
Numeric array or cell array of numeric arrays	NUMERIC
• Cell array of character vectors • String array • Datetime array • Duration array	DATE, TIME, or DATETIME
Logical array or cell array of logical arrays	BIT or BOOLEAN
Cell array of character vectors or string array	• CHAR • VARCHAR • TEXT • NTEXT • Other text data type

Data Types for New Table

The specified table name for the new database table must be unique across all tables in the database.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of character vectors
- String array
- Datetime array
- Duration array
- Logical array

The sqlwrite function ignores any invalid variable types and inserts only the valid variables from MATLAB as columns in a new database table.

The sqlwrite function converts the data type of the variable into the default data type of the column in the database table. The following table matches the valid data types of the MATLAB table variable to the default data types of the database column.

Data Type of MATLAB Table Variable	Default Data Type of Database Column
Numeric array or cell array of numeric arrays	NUMERIC
Datetime array	TIMESTAMP
Duration array	TIME
Logical array	NUMERIC

Data Type of MATLAB Table Variable	Default Data Type of Database Column
String array	VARCHAR **Note** The size of this column equals the sum of the maximum length of a string in the string array and 100.
Cell array of character vectors	VARCHAR **Note** The size of this column equals the sum of the maximum length of a character vector in the cell array and 100.

To specify database-specific column data types instead of the defaults, use the `'ColumnType'` name-value pair argument. For example, you can specify `'ColumnType',"bigint"` to create a `BIGINT` column in the new database table.

Also, using the `'ColumnType'` name-value pair argument, you can specify other data types that are not in the default list. For example, to insert images, specify `'ColumnType',"image"`.

Accepted Missing Data

The accepted missing data for inserting data into a database depends on the data type of the MATLAB table variable and the data type of the column in the database. The following table matches the data type of the MATLAB table variable to the data type of the database column and specifies the accepted missing data to use in each case.

Data Type of MATLAB Table Variable	Data Type of Database Column	Accepted Missing Data
`datetime` array	`Date`, `Time`, or `Timestamp`	`NaT`
`duration` array	`Time`	`NaN`
`double` or `single` array	• `Numeric` • `Double` • `Float` • `Decimal` • `Real`	`NaN`
cell array of `double` or `single` arrays	• `Numeric` • `Double` • `Float` • `Decimal` • `Real`	`NaN`, `[]`, or `''`
cell array of character vectors	`Date`, `Time`, or `Timestamp`	`'NaT'` or `''`
cell array of character vectors	`Char`, `Varchar`, or other text data type	`''`
string array	`Date`, `Time`, or `Timestamp`	`""`, `"NaT"`, or `missing`

Data Type of MATLAB Table Variable	Data Type of Database Column	Accepted Missing Data
string array	`Char`, `Varchar`, or other text data type	`missing`

Data Types: `table`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `sqlwrite(conn,"tablename",data,'ColumnType',["numeric" "timestamp" "image"])` inserts data into a new database table named `tablename` by specifying data types for all columns in the new database table.

`Catalog` — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`Schema` — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

`ColumnType` — Database column types
character vector | string scalar | cell array of character vectors | string array

Database column types, specified as a character vector, string scalar, cell array of character vectors, or string array. Use this name-value pair argument to define custom data types for the columns in a database table. Specify a column type for each column in the table.

Example: `'ColumnType',["numeric" "varchar(400)"]`

Data Types: `char` | `string` | `cell`

Version History

Introduced in R2018a

See Also

`sqlread` | `database` | `close` | `cell2table` | `array2table` | `struct2table`

Topics

“Insert Data into Database Table” on page 5-61
“Append Data to Existing Database Table Using Insert Functionality” on page 5-53
“Insert Data into New Database Table Using Insert Functionality” on page 5-55
“Writing Data Common Errors” on page 3-2

sqlwrite

Insert MATLAB data into SQLite database table

Syntax

```
sqlwrite(conn,tablename,data)
sqlwrite(conn,tablename,data,ColumnType=columntypes)
```

Description

`sqlwrite(conn,tablename,data)` inserts data from a MATLAB table into a database table with the MATLAB interface to SQLite. If the table exists in the database, this function appends the data in the MATLAB table as rows in the existing database table. If the table does not exist in the database, this function creates a table with the specified table name and then inserts the data as rows in the new table. This syntax is the equivalent of executing SQL statements that contain the `CREATE TABLE` and `INSERT INTO` ANSI SQL syntaxes.

`sqlwrite(conn,tablename,data,ColumnType=columntypes)` specifies the data type for the column in the SQLite database.

Examples

Append Data into Existing Table

Use the MATLAB® interface to SQLite to append product data from a MATLAB® table into an existing table in an SQLite database.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

To view the existing database table `productTable` before appending data, import its contents into MATLAB and display the last few rows.

```
tablename = "productTable";
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13            470816            1012            16          "Pancakes"
         14            510099            1011            19          "Shawl"
         15            899752            1011            20          "Snacks"
```

Create a MATLAB table that contains the data for one product.

```
data = table(30,500000,1000,25,"Rubik's Cube", ...
    'VariableNames',["productNumber" "stockNumber" ...
    "supplierNumber" "unitCost" "productDescription"]);
```

Append the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         13            470816            1012            16          "Pancakes"
         14            510099            1011            19          "Shawl"
         15            899752            1011            20          "Snacks"
         30            500000            1000            25          "Rubik's Cube"
```

Delete the inserted row to maintain the dataset.

```
sqlquery = "DELETE FROM productTable WHERE productnumber = 30";
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Insert Data into New Table

Use the MATLAB® interface to SQLite to insert product data from MATLAB into a new table in an SQLite database.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new database table named `toyTable`.

```
tablename = "toyTable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30            5e+05             1000            25         "Rubik's Cube"
         40            6e+05             2000            30         "Doll House"
```

Delete the new table to maintain the dataset.

```
sqlquery = "DROP TABLE toyTable";
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Specify Column Types When Inserting Data into New Table

Use the MATLAB® interface to SQLite to insert product data from MATLAB into a new table in an SQLite database. Specify the data types of the columns in the new database table.

Create the SQLite connection `conn` to the existing SQLite database file `tutorial.db`. The database file contains the table `productTable`. The SQLite connection is an `sqlite` object.

```
dbfile = "tutorial.db";
conn = sqlite(dbfile);
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new database table named `toyTable`. Use the `ColumnType` name-value argument and a string array to specify the data types of all the columns in the database table.

```
tablename = "toyTable";
coltypes = ["numeric" "numeric" "numeric" "numeric" "varchar(255)"];
sqlwrite(conn,tablename,data,ColumnType=coltypes)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30            500000            1000            25         "Rubik's Cube"
         40            600000            2000            30         "Doll House"
```

Delete the new table to maintain the dataset.

```
sqlquery = "DROP TABLE toyTable";
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — SQLite database connection
`sqlite` object

SQLite database connection, specified as an `sqlite` object created using the `sqlite` function.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

data — Data to insert
table

Data to insert into a database table, specified as a table.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of numeric arrays
- Cell array of character vectors
- String array
- Datetime array
- Logical array
- Cell array of logical arrays

The numeric array can contain these data types:

- `int8`
- `uint8`
- `int16`
- `uint16`
- `int32`
- `uint32`
- `int64`

- `uint64`
- `single`
- `double`

For date and time data, supported formats are:

- Date — `'yyyy-MM-dd'`
- Time — `'hh:mm:ss'`
- Timestamp — `'yyyy-MM-dd HH:mm:ss'`

If the date and time data is specified in an invalid format, then the `sqlwrite` function automatically converts the data to a supported format.

If the cell array of character vectors or string array is specified in an invalid format, then the `sqlwrite` function enables the database driver to check the format. If the format is unexpected, then the database driver throws an error.

You can insert data in an existing database table or a new database table. The data types of variables in `data` vary depending on whether the database table exists. For valid data types, see “Data Types for Existing Table” on page 12-0 and “Data Types for New Table” on page 12-0.

Note The `sqlwrite` function supports only the `table` data type for the `data` input argument. To insert data stored in a structure, cell array, or numeric matrix, convert the data to a `table` by using the `struct2table`, `cell2table`, and `array2table` functions, respectively.

Example: `table([10;20],{'M';'F'})`

Data Types for Existing Table

The variable names of the MATLAB table must match the column names in the database table. The `sqlwrite` function is case-sensitive.

When you insert data into a database table, use the data types shown in the following table to ensure that the data has the correct data type. This table matches the valid data types of the MATLAB table variable to the data types of the database column. For example, when you insert data into a database column that has the `BOOLEAN` data type, ensure that the corresponding variable in the MATLAB table is a logical array or cell array of logical arrays.

Data Type of MATLAB Table Variable	Data Type of Existing Database Column
Numeric array or cell array of numeric arrays	`DOUBLE`
• String array • Cell array of character vectors • Datetime array	`VARCHAR`
Logical array	`DOUBLE`

Data Types for New Table

The specified table name for the new database table must be unique across all tables in the database.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of character vectors
- String array
- Datetime array
- Logical array

The `sqlwrite` function ignores any invalid variable types and inserts only the valid variables from MATLAB as columns in a new database table.

The `sqlwrite` function converts the data type of the variable into the default data type of the column in the database table. The following table matches the valid data types of the MATLAB table variable to the default data types of the database column.

Data Type of MATLAB Table Variable	Default Data Type of Database Column
Numeric array or cell array of numeric arrays	`DOUBLE`
• String array • Cell array of character vectors • Datetime array	`VARCHAR`
Logical array	`DOUBLE`

To specify database-specific column data types instead of the defaults, use the `ColumnType` name-value argument. For example, you can specify `ColumnType="DOUBLE"` to create a `DOUBLE` column in the new database table.

Accepted Missing Data

The accepted missing data for inserting data into a database depends on the data type of the MATLAB table variable and the data type of the column in the database. The following table matches the data type of the MATLAB table variable to the data type of the database column and specifies the accepted missing data to use in each case.

Data Type of MATLAB Table Variable	Accepted Missing Data
Numeric array	`NaN`
String array	`missing`
Cell array of character vectors	`''`
Datetime array	`NaT`

Data Types: `table`

`columntypes` — Database column types

character vector | string scalar | cell array of character vectors | string array

Database column types, specified as a character vector, string scalar, cell array of character vectors, or string array. Use this argument to define custom data types for the columns in a database table. Specify a column type for each column in the table.

Example: `["numeric" "varchar(400)"]`

Data Types: `cell` | `char` | `string`

Version History

Introduced in R2022a

See Also

Objects
`sqlite`

Functions
`sqlread` | `close`

Topics
“Insert Data into SQLite Database Table” on page 5-36
“Create Table and Add Column in SQLite Database” on page 5-38
“Delete Data from SQLite Database” on page 5-39
“Roll Back Data in SQLite Database” on page 5-41

SQLImportOptions

Define import options for database data

Description

After you create an SQLImportOptions object, you can customize the import options for importing data from a database into MATLAB. Import options include defining the data types and fill values for missing data.

Creation

Create an SQLImportOptions object with the databaseImportOptions function.

Properties

ExcludeDuplicates — Flag to exclude duplicates
false (default) | true

Flag to exclude duplicates from imported data, specified as false or true. To exclude duplicates from the data in a database table or the results of an SQL query, set the ExcludeDuplicates property to true using dot notation.

Setting this property is the equivalent of using the DISTINCT SQL statement in ANSI SQL.

Data Types: logical

VariableNames — Variable names
cell array of character vectors

Variable names, specified as a cell array of character vectors. Each character vector in the cell array indicates the name of an imported database column from an SQL query or database table.

For a table or SQL query with only one database column, the cell array contains only one character vector.

The default variable names are the names of the columns in an SQL query or database table.

Example: {'productNumber','stockNumber'}

Data Types: cell

VariableTypes — Variable types
cell array of character vectors

Variable types, specified as a cell array of character vectors. Each character vector in the cell array indicates the data type of an imported database column from an SQL query or database table. Each character vector must be a valid MATLAB data type.

For a table or SQL query with only one database column, the cell array contains only one character vector.

When you create the `SQLImportOptions` object, the `databaseImportOptions` function automatically detects the data type based on the data type of a database column. This table maps the data type of a database column to the detected MATLAB data type.

Database Data Type	MATLAB Detected Data Type
`TEXT`	`char`
`DATE`, `TIME`, `DATETIME`, or `TIMESTAMP`	`char`
`NUMERIC`	`double`
`BOOLEAN` or `BIT`	`logical`

If you are using the MySQL native interface, this table maps the data type of a database column to the detected MATLAB data type.

MySQL Data Type	MATLAB Data Type
`BIT`	`logical`
`TINYINT`	`double`
`SMALLINT`	`double`
`BIGINT`	`double`
`REAL`	`double`
`DOUBLE`	`double`
`DECIMAL`	`double`
`NUMERIC`	`double`
`CHAR`	`string`
`VARCHAR`	`string`
`LONGVARCHAR`	`string`
`TIMESTAMP`	`datetime`
`DATE`	`datetime`
`TIME`	`duration`
`YEAR`	`double`
`ENUM`	`categorical`
`JSON`	`char`

If you are using the PostgreSQL native interface, this table maps the data type of a database column to the detected MATLAB data type.

PostgreSQL Data Type	MATLAB Data Type
`Boolean`	`logical`
`Smallint`	`double`
`Integer`	`double`
`Bigint`	`double`
`Decimal`	`double`

PostgreSQL Data Type	MATLAB Data Type
Numeric	double
Real	double
Double Precision	double
Smallserial	double
Serial	double
Bigserial	double
Money	double
Varchar	string
Char	string
Text	string
Bytea	string
Timestamp	datetime
Timestampz	datetime
Abstime	datetime
Date	datetime
Time	duration
Timez	duration
Interval	calendarDuration
Reltime	calendarDuration
Enum	categorical
Cidr	string
Inet	string
Macaddr	string
Uuid	string
Xml	string

To update the `VariableTypes` property, use the `setoptions` function.

Example: `{'int64','int32'}`

Data Types: `cell`

`SelectedVariableNames` — Subset of variables to import
character vector | cell array of character vectors | numeric array

Subset of variables to import, specified as a character vector, cell array of character vectors, or numeric array that contains indices. Use the `SelectedVariableNames` property to determine the database columns to import into the MATLAB workspace.

The values in the `SelectedVariableNames` property must be equal to the values in the `VariableNames` property or a subset of these values. By default, the `SelectedVariableNames` property contains all variable names specified in the `VariableNames` property. When the

SelectedVariableNames property specifies all variable names, the sqlread, fetch, and import functions of the DatabaseDatastore object import all database columns.

Example: {'productNumber','stockNumber'}

Example: [1,2,3]

Data Types: double | char | cell

FillValues — Fill value for missing data
cell array

Fill value for missing data, specified as a cell array that contains one or more values. Each value can be one of these data types:

- All integer classes
- single
- double
- char
- string scalar
- logical
- datetime array
- categorical array
- missing

When you create the SQLImportOptions object, the databaseImportOptions function automatically detects the fill value for missing data based on the data type of the database column. This table maps the data type of a database column to the detected MATLAB fill value.

Database Data Type	MATLAB Detected Fill Value
TEXT	''
DATE, TIME, DATETIME, or TIMESTAMP	''
NUMERIC	NaN
BOOLEAN or BIT	false

If you are using the MySQL native interface, this table maps the data type of a database column to the detected MATLAB data type.

MySQL Data Type	MATLAB Detected Fill Value
CHAR, VARCHAR, LONGVARCHAR, or JSON	'' (if the VariableTypes property is char) or <missing> (if the VariableTypes property is string)
DATE or TIMESTAMP	NaT
TIME	NaN

MySQL Data Type	MATLAB Detected Fill Value
• TINYINT • SMALLINT • BIGINT • REAL • DOUBLE • DECIMAL • NUMERIC • YEAR	NaN
ENUM	<undefined>

If you are using the PostgreSQL native interface, this table maps the data type of a database column to the detected MATLAB data type.

PostgreSQL Data Type	MATLAB Detected Fill Value
boolean	false
• smallint • integer • bigint • decimal • numeric • real • double precision	NaN
char, varchar, or text	<missing>
date or timestamp	NaT
time	NaN
interval	NaN
enum	undefined

To update the `FillValues` property, use the `setoptions` function.

Example: `{'',NaN}`

Data Types: `cell`

`VariableOptions` — Type-specific variable import options
array of variable import options objects

Type-specific variable import options, returned as an array of variable import options objects. The array contains an object corresponding to each variable specified in the `VariableNames` property. Each object in the array contains properties that support the importing of data with a specific data type.

To query the current (or detected) options for a variable, use the `getoptions` function.

To set and customize options for a variable, use the `setoptions` function.

Example: `opts.VariableOptions` returns a collection of `SQLVariableImportOptions` objects, one corresponding to each variable in the data.

`VariableNamingRule` — Variable naming rule
`"modify"` (default) | `"preserve"`

Variable naming rule, specified as one of these values:

- `"modify"` — Remove non-ASCII characters from variable names when the `SQLImportOptions` function imports data.
- `"preserve"` — Preserve most variable names when the `SQLImportOptions` function imports data. For details, see “Limitations” on page 12-456.

If you are using the MySQL or PostgreSQL native interface, `"preserve"` is the default value.

The `VariableNamingRule` property has these limitations:

- The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.
- The length of each variable name must be less than the number returned by `namelengthmax`.

Example: `"VariableNamingRule","modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object. Using `RowFilter` you can filter by columns or other criteria not listed in the `VariableNames` property. To do this, set a new `RowFilter` property containing the new variable name. See “Filter Data by Using Unique Variable Names” on page 12-454.

Example: `opt.RowFilter = opt.RowFilter.productnumber <= 5`

Object Functions

getoptions	Retrieve import options for database data
preview	Preview eight rows from database using import options
reset	Reset to default import options for database data
setoptions	Customize import options for database data

Examples

Import Data from Database Table Using Import Options

Customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
               VariableTypes: {'char', 'char', 'double' ... and 7 more}
       SelectedVariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
                  FillValues: {'', '',  NaN  ... and 7 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 10 VariableOptions
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                       (1) |      (2) |      (3) |        (4) |      (5) |      (6) |      (7) |
         Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smoker' |
         Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'double' |
  MissingRule:     'fill' |   'fill' |   'fill' |     'fill' |   'fill' |   'fill' |   'fill' |
    FillValue:         '' |       '' |      NaN |         '' |      NaN |      NaN |      NaN |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker` variables using the `setoptions` function. Because the `Gender`, `Location`, and `SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `logical`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'Smoker','Type','logical');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                           (1) |             (2) |         (3) |                          (4)
         Name:      'Gender' |      'Location' |    'Smoker' | 'SelfAssessedHealthStatus'
         Type: 'categorical' | 'categorical' | 'logical' |                'categorical'
  MissingRule:          'fill' |          'fill' |      'fill' |                       'fill'
    FillValue:   <undefined> |   <undefined> |           0 |                  <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts);
tail(data)
```

```
      LastName       Gender    Age              Location             Height    Weight    Smoker
    _____________    ______    ___    _________________________    ______    ______    ______

    {'Foster'   }    Female    30     St. Mary's Medical Center      70        124      false 
    {'Gonzales' }    Male      48     County General Hospital        71        174      false 
    {'Bryant'   }    Female    48     County General Hospital        66        134      false 
    {'Alexander'}    Male      25     County General Hospital        69        171      true  
    {'Russell'  }    Male      44     VA Hospital                    69        188      true  
    {'Griffin'  }    Male      49     County General Hospital        70        186      false 
    {'Diaz'     }    Male      45     County General Hospital        68        172      true  
    {'Hayes'    }    Male      48     County General Hospital        66        177      false 
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    LastName: 100×1 cell array of character vectors

    Gender: 100×1 categorical

        Values:

            Female       53   
            Male         47   

    Age: 100×1 double

        Values:

            Min          25   
            Median       39   
```

```
        Max           50

Location: 100×1 categorical

    Values:

        County General Hospital         39
        St. Mary s Medical Center       24
        VA Hospital                     37

Height: 100×1 double

    Values:

        Min           60
        Median        67
        Max           72

Weight: 100×1 double

    Values:

        Min            111
        Median       142.5
        Max            202

Smoker: 100×1 logical

    Values:

        True         34
        False        66

Systolic: 100×1 double

    Values:

        Min          109
        Median       122
        Max          138

Diastolic: 100×1 double

    Values:

        Min            68
        Median       81.5
        Max            99

SelfAssessedHealthStatus: 100×1 categorical

    Values:

        Excellent       34
        Fair            15
        Good            40
        Poor            11
```

Now set the filter condition to import only data for patients older than 40 years and not taller than 68 inches.

```
opts.RowFilter = opts.RowFilter.Age > 40 & opts.RowFilter.Height <= 68
```

```
opts =
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
               VariableTypes: {'char', 'categorical', 'double' ... and 7 more}
       SelectedVariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
                  FillValues: {'',  <undefined>,  NaN  ... and 7 more }
                   RowFilter: Age > 40 & Height <= 68

             VariableOptions: Show all 10 VariableOptions
```

Again, import the `patients` database table using the `sqlread` function, and display a summary of the imported data.

```
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    LastName: 24×1 cell array of character vectors

    Gender: 24×1 categorical

        Values:

            Female       17
            Male          7

    Age: 24×1 double

        Values:

            Min           41
            Median      45.5
            Max           50

    Location: 24×1 categorical

        Values:

            County General Hospital         13
            St. Mary s Medical Center        5
            VA Hospital                      6

    Height: 24×1 double

        Values:

            Min          62
```

```
            Median       66
            Max          68

    Weight: 24×1 double

        Values:

            Min         119
            Median      137
            Max         194

    Smoker: 24×1 logical

        Values:

            True         8
            False       16

    Systolic: 24×1 double

        Values:

            Min          114
            Median     121.5
            Max          138

    Diastolic: 24×1 double

        Values:

            Min           68
            Median      81.5
            Max           96

    SelfAssessedHealthStatus: 24×1 categorical

        Values:

            Excellent        7
            Fair             3
            Good            10
            Poor             4
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Filter Data by Using Unique Variable Names

Filter data by columns or other criteria not listed in the `VariableNames` property by using the `RowFilter` property.

Create a PostgreSQL native interface database connection to a PostgreSQL database. The database contains the table `productTable`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password);
```

Import data from the database table `productTable`. The `sqlread` function returns a MATLAB table that contains the product data. Display the first five rows of product data.

```
tablename = "productTable";
data = sqlread(conn,tablename);
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       "Victorian Doll"
          8          2.1257e+05          1001             5       "Train Set"
          7          3.8912e+05          1007            16       "Engine Kit"
          2          4.0031e+05          1002             9       "Painting Set"
          4          4.0034e+05          1008            21       "Space Cruiser"
```

Create an `SQLImportOptions` object using the `productTable` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'productnumber', 'stocknumber', 'suppliernumber' ... and 2 more}
               VariableTypes: {'double', 'double', 'double' ... and 2 more}
       SelectedVariableNames: {'productnumber', 'stocknumber', 'suppliernumber' ... and 2 more}
                  FillValues: { NaN,  NaN,  NaN  ... and 2 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 5 VariableOptions
```

Set the `RowFilter` property containing the new variable name. For example, use the `length` function to filter the `productdescription` strings by the number of characters.

```
opts.RowFilter = rowfilter("length(productdescription)");
opts.RowFilter
```

```
ans = 
  RowFilter with no constraints and no selected variables

    <unconstrained>

  VariableNames: length(productdescription), productnumber, stocknumber, suppliernumber, unitcos
```

By setting `RowFilter`, you added a unique `VariableName` to `RowFilter`. The `VariableNames` property of `SQLImportOptions` does not contain this variable name. Even though `VariableNames` of `RowFilter` does not completely match `VariableNames` of `SQLImportOptions`, updating `VariableNames` of `SQLImportOptions` still updates `VariableNames` of `RowFilter`.

```
opts.VariableNames{4} = "cost";
opts.RowFilter
```

```
ans =
  RowFilter with no constraints and no selected variables

    <unconstrained>

  VariableNames: length(productdescription), productnumber, stocknumber, suppliernumber, cost, pr
```

Set the filtering condition using the unique variable name, `length(productdescription)`, and the new variable name, `cost`.

```
opts.RowFilter = opts.RowFilter.("length(productdescription)") < 10 & opts.RowFilter.cost > 10;
```

Import data from the database table and display the first five rows of product data.

```
data = sqlread(conn,tablename,opts);
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    cost    productdescription
    _____________    ___________    ______________    ____    __________________

          3             4.01e+05         1009          17         "Slinky"
         12           2.1046e+05         1010          22         "Hugsy"
         13           4.7082e+05         1012        16.5         "Pancakes"
         14            5.101e+05         1011          19         "Shawl"
         15           8.9975e+05         1011          20         "Snacks"
```

Limitations

- If you use the `"VariableNamingRule"` name-value argument with the `SQLImportOptions` object `opts`, the data import functions return an error.
- If you set the `VariableNamingRule` name-value argument to the value `"modify"`:
  - The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.
  - The length of each variable name must be less than the number returned by `namelengthmax`.
- The `fetch` and `sqlread` functions return an error if you specify the `RowFilter` name-value argument with the `SQLImportOptions` object `opts`. In this case, it is ambiguous which of the `RowFilter` object to use, especially if the filter conditions are different.

Version History

Introduced in R2018b

R2023a: Selectively import rows of data

Use the `RowFilter` property of `SQLImportOptions` to define import options for database data.

See Also

Functions
`sqlwrite` | `database` | `close` | `sqlread` | `fetch` | `execute` | `databaseDatastore`

Topics
"Customize Options for Importing Data from Database into MATLAB" on page 5-67
"Importing Data Common Errors" on page 3-3

External Websites
SQL Tutorial

databaseImportOptions

Define import options for database data

Syntax

```
opts = databaseImportOptions(conn,source)
opts = databaseImportOptions(conn,source,Name,Value)
```

Description

`opts = databaseImportOptions(conn,source)` creates an `SQLImportOptions` object using the database connection and a source, which is a database table name or SQL query.

`opts = databaseImportOptions(conn,source,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'Catalog',"toystore_doc"` retrieves data from the `toystore_doc` database catalog.

Examples

Import Data from Database Table Using Import Options

Customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

```
opts = 
  SQLImportOptions with properties:
```

```
          ExcludeDuplicates: false
         VariableNamingRule: 'modify'

              VariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
              VariableTypes: {'char', 'char', 'double' ... and 7 more}
      SelectedVariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
                 FillValues: {'', '',  NaN  ... and 7 more }
                  RowFilter: <unconstrained>

            VariableOptions: Show all 10 VariableOptions
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |      (2) |      (3) |        (4) |      (5) |      (6) |      (7) |
         Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smoker' |
         Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'double' |
  MissingRule:     'fill' |   'fill' |   'fill' |     'fill' |   'fill' |   'fill' |   'fill' |
    FillValue:         '' |       '' |      NaN |         '' |      NaN |      NaN |      NaN |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker` variables using the `setoptions` function. Because the `Gender`, `Location`, and `SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `logical`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'Smoker','Type','logical');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                         (1) |           (2) |       (3) |                         (4)
         Name:      'Gender' |    'Location' |  'Smoker' | 'SelfAssessedHealthStatus'
         Type: 'categorical' | 'categorical' | 'logical' |               'categorical'
  MissingRule:        'fill' |        'fill' |    'fill' |                      'fill'
    FillValue:   <undefined> |   <undefined> |         0 |                 <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts);
tail(data)
```

```
      LastName       Gender    Age           Location            Height    Weight    Smoker
    _____________    ______    ___    _________________________    ______    ______    ______

    {'Foster'   }    Female    30     St. Mary's Medical Center      70        124      false
    {'Gonzales' }    Male      48     County General Hospital        71        174      false
    {'Bryant'   }    Female    48     County General Hospital        66        134      false
    {'Alexander'}    Male      25     County General Hospital        69        171      true
    {'Russell'  }    Male      44     VA Hospital                    69        188      true
    {'Griffin'  }    Male      49     County General Hospital        70        186      false
    {'Diaz'     }    Male      45     County General Hospital        68        172      true
    {'Hayes'    }    Male      48     County General Hospital        66        177      false
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    LastName: 100×1 cell array of character vectors

    Gender: 100×1 categorical

        Values:

            Female       53
            Male         47

    Age: 100×1 double

        Values:

            Min          25
            Median       39
            Max          50

    Location: 100×1 categorical

        Values:

            County General Hospital        39
            St. Mary s Medical Center      24
            VA Hospital                    37

    Height: 100×1 double

        Values:

            Min          60
            Median       67
            Max          72

    Weight: 100×1 double

        Values:
```

```
            Min           111
            Median      142.5
            Max           202

    Smoker: 100×1 logical

        Values:

            True        34
            False       66

    Systolic: 100×1 double

        Values:

            Min         109
            Median      122
            Max         138

    Diastolic: 100×1 double

        Values:

            Min           68
            Median      81.5
            Max           99

    SelfAssessedHealthStatus: 100×1 categorical

        Values:

            Excellent       34
            Fair            15
            Good            40
            Poor            11
```

Now set the filter condition to import only data for patients older than 40 years and not taller than 68 inches.

```
opts.RowFilter = opts.RowFilter.Age > 40 & opts.RowFilter.Height <= 68
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
               VariableTypes: {'char', 'categorical', 'double' ... and 7 more}
       SelectedVariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
                  FillValues: {'',  <undefined>,  NaN  ... and 7 more }
                   RowFilter: Age > 40 & Height <= 68

             VariableOptions: Show all 10 VariableOptions
```

Again, import the `patients` database table using the `sqlread` function, and display a summary of the imported data.

```
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    LastName: 24×1 cell array of character vectors

    Gender: 24×1 categorical

        Values:

            Female       17
            Male          7

    Age: 24×1 double

        Values:

            Min           41
            Median      45.5
            Max           50

    Location: 24×1 categorical

        Values:

            County General Hospital         13
            St. Mary s Medical Center        5
            VA Hospital                      6

    Height: 24×1 double

        Values:

            Min          62
            Median       66
            Max          68

    Weight: 24×1 double

        Values:

            Min         119
            Median      137
            Max         194

    Smoker: 24×1 logical

        Values:

            True         8
            False       16

    Systolic: 24×1 double
```

```
        Values:

            Min          114
            Median     121.5
            Max          138

    Diastolic: 24×1 double

        Values:

            Min           68
            Median      81.5
            Max           96

    SelfAssessedHealthStatus: 24×1 categorical

        Values:

            Excellent       7
            Fair            3
            Good           10
            Poor            4
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query Using Import Options

Customize import options when importing data from the results of an SQL query on a database. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different columns in the SQL query. Import data using the `fetch` function.

This example uses the `employees_database.mat` file, which contains the columns `first_name`, `hire_date`, and `DEPARTMENT_NAME`. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank username and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load employee information into the MATLAB® workspace.

```
employeedata = load('employees_database.mat');
```

Create the `employees` and `departments` database tables using the employee information.

```
emps = employeedata.employees;
depts = employeedata.departments;
```

```
sqlwrite(conn,'employees',emps)
sqlwrite(conn,'departments',depts)
```

Create an `SQLImportOptions` object using an SQL query and the `databaseImportOptions` function. This query retrieves all information for employees who are sales managers or programmers.

```
sqlquery = strcat("SELECT * from employees e join departments d ", ...
    "on (e.department_id = d.department_id) WHERE ", ...
    "(job_id = 'IT_PROG' or job_id = 'SA_MAN')");
opts = databaseImportOptions(conn,sqlquery)

opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
               VariableTypes: {'double', 'char', 'char' ... and 13 more}
       SelectedVariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
                  FillValues: { NaN, '', ''  ... and 13 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 16 VariableOptions
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)

varOpts = 
    1x16 SQLVariableImportOptions array with properties:

   Variable Options:
                           (1) |           (2) |           (3) |       (4) |              (5) |          (6
         Name: 'employee_id' | 'first_name' | 'last_name' | 'email' | 'phone_number' | 'hire_date
         Type:      'double' |        'char' |        'char' |  'char' |           'char' |       'char
  MissingRule:        'fill' |        'fill' |        'fill' |  'fill' |           'fill' |       'fil
    FillValue:           NaN |            '' |            '' |      '' |               '' |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `hire_date`, `DEPARTMENT_NAME`, and `first_name` variables using the `setoptions` function. Then, display the updated import options. Because `hire_date` stores date and time data, change the data type of this variable to `datetime`. Because `DEPARTMENT_NAME` designates a finite set of repeating values, change the data type of this variable to `categorical`. Also, change the name of this variable to lowercase. Because `first_name` stores text data, change the data type of this variable to `string`.

```
opts = setoptions(opts,'hire_date','Type','datetime');
opts = setoptions(opts,'DEPARTMENT_NAME','Name','department_name', ...
    'Type','categorical');
opts = setoptions(opts,'first_name','Type','string');
```

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |          (2) |         (3) |     (4) |            (5) |         (6
         Name: 'employee_id' | 'first_name' | 'last_name' | 'email' | 'phone_number' | 'hire_date
         Type:      'double' |     'string' |      'char' |  'char' |         'char' |  'datetime
  MissingRule:        'fill' |       'fill' |      'fill' |  'fill' |         'fill' |      'fil
    FillValue:           NaN |    <missing> |          '' |      '' |             '' |         Na

    To access sub-properties of each variable, use getoptions
```

Select the three modified variables using the `SelectVariableNames` property.

```
opts.SelectedVariableNames = ["first_name","hire_date","department_name"];
```

Set the filter condition to import only the data for the employees hired before January 1, 2006.

```
opts.RowFilter = opts.RowFilter.hire_date < datetime(2006,01,01)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'modify'

               VariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
               VariableTypes: {'double', 'string', 'char' ... and 13 more}
       SelectedVariableNames: {'first_name', 'hire_date', 'department_name'}
                  FillValues: { NaN,  <missing>, ''  ... and 13 more }
                   RowFilter: hire_date < 01-Jan-2006

             VariableOptions: Show all 16 VariableOptions
```

Import and display the results of the SQL query using the `fetch` function.

```
employees_data = fetch(conn,sqlquery,opts)
```

```
employees_data=4×3 table
    first_name     hire_date     department_name
    __________    ___________    _______________

    "David"       25-Jun-2005         IT
    "John"        01-Oct-2004         Sales
    "Karen"       05-Jan-2005         Sales
    "Alberto"     10-Mar-2005         Sales
```

Delete the `employees` and `departments` database tables using the `execute` function.

```
execute(conn,'DROP TABLE employees')
execute(conn,'DROP TABLE departments')
```

Close the database connection.

```
close(conn)
```

Import Data from Database Table Using Import Options with Specified Catalog and Schema

Customize import options when importing data from a database table. Control the import options by creating an SQLImportOptions object. Specify the location of the database table by using the database catalog and schema. Then, customize import options for different database columns. Import data using the sqlread function.

This example uses the patients.xls file, which contains the columns Gender, Location, SelfAssessedHealthStatus, and Smoker. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the patients database table in the toy_store database catalog and dbo database schema using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients, ...
    'Catalog','toy_store','Schema','dbo')
```

Create an SQLImportOptions object using the patients database table and the databaseImportOptions function. Specify the toy_store database catalog and dbo database schema for the location of the database table.

```
opts = databaseImportOptions(conn,tablename, ...
    'Catalog','toy_store','Schema','dbo');
```

Display the current import options for the variables selected in the SelectedVariableNames property of the SQLImportOptions object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |      (2) |      (3) |        (4) |      (5) |      (6) |      (7) |
         Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smoker' |
         Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'double' |
  MissingRule:     'fill' |   'fill' |   'fill' |     'fill' |   'fill' |   'fill' |   'fill' |
    FillValue:         '' |       '' |      NaN |         '' |      NaN |      NaN |      NaN |

    To access sub-properties of each variable, use getoptions
```

Change the data types for the Gender, Location, SelfAssessedHealthStatus, and Smoker variables using the setoptions function. Because the Gender, Location, and

`SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `logical`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'Smoker','Type','logical');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |           (2) |       (3) |                          (4)
        Name:      'Gender' |    'Location' |  'Smoker' | 'SelfAssessedHealthStatus'
        Type: 'categorical' | 'categorical' | 'logical' |              'categorical'
  MissingRule:         'fill' |        'fill' |    'fill' |                     'fill'
    FillValue:   <undefined> |   <undefined> |         0 |                <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts,'Catalog','toy_store','Schema','dbo');
tail(data)
```

```
ans=8×10 table
      LastName       Gender    Age            Location             Height    Weight    Smoker
    _____________    ______    ___    _________________________    ______    ______    ______

    {'Foster'   }    Female    30     St. Mary's Medical Center      70       124      false 
    {'Gonzales' }    Male      48     County General Hospital        71       174      false 
    {'Bryant'   }    Female    48     County General Hospital        66       134      false 
    {'Alexander'}    Male      25     County General Hospital        69       171      true  
    {'Russell'  }    Male      44     VA Hospital                    69       188      true  
    {'Griffin'  }    Male      49     County General Hospital        70       186      false 
    {'Diaz'     }    Male      45     County General Hospital        68       172      true  
    {'Hayes'    }    Male      48     County General Hospital        66       177      false 
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    LastName: 100×1 cell array of character vectors

    Gender: 100×1 categorical

        Values:

            Female       53
            Male         47
```

```
Age: 100×1 double

    Values:

        Min          25
        Median       39
        Max          50

Location: 100×1 categorical

    Values:

        County General Hospital         39
        St. Mary s Medical Center       24
        VA Hospital                     37

Height: 100×1 double

    Values:

        Min          60
        Median       67
        Max          72

Weight: 100×1 double

    Values:

        Min           111
        Median      142.5
        Max           202

Smoker: 100×1 logical

    Values:

        True        34
        False       66

Systolic: 100×1 double

    Values:

        Min         109
        Median      122
        Max         138

Diastolic: 100×1 double

    Values:

        Min           68
        Median      81.5
        Max           99

SelfAssessedHealthStatus: 100×1 categorical
```

```
    Values:

        Excellent       34
        Fair            15
        Good            40
        Poor            11
```

Delete the `patients` database table from the `toy_store` database catalog and the `dbo` database schema by using the `execute` function.

```
sqlquery = ['DROP TABLE toy_store.dbo.' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection

connection object

Database connection, specified as a `connection` object created with the `database` function, `connection` object created with the `mysql` function, `connection` object created with the `postgresql` function, or `sqlite` object.

Create a parallelizable `databaseDatastore` object by first creating a parallel pool constant. You can use the `getSecret` function to retrieve your user credentials when you create this constant.

Example: `conn = parallel.pool.Constant(@()postgresql(getsecret("PostgreSQL.username"),getsecret("Postgresql.password"),"Server","localhost","DatabaseName","toy_store"),@close);`

source — Source

character vector | string scalar

Source, specified as a character vector or string scalar. Use the `source` input argument to specify the name of a database table or an SQL query for importing data from a database.

Example: `"inventorytable"`

Example: `"SELECT * FROM inventorytable"`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `opts = databaseImportOptions(conn,"inventorytable",'Catalog',"toystore_doc",'Schema'`

,"dbo") defines import options for importing data from the inventorytable database table located in the toystore_doc catalog and dbo schema.

Catalog — Database catalog name
character vector | string scalar

Database catalog name, specified as the comma-separated pair consisting of 'Catalog' and a character vector or string scalar. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have numerous catalogs.

Use the 'Catalog' name-value pair argument only when source is a database table.

Example: 'Catalog','toy_store'

Data Types: char | string

Schema — Database schema name
character vector | string scalar

Database schema name, specified as the comma-separated pair consisting of 'Schema' and a character vector or string scalar. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Use the 'Schema' name-value pair argument only when source is a database table.

Example: 'Schema','dbo'

Data Types: char | string

Output Arguments

opts — Database import options
SQLImportOptions object

Database import options, returned as an SQLImportOptions object.

Version History

Introduced in R2018b

See Also

setoptions | getoptions | reset | close | database | execute | sqlwrite | sqlread | fetch | mysql | postgresql

Topics

"Customize Options for Importing Data from Database into MATLAB" on page 5-67
"Importing Data Common Errors" on page 3-3

External Websites

SQL Tutorial

getoptions

Namespace: `database.options`

Retrieve import options for database data

Syntax

```
varOpts = getoptions(opts)
varOpts = getoptions(opts,varnames)
varOpts = getoptions(opts,index)
```

Description

`varOpts = getoptions(opts)` returns the import options for all variables in the `SQLImportOptions` object.

`varOpts = getoptions(opts,varnames)` returns the import options for the specified variable names.

`varOpts = getoptions(opts,index)` returns the import options for the variables specified by a numeric index.

Examples

Retrieve Default Import Options for Database Table

Control the import options by creating an `SQLImportOptions` object. Then, retrieve the default import options from a database table.

This example uses the `patients.xls` spreadsheet, which contains patient information. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve and display the default import options for the `patients` database table.

```
varOpts = getoptions(opts)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                     (1) |      (2) |      (3) |        (4) |      (5) |      (6) |      (7) |
       Name: 'LastName' | 'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' | 'Smoker' | 'Sy
       Type:     'char' |   'char' | 'double' |     'char' | 'double' | 'double' | 'double' |
  FillValue:         '' |       '' |    [NaN] |         '' |    [NaN] |    [NaN] |    [NaN] |

    To access sub-properties of each variable, use getoptions
```

To modify the variable import options, see the `setoptions` function.

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Retrieve Default Import Options for Database Columns Using Variable Names

Control the import options by creating an `SQLImportOptions` object. Then, retrieve the default import options for several columns from a database table. Specify the columns to retrieve by using the database column names.

This example uses the `patients.xls` spreadsheet, which contains the columns `LastName`, `Age`, and `Location`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Specify the names of the database columns in the `patients` database table.

```
varnames = {'LastName','Age','Location'};
```

Retrieve and display the default import options for the specified database columns.

```
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
    1x3 SQLVariableImportOptions array with properties:

   Variable Options:
                     (1) |      (2) |        (3)
       Name: 'LastName' |    'Age' | 'Location'
       Type:     'char' | 'double' |     'char'
  FillValue:         '' |    [NaN] |         ''

    To access sub-properties of each variable, use getoptions
```

To modify the variable import options, see the `setoptions` function.

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Retrieve Default Import Options for Database Columns Using Numeric Index

Control the import options by creating an `SQLImportOptions` object. Then, retrieve the default import options for several columns from a database table. Specify the columns to retrieve by using a numeric index.

This example uses the `patients.xls` spreadsheet, which contains the columns `LastName`, `Gender`, and `Age`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Specify the first three database columns by using a numeric index.

```
index = [1,2,3];
```

Retrieve and display the default import options for the specified database columns.

```
varOpts = getoptions(opts,index)
```

```
varOpts =
    1x3 SQLVariableImportOptions array with properties:

   Variable Options:
                    (1) |      (2) |      (3)
       Name: 'LastName' | 'Gender' |    'Age'
       Type:     'char' |   'char' | 'double'
  FillValue:         '' |       '' |    [NaN]

    To access sub-properties of each variable, use getoptions
```

To modify the variable import options, see the `setoptions` function.

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

`opts` — Database import options

`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

`varnames` — Variable names

character vector | cell array of character vectors | string scalar | string array | numeric vector

Variable names, specified as a character vector, cell array of character vectors, string scalar, string array, or numeric vector. The `varnames` input argument indicates the variables in the `VariableNames` property of the `SQLImportOptions` object to use for importing data.

Example: `'productname'`

Data Types: `double` | `char` | `string` | `cell`

index — Index
numeric vector

Index, specified as a numeric vector that identifies the variables in the VariableNames property of the SQLImportOptions object to use for importing data.

Example: [1,2,3]

Data Types: double

Output Arguments

varOpts — Type-dependent options for selected variables
array of variable import options objects

Type-dependent options for selected variables, returned as an array of variable import options objects. The array contains an object corresponding to each variable in the opts input argument or in the selected variables specified by the varnames or index input argument. The data type of each object in the array depends on the data type of the corresponding variable.

For categorical and datetime data types, each variable import options object contains additional properties that correspond to the data type.

To modify the properties of the individual objects, use the setoptions function.

Version History

Introduced in R2018b

See Also

databaseImportOptions | setoptions | reset | close | database | execute | sqlwrite | sqlread

Topics

“Customize Options for Importing Data from Database into MATLAB” on page 5-67
“Importing Data Common Errors” on page 3-3

External Websites

SQL Tutorial

preview

Namespace: `database.options`

Preview eight rows from database using import options

Syntax

`T = preview(opts)`

Description

`T = preview(opts)` returns a table containing the first eight rows of database data by using the `SQLImportOptions` object. The value of the `SelectedVariableNames` property of the `SQLImportOptions` object specifies the variables that appear in the table.

Usually, the table contains eight rows of data. However, in some instances, the number of rows differs depending on property values defined in the `SQLImportOptions` object. The `preview` function returns fewer than eight rows if:

- The SQL query or table contains fewer than eight rows of data.
- The SQL query or table is empty or the `MissingRule` import option (of the variable import options) specifies to omit rows that contain missing data. To access the values of variable import options, use the `getoptions` function.

Examples

Preview Database Data After Customizing Options

Customize import options when importing text data from a database table. Control the import options by creating an `SQLImportOptions` object. Customize the import options for a text database column. Preview the database data before importing data. Then, import the data using the `sqlread` function.

This example uses the `patients.xls` spreadsheet, which contains the first column `LastName`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `LastName` variable.

```
varnames = 'LastName';
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
  SQLVariableImportOptions with properties:

  Variable Properties :
               Name: 'LastName'
               Type: 'char'
        MissingRule: 'fill'
          FillValue: ''

  String Properties :
     WhitespaceRule: 'preserve'
       TextCaseRule: 'preserve'
```

Set the import options for the data type of the `LastName` variable to `string`. Specify the `LastName` variable by using a numeric index that finds the variable within the `SelectedVariables` property of the `SQLImportOptions` object. Also, set the import options to replace missing data in the `LastName` variable with the `NoName` fill value.

```
index = 1;
opts = setoptions(opts,index,'Type','string', ...
    'FillValue','NoName');
```

Preview the first eight rows of database data using the import options. The data preview shows that the `LastName` variable has the `string` data type.

```
T = preview(opts)
```

```
T=8×10 table
     LastName       Gender      Age              Location               Height    Weight    Smoker
    __________    ________    ___    ___________________________    ______    ______    ______

    "Smith"       'Male'      38     'County General Hospital'        71       176        1
    "Johnson"     'Male'      43     'VA Hospital'                    69       163        0
    "Williams"    'Female'    38     'St. Mary's Medical Center'      64       131        0
    "Jones"       'Female'    40     'VA Hospital'                    67       133        0
    "Brown"       'Female'    49     'County General Hospital'        64       119        0
    "Davis"       'Female'    46     'St. Mary's Medical Center'      68       142        0
    "Miller"      'Female'    33     'VA Hospital'                    64       142        1
    "Wilson"      'Male'      40     'VA Hospital'                    68       180        0
```

Import the text data in the selected variable and display the first eight rows. The imported data shows that the variable has the `string` data type.

```
opts.SelectedVariableNames = 'LastName';
data = sqlread(conn,tablename,opts);
head(data)
```

```
ans=8×1 table
     LastName
    __________

    "Smith"
    "Johnson"
    "Williams"
    "Jones"
    "Brown"
    "Davis"
    "Miller"
    "Wilson"
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

`opts` — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Version History

Introduced in R2019a

See Also

`databaseImportOptions` | `getoptions` | `setoptions` | `reset` | `close` | `database`

Topics

“Customize Options for Importing Data from Database into MATLAB” on page 5-67
“Importing Data Common Errors” on page 3-3

External Websites

SQL Tutorial

reset

Namespace: database.options

Reset to default import options for database data

Syntax

```
opts = reset(opts)
```

Description

opts = reset(opts) resets the import options for importing data from a database back to the original state. The function returns the SQLImportOptions object. The VariableNames, VariableTypes, and FillValues properties of the SQLImportOptions object revert to the default values.

Examples

Reset Options When Importing Data

Reset import options when importing numeric data from a database table. Control the import options by creating an SQLImportOptions object. Then, customize the import options for a numeric database column. Import data using the sqlread function. Then, reset the import options back to the original state.

This example uses the patients.xls file, which contains the column Weight. The example also uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create an ODBC database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the patients database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an SQLImportOptions object using the patients database table and the databaseImportOptions function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the import options for the Weight variable. This variable has the double data type.

```
varnames = 'Weight';
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
  SQLVariableImportOptions with properties:

  Variable Properties :
                Name: 'Weight'
                Type: 'double'
           FillValue: NaN
```

Customize the import options for the `Weight` column in the `patients` database table. Because this column contains numeric data, change the data type to `int64`.

```
opts = setoptions(opts,varnames,'Type','int64');
```

Import the numeric data in the specified column and display a summary of the imported variable. The summary shows that the variable has the `int64` data type.

```
opts.SelectedVariableNames = varnames;
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    Weight: 100×1 int64

        Values:

            Min         111
            Median      143
            Max         202
```

Reset the import options back to their original state, and retrieve the import options for the `Weight` variable. This variable has the `double` data type again.

```
opts = reset(opts);
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
  SQLVariableImportOptions with properties:

  Variable Properties :
                Name: 'Weight'
                Type: 'double'
           FillValue: NaN
```

Import the numeric data again using the default import options, and display a summary of the imported variable.

```
opts.SelectedVariableNames = varnames;
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    Weight: 100×1 double
```

```
    Values:

        Min          111
        Median     142.5
        Max          202
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

`opts` — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Version History

Introduced in R2018b

See Also

`databaseImportOptions` | `setoptions` | `getoptions` | `close` | `database` | `execute` | `sqlwrite`

Topics

"Customize Options for Importing Data from Database into MATLAB" on page 5-67
"Importing Data Common Errors" on page 3-3

External Websites

SQL Tutorial

setoptions

Namespace: `database.options`

Customize import options for database data

Syntax

```
opts = setoptions(opts,varnames,
Option1,OptionValue1,...,OptionN,OptionValueN)
opts = setoptions(opts,index,Option1,OptionValue1,...,OptionN,OptionValueN)
```

Description

`opts = setoptions(opts,varnames,`
`Option1,OptionValue1,...,OptionN,OptionValueN)` customizes the import options for importing data from a database into MATLAB. The function returns the `SQLImportOptions` object. To import data, you use the `SQLImportOptions` object, the specified variable names, and the import options with their corresponding values.

`opts = setoptions(opts,index,Option1,OptionValue1,...,OptionN,OptionValueN)` customizes the import options for the variables specified by a numeric index.

Examples

Customize Options When Importing Numeric Data

Customize import options when importing numeric data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for a numeric database column. Import data using the `sqlread` function.

This example uses the `patients.xls` spreadsheet, which contains the column `Weight`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Customize the import options for the `Weight` column in the `patients` database table. Because this column is numeric, change the data type to `int64`.

```
varnames = 'Weight';
opts = setoptions(opts,varnames,'Type','int64');
```

Import the numeric data in the specified column and display a summary of the imported variable. The summary shows that the variable has the `int64` data type.

```
opts.SelectedVariableNames = {'Weight'};
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    Weight: 100×1 int64

        Values:

            Min         111
            Median      143
            Max         202
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options When Importing Text Data

Customize import options when importing text data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for a text database column. Import data using the `sqlread` function.

This example uses the `patients.xls` spreadsheet, which contains the first column `LastName`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MS SQL Server Auth";
conn = database(datasource,"","");
```

Load patient information into the MATLAB® workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `LastName` and `SelfAssessedHealthStatus` variables.

```
varnames = ["LastName" "SelfAssessedHealthStatus"];
varOpts = getoptions(opts,varnames)
```

```
varOpts =
    1x2 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |                          (2)
         Name: 'LastName' | 'SelfAssessedHealthStatus'
         Type:     'char' |                     'char'
  MissingRule:     'fill' |                     'fill'
    FillValue:         '' |                         ''

    To access sub-properties of each variable, use getoptions
```

Set the import options for the data type of the `LastName` variable to `string`. Specify the `LastName` variable by using a numeric index that finds the variable within the `SelectedVariables` property of the `SQLImportOptions` object. Also, set the import options to replace missing data in the `LastName` variable with the `NoName` fill value.

```
index = 1;
opts = setoptions(opts,index,'Type',"string", ...
    'FillValue',"NoName");
```

Set the import options for the text case of the `SelfAssessedHealthStatus` variable to uppercase.

```
varname = "SelfAssessedHealthStatus";
opts = setoptions(opts,varname,'TextCaseRule',"upper");
```

Import the text data in the selected variables and display the first eight rows. The imported data shows that the `LastName` variable has the `string` data type and the `SelfAssessedHealthStatus` variable text is uppercase.

```
opts.SelectedVariableNames = ["LastName" "SelfAssessedHealthStatus"];
T = sqlread(conn,tablename,opts);
head(T)
```

```
ans=8×2 table
     LastName     SelfAssessedHealthStatus
    __________    ________________________

    "Smith"             'EXCELLENT'
    "Johnson"           'FAIR'
    "Williams"          'GOOD'
    "Jones"             'FAIR'
```

```
    "Brown"             'GOOD'
    "Davis"             'GOOD'
    "Miller"            'GOOD'
    "Wilson"            'GOOD'
```

Delete the `patients` database table using the `execute` function.

```
sqlstr = "DROP TABLE ";
sqlquery = strcat(sqlstr,tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options When Importing Date and Time Data

Customize import options when importing date and time data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database columns that contain date and time data. Import data using the `sqlread` function.

This example uses the `outages.csv` file, which contains the columns `OutageTime` and `RestorationTime`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load outage information into the MATLAB® workspace.

```
outages = readtable('outages.csv');
```

Create the `outages` database table using the outage information.

```
tablename = 'outages';
sqlwrite(conn,tablename,outages)
```

Retrieve the data using the `sqlread` function and display the first eight rows. The second row of the `RestorationTime` variable contains missing data.

```
data = sqlread(conn,tablename);
head(data)
```

```
ans=8×6 table
      Region                OutageTime              Loss      Customers          RestorationTime
    ___________    _________________________    ______    __________    _________________________

    'SouthWest'    '2002-02-01 12:18:00.000'    458.98    1.8202e+06    '2002-02-07 16:50:00.000
    'SouthEast'    '2003-01-23 00:49:00.000'    530.14    2.1204e+05    ''
    'SouthEast'    '2003-02-07 21:15:00.000'     289.4    1.4294e+05    '2003-02-17 08:14:00.000
    'West'         '2004-04-06 05:44:00.000'    434.81    3.4037e+05    '2004-04-06 06:10:00.000
```

```
    'MidWest'      '2002-03-16 06:18:00.000'    186.44    2.1275e+05    '2002-03-18 23:23:00.000
    'West'         '2003-06-18 02:49:00.000'         0             0    '2003-06-18 10:54:00.000
    'West'         '2004-06-20 14:39:00.000'    231.29           NaN    '2004-06-20 19:16:00.000
    'West'         '2002-06-06 19:28:00.000'    311.86           NaN    '2002-06-07 00:51:00.000
```

Create an `SQLImportOptions` object using the `outages` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `OutageTime` and `RestorationTime` variables.

```
varnames = {'OutageTime','RestorationTime'};
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
    1x2 SQLVariableImportOptions array with properties:

   Variable Options:
                        (1) |                 (2)
       Name: 'OutageTime' | 'RestorationTime'
       Type:        'char' |              'char'
  FillValue:            '' |                  ''

    To access sub-properties of each variable, use getoptions
```

Set the import options for the data type of the specified variables to `datetime`. Also, set the import options to replace missing data in the specified variables with the current date and time.

```
opts = setoptions(opts,varnames,'Type','datetime', ...
    'FillValue',datetime('now'));
```

Import the date and time data in the selected variables and display the first eight rows. The imported data shows that the variables have the `datetime` data type. The missing value in the second row of the `RestorationTime` variable is filled with the current date and time.

```
opts.SelectedVariableNames = varnames;
T = sqlread(conn,tablename,opts);
head(T)
```

```
ans=8×2 table
         OutageTime            RestorationTime   
    ____________________    ____________________

    01-Feb-2002 12:18:00    07-Feb-2002 16:50:00
    23-Jan-2003 00:49:00    19-Jun-2018 15:30:14
    07-Feb-2003 21:15:00    17-Feb-2003 08:14:00
    06-Apr-2004 05:44:00    06-Apr-2004 06:10:00
    16-Mar-2002 06:18:00    18-Mar-2002 23:23:00
    18-Jun-2003 02:49:00    18-Jun-2003 10:54:00
    20-Jun-2004 14:39:00    20-Jun-2004 19:16:00
    06-Jun-2002 19:28:00    07-Jun-2002 00:51:00
```

Delete the `outages` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options When Importing Categorical Array Data

Customize import options when importing categorical array data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database columns that contain categorical array data. Import data using the `sqlread` function.

This example uses the `outages.csv` file, which contains the columns `Region` and `Cause`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load outage information into the MATLAB® workspace.

```
outages = readtable('outages.csv');
```

Create the `outages` database table using the outage information.

```
tablename = 'outages';
sqlwrite(conn,tablename,outages)
```

Create an `SQLImportOptions` object using the `outages` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Retrieve the default import options for the `Region` and `Cause` variables.

```
varnames = {'Region','Cause'};
varOpts = getoptions(opts,varnames)
```

```
varOpts = 
    1x2 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |      (2)
       Name: 'Region' | 'Cause'
       Type:   'char' |  'char'
  FillValue:       '' |       ''

    To access sub-properties of each variable, use getoptions
```

Set the import options for the data type of the specified variables to `categorical`. Also, set the import options to replace missing data in the specified variables with the fill value `unknown`.

```
opts = setoptions(opts,varnames,'Type','categorical', ...
    'FillValue','unknown');
```

Import the categorical array data in the selected variables and display a summary of the data. The imported data shows that the variables have the `categorical` data type. The missing values of both variables are filled with the value `unknown`.

```
opts.SelectedVariableNames = varnames;
T = sqlread(conn,tablename,opts);
summary(T)
```

```
Variables:

    Region: 1468×1 categorical

        Values:

            MidWest        142
            NorthEast      557
            SouthEast      389
            SouthWest       26
            West           354
            unknown          0

    Cause: 1468×1 categorical

        Values:

            attack                294
            earthquake              2
            energy emergency      188
            equipment fault       156
            fire                   25
            severe storm          338
            thunder storm         201
            unknown                24
            wind                   95
            winter storm          145
```

Delete the `outages` database table using the `execute` function.

```
sqlquery = ['DROP TABLE ' tablename];
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options When Importing Logical Data

Customize import options when importing logical data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options for database columns that contain logical data. Import data using the `sqlread` function.

This example uses the `airlinesmall_subset.xls` spreadsheet, which contains the column `Cancelled`. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = 'MS SQL Server Auth';
conn = database(datasource,'','');
```

Load flight information in the MATLAB® workspace.

```
flights = readtable('airlinesmall_subset.xlsx');
```

Create the `flights` database table using the flight information.

```
tablename = 'flights';
sqlwrite(conn,tablename,flights)
```

Create an `SQLImportOptions` object using the `flights` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,'flights');
```

Retrieve the default import options for the `Cancelled` variable.

```
varnames = 'Cancelled';
varOpts = getoptions(opts,varnames)
```

```
varOpts =
  SQLVariableImportOptions with properties:

  Variable Properties :
              Name: 'Cancelled'
              Type: 'double'
         FillValue: NaN
```

Set the import options for the data type of the specified variable to `logical`. Also, set the import options to replace missing data in the specified variable with the fill value `true`.

```
opts = setoptions(opts,varnames,'Type','logical', ...
    'FillValue',true);
```

Import the logical data in the selected variable and display a summary of the data. The imported data shows that the variable has the `logical` data type.

```
opts.SelectedVariableNames = varnames;
T = sqlread(conn,tablename,opts);
summary(T)
```

```
Variables:

    Cancelled: 1338×1 logical

        Values:

            True          29
            False       1309
```

Delete the `flights` database table using the `execute` function.

```
sqlquery = 'DROP TABLE flights';
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Customize Options to Omit Missing Data

Customize import options when importing data from a database table. Control the import options by creating an `SQLImportOptions` object. Then, customize the import options to omit missing data. Import data using the `sqlread` function.

This example uses the `outages.csv` file, which contains outage data. Also, the example uses a Microsoft® SQL Server® Version 11.00.2100 database and the Microsoft SQL Server Driver 11.00.5058.

Create a database connection to a Microsoft SQL Server database with Windows® authentication. Specify a blank user name and password.

```
datasource = "MS SQL Server Auth";
conn = database(datasource,"","");
```

Load outage information into the MATLAB® workspace.

```
outages = readtable("outages.csv");
```

Create the `outages` database table using the outage information.

```
tablename = "outages";
sqlwrite(conn,tablename,outages)
```

Create an `SQLImportOptions` object using the `outages` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename);
```

Determine the size of `outages`.

```
size(outages)
```

```
ans = 1×2

        1468           6
```

Set the import options to omit rows that have missing data in the `Customers` variable.

```
varnames = "Customers";
opts = setoptions(opts,varnames,'MissingRule',"omitrow");
```

Import the data and display the first eight rows. The imported data contains no missing data in the `Customers` variable.

```
T = sqlread(conn,tablename,opts);
head(T)
```

```
ans=8×6 table
      Region              OutageTime             Loss     Customers         RestorationTime
    ___________    _________________________    ______    __________    _________________________

    'SouthWest'    '2002-02-01 12:18:00.000'    458.98    1.8202e+06    '2002-02-07 16:50:00.000
    'SouthEast'    '2003-01-23 00:49:00.000'    530.14    2.1204e+05    ''
    'SouthEast'    '2003-02-07 21:15:00.000'     289.4    1.4294e+05    '2003-02-17 08:14:00.000
    'West'         '2004-04-06 05:44:00.000'    434.81    3.4037e+05    '2004-04-06 06:10:00.000
    'MidWest'      '2002-03-16 06:18:00.000'    186.44    2.1275e+05    '2002-03-18 23:23:00.000
    'West'         '2003-06-18 02:49:00.000'         0             0    '2003-06-18 10:54:00.000
    'NorthEast'    '2003-07-16 16:23:00.000'    239.93         49434    '2003-07-17 01:12:00.000
    'MidWest'      '2004-09-27 11:09:00.000'    286.72         66104    '2004-09-27 16:37:00.000
```

Determine the size of `T`. The number of rows in the imported data is smaller because the software removes all rows with missing data in the `Customers` variable.

```
size(T)
```

```
ans = 1×2

        1140           6
```

Delete the `outages` database table using the `execute` function.

```
sqlstr = "DROP TABLE ";
sqlquery = strcat(sqlstr,tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

opts — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

varnames — Variable names
character vector | cell array of character vectors | string scalar | string array | numeric vector

Variable names, specified as a character vector, cell array of character vectors, string scalar, string array, or numeric vector. The `varnames` input argument indicates the variables in the `VariableNames` property of the `SQLImportOptions` object to use for importing data.

Example: `'productname'`

Data Types: `double` | `char` | `string` | `cell`

index — Index
numeric vector

Index, specified as a numeric vector that identifies the variables in the `VariableNames` property of the `SQLImportOptions` object to use for importing data.

Example: `[1,2,3]`

Data Types: `double`

`Option1,OptionValue1,...,OptionN,OptionValueN` — Import options
name-value pair arguments

Import options, specified as one or more name-value pair arguments. `Option` is a character vector or string scalar that specifies the name of an import option. `OptionValue` specifies the value of the import option.

Example: `'FillValue',true,'Type','logical'` sets the data type of the specified variable as `logical` and sets the fill value for missing data in the specified variable as `true`.

Example: `'Name',"Location"` changes the name of the specified variable to `Location`.

All Variables

You can set import options to change the value of missing data, the name of a variable, or the data type of a variable. These import options apply to all variables specified by either the `varnames` or `index` input argument.

Import Option Name	Description	Import Option Values
`'FillValue'`	Missing data value	Value must be a scalar for a single variable or a cell array for multiple variables. Valid data types are: • All integer classes • `single` • `double` • `logical` • `char` • `string` • `datetime` • `missing` The data type depends on the variable type in the database.

Import Option Name	Description	Import Option Values
`'MissingRule'`	Missing data rule	Value must be one of the following: • `'fill'` (default) — Replace missing data with the missing data value specified by the `'FillValue'` import option. • `'omitrow'` — Omit rows that contain missing data. You can specify these values as a character vector or string scalar. Setting the `'MissingRule'` import option is the equivalent of using the `IS NOT NULL` SQL statement in ANSI SQL.
`'Name'`	Variable name	Value must be a character vector or string scalar for a single variable or a cell array of character vectors or string array for multiple variables.
`'Type'`	Data type	Value must be a character vector or string scalar for a single variable or a cell array of character vectors or string array for multiple variables.

The following table describes the valid import option values for the `'Type'` import option. The first column shows the data types in the `VariableTypes` property of the `SQLImportOptions` object. The second column shows the valid data types to specify in the character vector. To use the valid data type value, enclose it in quotes (for example, `'single'`).

<table>
<tr><th>Variable Data Type</th><th>Valid Data Type Values for 'Type' Import Option</th></tr>
<tr><td>• Any integer class
• single
• double</td><td>• Any integer class
• single
• double
• logical
• categorical

The undefined floating-point numbers NaN, –Inf, and +Inf are valid only for the single and double data types. When you change the data type of a floating-point number to an integer, the function that imports the data from the database converts the undefined floating-point number. For example, when you change the data type to 'int8':

• NaN values change to 0.
• –Inf values change to intmin('int8').
• +Inf values change to intmax('int8').

For details, see intmin and intmax.

The same conversion applies to all integer classes.</td></tr>
<tr><td>logical</td><td>• All integer classes
• single
• double
• logical
• categorical</td></tr>
<tr><td>char or string</td><td>• char
• string
• datetime
• duration
• categorical

You can change the VariableTypes property to datetime only if the column in the database table has the DATETIME data type. Also, you can change the VariableTypes property to duration only if the column in the database table has the TIME data type.</td></tr>
<tr><td>datetime</td><td>• char
• string
• datetime</td></tr>
</table>

Variable Data Type	Valid Data Type Values for 'Type' Import Option
duration	• char • string • duration
categorical	• All integer classes • single • double • char • string • logical • categorical

Variables with Text Data Type

You can set import options to change the value of variables with a text data type. These import options apply to variables that are either character vectors or string arrays specified by either the `varnames` or `index` input argument. You can specify the import option values as a character vector or string scalar.

Import Option Name	Description	Import Option Values
'WhiteSpaceRule'	Leading and trailing white spaces	• `'preserve'` (default) — Preserve white spaces. • `'trim'` — Remove any leading and trailing white spaces from the text. This import option value ignores white spaces in the middle of the text. • `'trimleading'` — Remove only the leading white spaces. • `'trimtrailing'` — Remove only the trailing white spaces.
'TextCaseRule'	Text case	• `'preserve'` (default) — Preserve the text case. • `'lower'` — Convert text to lowercase. • `'upper'` — Convert text to uppercase.

Variables with datetime Data Type

You can set import options to change the value of variables with the `datetime` data type. These import options apply to variables with the `datetime` data type specified by either the `varnames` or `index` input argument.

Import Option Name	Description	Import Option Values	Default Import Option Value
'DatetimeFormat'	Display format of dates and times	For valid values, see the description of the Format property in the datetime function.	'default'
'DatetimeLocale'	Locale to use for interpreting dates	For valid values, see the description of the 'Locale' name-value pair argument in the datetime function.	'en-US'
'TimeZone'	Time zone	For valid values, see the description of the TimeZone property in the datetime function.	''
'InputFormat'	Format of the input text representing dates and times	For valid values, see the description of the infmt input argument in the datetime function.	'yyyy-MM-dd HH:mm:ss.SSSSSSSSS '

Variables with duration Data Type

You can set import options to change the value of variables with the duration data type. These import options apply to variables with the duration data type specified by either the varnames or index input argument.

Import Option Name	Description	Import Option Values	Default Import Option Value
'InputFormat'	Format of the input text representing time	For valid values, see the description of the infmt input argument in the duration function.	''
'DurationFormat'	Display format of time	For valid values, see the description of the Format property in the duration function.	'hh:mm:ss'

Variable with categorical Data Type

You can set import options to change the value of variables with the categorical data type. These import options apply to variables with the categorical data type specified by either the varnames or index input argument.

Import Option Name	Description	Import Option Values	Default Import Option Value
'Categories'	Expected categories	For valid values, see the description of the catnames input argument in the categorical function.	{}
'Protected'	Category protection indicator	For valid values, see the description of the 'Protected' name-value pair argument in the categorical function.	false
'Ordinal'	Mathematical ordering indicator	For valid values, see the description of the 'Ordinal' name-value pair argument in the categorical function.	false

Data Types: char | string

Version History

Introduced in R2018b

See Also

databaseImportOptions | getoptions | preview | reset | close | database | execute | sqlwrite | sqlread

Topics

"Customize Options for Importing Data from Database into MATLAB" on page 5-67
"Importing Data Common Errors" on page 3-3

External Websites

SQL Tutorial

connection

MySQL native interface database connection

Description

Create a connection to a MySQL database using the MySQL native interface. Configure a MySQL native interface data source using the `databaseConnectionOptions` function. For details, see "Configure MySQL Native Interface Data Source" on page 6-2.

Creation

Create a `connection` object by using the `mysql` function.

Properties

`DataSource` — Data source name
string scalar

This property is read-only.

Data source name, specified as a string scalar.

Example: `"MySQLDataSource"`

Data Types: `string`

`Database` — Database name
`""` (default) | string scalar

This property is read-only.

Database name, specified as a string scalar.

If you use the `'DatabaseName'` name-value pair argument of the `mysql` function, the `mysql` function sets the `Database` property of the `connection` object to the specified value.

Example: `"toystore_doc"`

Data Types: `string`

`Server` — Server name
`localhost` (default) | string scalar

This property is read-only.

Server name, specified as a string scalar.

If you use the `'Server'` name-value pair argument of the `mysql` function, the `mysql` function sets the `Server` property of the `connection` object to the specified value.

Example: `"dbtb00"`

Data Types: `string`

`UserName` — User name
`""` (default) | string scalar

This property is read-only.

User name, specified as a string scalar.

Data Types: `string`

`DefaultCatalog` — Default catalog
`""` (default) | string scalar

This property is read-only.

Default catalog, specified as a string scalar.

Example: `"toy_store"`

Data Types: `string`

`Catalogs` — Catalogs in database
`""` (default) | string array

This property is read-only.

Catalogs in database, specified as a string array.

Example: `["information", "mysql"]`

Data Types: `string`

`Schemas` — Schemas in database
`""` (default) | string array

This property is read-only.

Schemas in database, specified as a string array.

Example: `["information_schema", "toys"]`

Data Types: `string`

`AutoCommit` — Flag to autocommit transactions
string scalar

Flag to autocommit transactions, specified as one of these values:

- `"on"` — Database transactions are automatically committed to the database.
- `"off"` — Database transactions must be committed to the database manually.

You can set this property by using dot notation.

`LoginTimeout` — Login timeout
`0` (default) | positive numeric scalar

This property is read-only.

Login timeout, specified as a positive numeric scalar. The login timeout specifies the number of seconds that the driver waits while trying to connect to a database before throwing an error.

When no login timeout for the connection attempt is specified, the value is `0`.

When a login timeout is not supported by the database, the value is `-1`.

Data Types: `double`

`MaxDatabaseConnections` — Maximum number of database connections
`-1` (default) | positive numeric scalar

This property is read-only.

Maximum number of database connections, specified as a positive numeric scalar.

When the database has no upper limit to the maximum number of database connections, the value is `0`.

When a maximum number of database connections is not supported by the database, the value is `-1`.

Data Types: `double`

`DatabaseProductName` — Database product name
`""` (default) | string scalar

This property is read-only.

Database product name, specified as a string scalar.

Example: `"MySQL"`

Data Types: `string`

`DatabaseProductVersion` — Database product version
`""` (default) | string scalar

This property is read-only.

Database product version, specified as a string scalar.

Example: `"5.7.22"`

Data Types: `string`

`DriverName` — Driver name
`""` (default) | string scalar

This property is read-only.

Driver name of the MySQL driver, specified as a string scalar.

Example: `"Mariadb Connector/C"`

Data Types: `string`

`DriverVersion` — Driver version
`""` (default) | string scalar

This property is read-only.

Driver version of the MySQL driver, specified as a string scalar.

Example: "3.2.5"

Data Types: string

Object Functions

Manage MySQL Database Connection

close	Close MySQL native interface database connection
isopen	Determine if MySQL native interface database connection is open

Import Data from MySQL Database

sqlouterjoin	Outer join between two MySQL database tables
sqlinnerjoin	Inner join between two MySQL database tables
sqlfind	Find information about all table types in MySQL database
sqlread	Import data into MATLAB from MySQL database table
fetch	Import results of SQL statement in MySQL database into MATLAB
executeSQLScript	Execute SQL script on MySQL database

Export Data to MySQL Database

sqlwrite	Insert MATLAB data into MySQL database table

MySQL Database Operations

execute	Execute SQL statement using MySQL native interface database connection
commit	Make changes to MySQL database permanent
rollback	Undo changes to MySQL database
sqlupdate	Update rows in MySQL database table

Examples

Connect to MySQL Database Using MySQL Native Interface

Create a MySQL® native interface connection to a MySQL database. Then, import data from the database into MATLAB® and perform simple data analysis. Close the database connection.

This example assumes that you are connecting to a MySQL database using the MariaDB® C Connector driver.

Connect to the database using the data source name, user name, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password)
```

```
conn = 
  connection with properties:

                  DataSource: "MySQLNative"
```

```
                  UserName: "root"

  Database Properties:

                AutoCommit: "on"
              LoginTimeout: 0
    MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: "toy_store"
                  Catalogs: ["information_schema", "mysql", "performance_schema" ... and 3 more
                   Schemas: []

  Database and Driver Information:

       DatabaseProductName: "MySQL"
    DatabaseProductVersion: "8.0.3-rc-log"
                DriverName: "Mariadb Connector/C"
             DriverVersion: "3.2.5"
```

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `sqlread` function. Display the first three rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
    productNumber    Quantity    Price        inventoryDate
    _____________    ________    _____    ____________________

          1            1700       15      23-Sep-2014 13:38:34
          2            1200        9      09-Jul-2014 02:50:45
          3             356       17      14-May-2014 11:14:28
```

Determine the highest product quantity from the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection `conn`.

```
close(conn)
```

Version History

Introduced in R2020b

See Also

`close` | `fetch` | `sqlread` | `sqlupdate`

Topics

"Import Data from MySQL Database Table" on page 6-6

SQLConnectionOptions

Define MySQL native interface database connection options

Description

Create connection options for a MySQL native interface connection.

First, create an `SQLConnectionOptions` object, set the connection options, test the connection, and save the data source. Then, create a MySQL native interface connection using the saved data source. The connection options include the options required to make a database connection. You can also define additional connection options for a specific database driver.

Creation

Create an `SQLConnectionOptions` object using the `databaseConnectionOptions` function.

Properties

`DataSourceName` — Data source name
string scalar

Data source name, specified as a string scalar. You can use the data source name in the `mysql` function to create a database connection for the MySQL native interface.

Example: `"MySQLDataSource"`

Data Types: `string`

`Vendor` — Database vendor
string scalar

This property is read-only.

Database vendor, specified as a string scalar. Specify this property using the `vendor` input argument in the `databaseConnectionOptions` function. After the `SQLConnectionOptions` object exists, you cannot set this property to another value.

Example: `"MySQL"`

Data Types: `string`

`DatabaseName` — Database name
string scalar

Database name, specified as a string scalar. Set this property using the `setoptions` function.

Example: `"toystore_doc"`

Data Types: `string`

`Server` — Database server name or address
`"localhost"` (default) | string scalar

Database server name or address, specified as a string scalar. Set this property using the `setoptions` function.

Data Types: `string`

`PortNumber` — Server port number where the server is listening
numeric scalar

Server port number where the server is listening, specified as a numeric scalar. The default value is `3306` for a MySQL database. Set this property using the `setoptions` function.

Data Types: `double`

Object Functions

rmoptions	Remove MySQL native interface connection options
saveAsDataSource	Save MySQL native interface data source
setoptions	Set MySQL native interface connection options
reset	Reset MySQL native interface connection options to defaults
testConnection	Test MySQL native interface database connection

Examples

Create MySQL Native Interface Data Source

Create, configure, test, and save a MySQL® native interface data source for a MySQL database.

Create a MySQL native interface data source for a MySQL native interface database connection.

```
vendor = "MySQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "MySQL"

              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 3306
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `MySQLDataSource`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `mysql` function or the Database Explorer app.

Version History

Introduced in R2020b

See Also

`databaseConnectionOptions` | `deleteDataSource`

Topics

"Configure MySQL Native Interface Data Source" on page 6-2
"Import Data from MySQL Database Table" on page 6-6

mysql

Create MySQL native interface database connection

Syntax

```
conn = mysql(datasource,username,password)
conn = mysql(username,password,Name,Value)
```

Description

`conn = mysql(datasource,username,password)` creates a MySQL native interface database connection using the specified data source, user name, and password. `conn` is a `connection` object.

`conn = mysql(username,password,Name,Value)` creates a MySQL native interface database connection using the specified user name and password, with additional options specified by one or more name-value pair arguments. For example, `"Server","dbtb00"` specifies the database server name as `dbtb00`.

Examples

Connect to MySQL Database Using MySQL Native Interface

Create a MySQL® native interface connection to a MySQL database. Then, import data from the database into MATLAB® and perform simple data analysis. Close the database connection.

This example assumes that you are connecting to a MySQL database using the MariaDB® C Connector driver.

Connect to the database using the data source name, user name, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password)
```

```
conn =
  connection with properties:

                DataSource: "MySQLNative"
                  UserName: "root"

  Database Properties:

                AutoCommit: "on"
              LoginTimeout: 0
    MaxDatabaseConnections: 0

  Catalog and Schema Information:
```

```
              DefaultCatalog: "toy_store"
                    Catalogs: ["information_schema", "mysql", "performance_schema" ... and 3 more
                     Schemas: []

  Database and Driver Information:

         DatabaseProductName: "MySQL"
      DatabaseProductVersion: "8.0.3-rc-log"
                  DriverName: "Mariadb Connector/C"
               DriverVersion: "3.2.5"
```

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `sqlread` function. Display the first three rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
    productNumber    Quantity    Price        inventoryDate
    _____________    ________    _____    ____________________

          1            1700       15      23-Sep-2014 13:38:34
          2            1200        9      09-Jul-2014 02:50:45
          3             356       17      14-May-2014 11:14:28
```

Determine the highest product quantity from the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection `conn`.

```
close(conn)
```

Connect to MySQL Database Using MySQL Native Interface and Additional Options

Create a MySQL® native interface connection to a MySQL database using name-value pair arguments. Then, import data from the database into MATLAB® and perform simple data analysis. Close the database connection.

This example assumes that you are connecting to a MySQL database version 5.7.22 using the MySQL Connector/C++ driver version 8.0.15.

Connect to the database using the user name and password shown. Specify the database server name `dbtb01`, database name `toystore_doc`, and port number `3306` by setting the corresponding name-value pair arguments.

```
username = "root";
password = "matlab";

conn = mysql(username,password,'Server',"dbtb01", ...
    'DatabaseName',"toystore_doc",'PortNumber',3306)
```

```
conn = 
  connection with properties:

                  Database: "toystore_doc"
                  UserName: "root"

  Database Properties:

                AutoCommit: "on"
              LoginTimeout: 0
    MaxDatabaseConnections: 151

  Catalog and Schema Information:

            DefaultCatalog: "toystore_doc"
                  Catalogs: ["information_schema", "mysql", "performance_schema" ... and 3 more
                   Schemas: []

  Database and Driver Information:

       DatabaseProductName: "MySQL"
    DatabaseProductVersion: "5.7.22"
                DriverName: "MySQL Connector/C++"
             DriverVersion: "8.0.15"
```

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `sqlread` function. Display the first three rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
ans=3×4 table
    productNumber    Quantity    Price        inventoryDate    
    _____________    ________    _____    _____________________

          1            1700      14.5     "2014-09-23 09:38:34"
          2            1200         9     "2014-07-08 22:50:45"
          3             356        17     "2014-05-14 07:14:28"
```

Determine the highest product quantity from the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection `conn`.

```
close(conn)
```

Input Arguments

`datasource` — Data source name

character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing data source.

Example: `"myDataSource"`

Data Types: `char` | `string`

`username` — User name

character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password

character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `conn = mysql(username,password,"Server","dbtb01","PortNumber",3306,"DatabaseName","toystore_doc")` creates a MySQL native interface database connection using the database server `dbtb01`, port number `3306`, and database name `toystore_doc`.

`Server` — Database server name

`"localhost"` (default) | string scalar | character vector

Database server name or address, specified as the comma-separated pair consisting of `'Server'` and a string scalar or character vector.

Example: `"dbtb00"`

Data Types: `char` | `string`

`PortNumber` — Port number
`3306` (default) | numeric scalar

Port number, specified as the comma-separated pair consisting of `'PortNumber'` and a numeric scalar.

Example: `3306`

Data Types: `double`

`DatabaseName` — Database name
`""` (default) | string scalar | character vector

Database name, specified as the comma-separated pair consisting of `'DatabaseName'` and a string scalar or character vector. If you do not specify a database name, the `mysql` function connects to the default database on the database server.

Example: `"toystore_doc"`

Data Types: `char` | `string`

Version History

Introduced in R2020b

See Also

`databaseConnectionOptions` | `close` | `isopen` | `sqlread`

Topics

"Configure MySQL Native Interface Data Source" on page 6-2
"Import Data from MySQL Database Table" on page 6-6

close

Namespace: `database.mysql`

Close MySQL native interface database connection

Syntax

`close(conn)`

Description

`close(conn)` closes and invalidates the MySQL native interface database connection to free up database and driver resources.

Examples

Connect to MySQL Database Using MySQL Native Interface

Create a MySQL® native interface connection to a MySQL database. Then, import data from the database into MATLAB® and perform simple data analysis. Close the database connection.

This example assumes that you are connecting to a MySQL database using the MariaDB® C Connector driver.

Connect to the database using the data source name, user name, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password)
```

```
conn =
  connection with properties:

                DataSource: "MySQLNative"
                  UserName: "root"

  Database Properties:

                AutoCommit: "on"
              LoginTimeout: 0
      MaxDatabaseConnections: 0

  Catalog and Schema Information:

            DefaultCatalog: "toy_store"
                  Catalogs: ["information_schema", "mysql", "performance_schema" ... and 3 more
                   Schemas: []

  Database and Driver Information:
```

```
      DatabaseProductName: "MySQL"
   DatabaseProductVersion: "8.0.3-rc-log"
               DriverName: "Mariadb Connector/C"
            DriverVersion: "3.2.5"
```

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `sqlread` function. Display the first three rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
    productNumber    Quantity    Price        inventoryDate
    _____________    ________    _____    ____________________

          1            1700       15      23-Sep-2014 13:38:34
          2            1200        9      09-Jul-2014 02:50:45
          3             356       17      14-May-2014 11:14:28
```

Determine the highest product quantity from the table.

```
max(data.Quantity)
```

```
ans = 9000
```

Close the database connection `conn`.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

Version History

Introduced in R2020b

See Also

`mysql` | `fetch`

Topics

“Configure MySQL Native Interface Data Source” on page 6-2

"Import Data from MySQL Database Table" on page 6-6

commit

Namespace: `database.mysql`

Make changes to MySQL database permanent

Syntax

```
commit(conn)
```

Description

`commit(conn)` makes changes to the database connection `conn` permanent, specifically any changes made since the last `commit` or `rollback` function has been run. To use the `commit` function, you must set the `AutoCommit` property of the `connection` object to `off`.

Examples

Commit Data to MySQL Database

Use a MySQL® native interface database connection to insert product data from MATLAB® into a new table in a MySQL database. Then, commit the changes to the database.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Allow manual committing of changes to the database by setting the `AutoCommit` property to `off`.

```
conn.AutoCommit = "off";
```

Create a MATLAB table that contains data for two products. The data is stored in the `productTable` and `suppliers` tables.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new table named `toyTable`.

```
tablename = "toyTable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30            5e+05             1000            25         "Rubik's Cube"
         40            6e+05             2000            30         "Doll House"
```

Commit the changes to the database.

```
commit(conn)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

Version History

Introduced in R2020b

See Also

`mysql` | `execute` | `sqlwrite` | `rollback`

Topics

"Roll Back Data in Database Using MySQL Native Interface" on page 6-16
"Create Table and Add Column Using MySQL Native Interface" on page 6-18
"Delete Data from Database Using MySQL Native Interface" on page 6-19

reset

Namespace: `database.options.native.mysql`

Reset MySQL native interface connection options to defaults

Syntax

`opts = reset(opts)`

Description

`opts = reset(opts)` resets all connection options to their default values for all properties of the `SQLConnectionOptions` object. The `reset` function also removes any additional driver-specific properties from the `SQLConnectionOptions` object.

Examples

Reset Connection Options to Default Values

Create, configure, and test a MySQL® native interface data source for a MySQL database. Reset the database connection options to their default values. Then configure, test, and save the data source with different database connection options.

Create a MySQL native interface data source for a MySQL database connection.

```
vendor = "MySQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

             DataSourceName: ""
                     Vendor: "MySQL"

               DatabaseName: ""
                     Server: "localhost"
                 PortNumber: 3306
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `MySQLDataSource`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Reset the database connection options to their default values.

```
opts = reset(opts)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "MySQL"

                DatabaseName: ""
                      Server: "localhost"
                  PortNumber: 3306
```

Configure the data source again by setting the database connection options for the data source `MySQLDataSource`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`. Also, set a driver-specific connection option to specify a timeout value for establishing the database connection.

```
opts = setoptions(opts, ...
    "DataSourceName","MySQLDataSource", ...
    "DatabaseName","toystore_doc", ...
    "Server","dbtb01","PortNumber",3306, ...
    "OPT_CONNECT_TIMEOUT",20)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306

    Additional Connection Options:

         OPT_CONNECT_TIMEOUT: 20
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object. The driver-specific connection option appears below the other connection options.

Test the database connection again.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

Input Arguments

opts — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as an `SQLConnectionOptions` object.

Output Arguments

opts — Database connection options
`SQLConnectionOptions` object

Database connection options, returned as an `SQLConnectionOptions` object.

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `rmoptions` | `saveAsDataSource` | `setoptions` | `testConnection` | `deleteDataSource` | `mysql`

Topics
“Configure MySQL Native Interface Data Source” on page 6-2
“Import Data from MySQL Database Table” on page 6-6
“Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface” on page 6-8

rmoptions

Namespace: `database.options.native.mysql`

Remove MySQL native interface connection options

Syntax

`opts = rmoptions(opts,option)`

Description

`opts = rmoptions(opts,option)` removes one or more specified connection options from the `SQLConnectionOptions` object `opts`.

Examples

Remove Driver-Specific Connection Option

Edit an existing MySQL® native interface data source for a MySQL database. Set an additional driver-specific option, and test the database connection. Then, remove the additional driver-specific option, and test and save the data source.

Retrieve the existing MySQL native interface data source.

```
datasource = "MySQLDataSource";
opts = databaseConnectionOptions(datasource)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "MySQLDataSource"
                    Vendor: "MySQL"

              DatabaseName: "toystore_doc"
                    Server: "dbtb01"
                PortNumber: 3306
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Add a driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. `opts` contains a new property for the additional connection option.

```
opts = setoptions(opts,"OPT_CONNECT_TIMEOUT",20)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306

    Additional Connection Options:

         OPT_CONNECT_TIMEOUT: 20
```

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Remove the driver-specific option for specifying a timeout value. The `opts` object no longer contains the `OPT_CONNECT_TIMEOUT` property.

```
opts = rmoptions(opts,"OPT_CONNECT_TIMEOUT")
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306
```

Test the database connection again.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the data source.

```
saveAsDataSource(opts)
```

Input Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as an `SQLConnectionOptions` object.

`option` — MySQL native interface connection option
character vector | string scalar | cell array of character vectors | string array

MySQL native interface connection option, specified as a character vector, string scalar, cell array of character vectors, or string array. Specify the name of one or more MySQL native interface connection options or driver-specific connection options.

Example: `["sslCert" "OPT_RECONNECT"]`

Example: `"OPT_CONNECT_TIMEOUT"`

Data Types: `char` | `string` | `cell`

Output Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, returned as an `SQLConnectionOptions` object.

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `mysql` | `reset` | `setoptions` | `testConnection` | `deleteDataSource` | `saveAsDataSource`

Topics
"Configure MySQL Native Interface Data Source" on page 6-2
"Import Data from MySQL Database Table" on page 6-6
"Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface" on page 6-8

saveAsDataSource

Namespace: `database.options.native.mysql`

Save MySQL native interface data source

Syntax

`saveAsDataSource(opts)`

Description

`saveAsDataSource(opts)` saves the MySQL native interface data source specified by the `SQLConnectionOptions` object `opts`.

Examples

Create MySQL Native Interface Data Source

Create, configure, test, and save a MySQL® native interface data source for a MySQL database.

Create a MySQL native interface data source for a MySQL native interface database connection.

```
vendor = "MySQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "MySQL"

              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 3306
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `MySQLDataSource`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQLDataSource", ...
```

```
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "MySQLDataSource"
                    Vendor: "MySQL"

              DatabaseName: "toystore_doc"
                    Server: "dbtb01"
                PortNumber: 3306
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `mysql` function or the Database Explorer app.

Input Arguments

`opts` — Database connection options

`SQLConnectionOptions` object

Database connection options, specified as an `SQLConnectionOptions` object.

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `mysql` | `reset` | `rmoptions` | `setoptions` | `testConnection` | `deleteDataSource`

Topics

"Configure MySQL Native Interface Data Source" on page 6-2
"Import Data from MySQL Database Table" on page 6-6
"Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface" on page 6-8

setoptions

Namespace: `database.options.native.mysql`

Set MySQL native interface connection options

Syntax

```
opts = setoptions(opts,Option1,OptionValue1,...,OptionN,OptionValueN)
```

Description

`opts = setoptions(opts,Option1,OptionValue1,...,OptionN,OptionValueN)` sets connection options using the `SQLConnectionOptions` object `opts`.

Examples

Create MySQL Native Interface Data Source

Create, configure, test, and save a MySQL® native interface data source for a MySQL database.

Create a MySQL native interface data source for a MySQL native interface database connection.

```
vendor = "MySQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "MySQL"

                DatabaseName: ""
                      Server: "localhost"
                  PortNumber: 3306
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `MySQLDataSource`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQLDataSource", ...
```

```
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `mysql` function or the Database Explorer app.

Edit Existing MySQL Native Interface Data Source

Edit an existing MySQL® native interface data source for a MySQL database. Set an additional driver-specific option and save the data source.

Retrieve the existing MySQL data source `MySQLDataSource`.

```
datasource = "MySQLDataSource";
opts = databaseConnectionOptions(datasource)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Add a driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. `opts` contains a new section of properties for the additional connection option.

```
opts = setoptions(opts,"OPT_CONNECT_TIMEOUT",20)
```

```
opts =
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306

    Additional Connection Options:

         OPT_CONNECT_TIMEOUT: 20
```

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the updated data source.

```
saveAsDataSource(opts)
```

Input Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as an `SQLConnectionOptions` object.

`Option1,OptionValue1,...,OptionN,OptionValueN` — MySQL native interface connection options
name-value pair arguments

MySQL native interface connection options, specified as one or more name-value pair arguments. `Option` is a character vector or string scalar that specifies the name of a MySQL native interface

connection option. `OptionValue` specifies the value of the option. `OptionValue` can be a character vector, string scalar, logical scalar, or numeric scalar. You can specify any MySQL native interface connection option that is a property of the `SQLConnectionOptions` object. You can also set driver-specific connection options.

Example: `'DataSourceName',"myDataSource",'Server',"localhost",'PortNumber',3306` configures a MySQL native interface data source named `myDataSource` that is located on the local server with the port number `3306`.

Output Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, returned as an `SQLConnectionOptions` object.

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `mysql` | `reset` | `rmoptions` | `testConnection` | `deleteDataSource` | `saveAsDataSource`

Topics
“Configure MySQL Native Interface Data Source” on page 6-2
“Import Data from MySQL Database Table” on page 6-6
“Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface” on page 6-8

testConnection

Namespace: `database.options.native.mysql`

Test MySQL native interface database connection

Syntax

```
status = testConnection(opts,username,password)
[status,message] = testConnection(opts,username,password)
```

Description

`status = testConnection(opts,username,password)` tests the MySQL native interface database connection specified by the `SQLConnectionOptions` object `opts`, a user name, and a password.

`[status,message] = testConnection(opts,username,password)` also returns the error message associated with testing the database connection.

Examples

Create MySQL Native Interface Data Source

Create, configure, test, and save a MySQL® native interface data source for a MySQL database.

Create a MySQL native interface data source for a MySQL native interface database connection.

```
vendor = "MySQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "MySQL"

              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 3306
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `MySQLDataSource`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "MySQLDataSource"
                    Vendor: "MySQL"

              DatabaseName: "toystore_doc"
                    Server: "dbtb01"
                PortNumber: 3306
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "root";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `mysql` function or the Database Explorer app.

Retrieve Message for MySQL Native Interface Database Connection Test

Create and configure a MySQL native interface data source to a MySQL database. Test the database connection to the MySQL native interface data source and retrieve the error message.

Create a MySQL native interface data source for a MySQL database connection.

```
vendor = "MySQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "MySQL"
```

```
            DatabaseName: ""
                  Server: "localhost"
              PortNumber: 3306
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `MySQLDataSource`, database name `toystore_doc`, database server `dbtb01`, and port number `3306`.

```
opts = setoptions(opts, ...
    'DataSourceName',"MySQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb01", ...
    'PortNumber',3306)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "MySQLDataSource"
                      Vendor: "MySQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb01"
                  PortNumber: 3306
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection using an incorrect user name and password. The `testConnection` function returns the logical `0`, which indicates the database connection fails. Retrieve and display the error message for the failed connection.

```
username = "wronguser";
password = "wrongpassword";
[status,message] = testConnection(opts,username,password)
```

```
status = logical
   0

message = 
'1045 : Access denied for user 'wronguser'@'SERVERNAME' (using password: YES).'
```

Input Arguments

`opts` — Database connection options

`SQLConnectionOptions` object

Database connection options, specified as an `SQLConnectionOptions` object.

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

Output Arguments

`status` — Connection status
logical

Connection status, returned as a logical `true` if the connection test passes or `false` if the connection test fails.

`message` — Error message
character vector

Error message, returned as a character vector. If the connection test passes, then the error message is an empty character vector. Otherwise, the error message contains text describing the failed database connection.

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `mysql` | `reset` | `rmoptions` | `setoptions` | `deleteDataSource` | `saveAsDataSource`

Topics
“Configure MySQL Native Interface Data Source” on page 6-2
“Import Data from MySQL Database Table” on page 6-6
“Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface” on page 6-8

execute

Namespace: `database.mysql`

Execute SQL statement using MySQL native interface database connection

Syntax

`execute(conn,sqlquery)`

Description

`execute(conn,sqlquery)` executes an SQL query that contains a non-`SELECT` SQL statement by using the relational database connection.

Examples

Execute Non-SELECT SQL Statement

Using a relational database connection, create and execute a non-`SELECT` SQL statement that deletes a database table. The `MySQLNative` data source configures a database connection to a MySQL® database.

This example uses a MySQL database version 5.7.22 database and the MySQL Connector/C++ driver version 8.0.15.

Connect to the database using the data source name, user name, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password);
```

Load patient information into the MATLAB® workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Import the data from the `patients` database table.

```
data = sqlread(conn,tablename);
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Ensure that the table no longer exists.

```
data = sqlfind(conn,tablename)
```

```
data = 

  0×5 empty table
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
connection object

MySQL native interface database connection, specified as a `connection` object.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid non-`SELECT` SQL statement.

The SQL statement can be a stored procedure that does not return any result sets. For stored procedures that return one or more result sets, use the `fetch` function.

For information about the SQL query language, see the SQL Tutorial.

Example: `"DROP TABLE patients"`

Data Types: `char` | `string`

Version History

Introduced in R2020b

See Also

`mysql` | `close` | `fetch` | `sqlread`

Topics

"Create Table and Add Column Using MySQL Native Interface" on page 6-18
"Delete Data from Database Using MySQL Native Interface" on page 6-19

External Websites

MySQL Documentation

executeSQLScript

Namespace: `database.mysql`

Execute SQL script on MySQL database

Syntax

```
results = executeSQLScript(conn,scriptfile)
results = executeSQLScript(conn,scriptfile,Name,Value)
```

Description

`results = executeSQLScript(conn,scriptfile)` uses the database connection `conn` to return a structure array that contains results as a table (by default) for each executed SQL `SELECT` statement in the SQL script file. For any non-`SELECT` SQL statements, the corresponding table is empty. The `executeSQLScript` function executes all SQL statements in the SQL script file.

`results = executeSQLScript(conn,scriptfile,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'DataReturnFormat','cellarray'` stores the results of an executed SQL statement as a cell array. The results are stored in the `Data` field of the `results` structure array.

Examples

Execute SQL Script Using MySQL Native Interface

Connect to a MySQL® database. Then, run two SQL `SELECT` statements from the SQL script file `compare_sales.sql`, import the results, and perform simple sales data analysis. The file contains two SQL queries: the first retrieves sales of products from US suppliers, and the second retrieves sales of products from foreign suppliers.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Execute the SQL script. The SQL script contains two SQL queries that retrieve sales data from US and foreign suppliers, respectively.

```
scriptfile = "compare_sales.sql";
results = executeSQLScript(conn,scriptfile)
```

```
results=1×2 struct array with fields:
    SQLQuery
    Data
    Message
```

The executeSQLScript function returns a structure array that contains two tables in the Data field. The first table contains the results of executing the first SQL query in the SQL script file. The second table contains the results of executing the second SQL query.

Display the first eight rows of imported data for the second SQL query in the SQL script file. The data shows sales results from foreign suppliers.

```
data = head(results(2).Data)
```

```
data=4×6 table
    productDescription        supplierName            city        Jan_Sales    Feb_Sales    Mar_Sa
    __________________    _____________________    __________    _________    _________    ______

     "Victorian Doll"     "Wacky Widgets"          "Adelaide"      1400         1100          981
     "Painting Set"       "Terrific Toys"          "London"        3000         2400         1800
     "Sail Boat"          "Incredible Machines"    "Dublin"        3000         2400         1500
     "Slinky"             "Doll's Galore"          "London"        3000         1500         1000
```

Retrieve the variable names in the table.

```
names = data.Properties.VariableNames
```

```
names = 1×6 cell
    {'productDescription'}    {'supplierName'}    {'city'}    {'Jan_Sales'}    {'Feb_Sales'}    
```

Determine the highest sales amount in January.

```
max(data.Jan_Sales)
```

```
ans = 3000
```

Close the database connection.

```
close(conn)
```

Execute SQL Script and Return Results as Structures

Connect to a MySQL® database. Then, run two SQL SELECT statements from the SQL script file compare_sales.sql. Import the results from the SQL queries as structures and perform simple sales data analysis. The file contains two SQL queries: the first SQL query retrieves sales of products from US suppliers, and the second retrieves sales of products from foreign suppliers.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the tables productTable and suppliers.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Execute the SQL script. The SQL script contains two SQL queries that retrieve sales data from US and foreign suppliers, respectively. Specify structure as the data return format for the query results.

```
scriptfile = "compare_sales.sql";
results = executeSQLScript(conn,scriptfile, ...
    'DataReturnFormat',"structure")
```

```
results=1×2 struct array with fields:
    SQLQuery
    Data
    Message
```

The `executeSQLScript` function returns a structure array that contains two structures in the `Data` field. The first structure contains the results of executing the first SQL query in the SQL script file. The second structure contains the results of executing the second SQL query.

Display the imported data for the second SQL query in the SQL script file. The data contains sales results from foreign suppliers.

```
data = results(2).Data
```

```
data = struct with fields:
    productDescription: [4×1 string]
          supplierName: [4×1 string]
                  city: [4×1 string]
             Jan_Sales: [4×1 double]
             Feb_Sales: [4×1 double]
             Mar_Sales: [4×1 double]
```

Determine the highest sales amount in January.

```
max(data.Jan_Sales)
```

```
ans = 3000
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

`scriptfile` — Name of SQL script file
character vector | string scalar

Name of SQL script file that contains one or more SQL statements to run, specified as a character vector or string scalar. The file must be a text file and can contain comments in addition to SQL queries. Start single-line comments with `--`. Enclose multiline comments in `/*...*/`.

The SQL script file can contain one or more SQL statements terminated by either a semicolon or the keyword `GO`. The following is an example of two SQL `SELECT` statements.

```
SELECT productDescription, supplierName
FROM suppliers A, productTable B
```

```
WHERE A.SupplierNumber = B.SupplierNumber;

SELECT supplierName, Country
FROM suppliers;
```

Example: `'C:\work\sql_file.sql'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = executeSQLScript(conn,scriptfile,'DataReturnFormat','numeric','ErrorHandling','store')` returns query results as a numeric matrix in the `Data` field of the `results` structure array and stores any error message in the `Message` field of `results`.

`DataReturnFormat` — Data return format

`'table'` (default) | `'cellarray'` | `'numeric'` | `'structure'`

Data return format, specified as the comma-separated pair consisting of `'DataReturnFormat'` and one of these values:

- `'table'`
- `'cellarray'`
- `'numeric'`
- `'structure'`

You can specify the value using a character vector or string scalar.

The `'DataReturnFormat'` name-value pair argument specifies the data type of the `Data` field in the `results` structure array.

Example: `'DataReturnFormat','structure'` returns a structure array that contains query results stored in structures.

`ErrorHandling` — Error handling

`'report'` (default) | `'store'`

Error handling, specified as the comma-separated pair consisting of `'ErrorHandling'` and one of these values:

- `'report'` — When an SQL statement fails to execute, stop execution of the remaining SQL statements in the SQL script file and display an error message at the command line.
- `'store'` — When an SQL statement fails to execute, store an error message in the `Message` field of the `results` structure array.

You can specify the value using a character vector or string scalar.

Example: `'ErrorHandling','report'` displays an error message at the command line.

Output Arguments

`results` — Query results

structure array

Query results from executed SQL statements in the SQL script file, returned as a structure array with these fields.

Field Name	Field Data Type	Field Description
`SQLQuery`	character vector	Stores the SQL statement or statements executed in the SQL script file.
`Data`	• table (default) • cell array • numeric matrix • structure	Stores the results of executed SQL `SELECT` statements. The `'DataReturnFormat'` name-value pair argument specifies the data type of the `Data` field. For non-`SELECT` SQL statements, the `Data` field is an empty double, which means the executed SQL query has no results.
`Message`	character vector	Stores an error message for the respective SQL statement that fails to execute. The `Message` field contains an error message only if you specify the `'ErrorHandling'` name-value pair argument with the value `'store'`.

The number of elements in the structure array is equal to the number of SQL statements in the SQL script file. `results(M)` contains the results from executing the `M`th SQL statement in the SQL script file. If the SQL statement returns query results, then the results are stored in `results(M).Data`.

For details about accessing structure arrays, see “Structure Arrays”.

Limitations

- Use the `executeSQLScript` function to import data into MATLAB, especially if you have long and complex SQL queries that are difficult to convert into MATLAB character vectors or string scalars. The `executeSQLScript` function does not support SQL scripts containing continuous PL/SQL blocks with `BEGIN` and `END`, such as stored procedure definitions or trigger definitions. However, `executeSQLScript` does support table definitions.
- An SQL script containing either of the following can produce unexpected results:
  - Apostrophes that are not escaped, including those in comments. For example, write the character vector `'Here's the code'` as `'Here''s the code'`.
  - Nested comments.
- An SQL script containing more than 25,000 characters causes the `executeSQLScript` function to return an error.

Version History

Introduced in R2020b

See Also

`mysql` | `close` | `rollback` | `commit`

Topics

"Import Data from MySQL Database Table" on page 6-6
"Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface" on page 6-8
"Import Large Data Using DatabaseDatastore Object and MySQL Native Interface" on page 6-11
"Roll Back Data in Database Using MySQL Native Interface" on page 6-16

External Websites

MySQL Documentation

fetch

Namespace: `database.mysql`

Import results of SQL statement in MySQL database into MATLAB

Syntax

```
results = fetch(conn,sqlquery)
results = fetch(conn,sqlquery,opts)
results = fetch( ___ ,Name,Value)
[results,metadata] = fetch( ___ )
```

Description

`results = fetch(conn,sqlquery)` returns all rows of data after executing the SQL statement `sqlquery` for the `connection` object. `fetch` imports data in batches.

`results = fetch(conn,sqlquery,opts)` customizes options for importing data from an executed SQL query by using the `SQLImportOptions` object.

`results = fetch( ___ ,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, specify `MaxRows = 5` to import five rows of data.

`[results,metadata] = fetch( ___ )` also returns the `metadata` table, which contains metadata information about the imported data.

Examples

Import All Data Using MySQL Native Interface

Import all product data from a MySQL® database table into MATLAB® using the MySQL native interface and the `fetch` function. Determine the highest unit cost among products in the table. Then, use a row filter to import only the data for products with a unit cost less than 15.

Create a MySQL native interface database connection to a MySQL database using a data source, username, and password. The database contains the table `productTable`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Import all the data from `productTable` by using the connection object and SQL query. Then, display the first five rows of the imported data.

```
sqlquery = "SELECT * FROM productTable";
data = fetch(conn,sqlquery);
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        "Victorian Doll"
          8          2.1257e+05          1001             5        "Train Set"
          7          3.8912e+05          1007            16        "Engine Kit"
          2          4.0031e+05          1002             9        "Painting Set"
          4          4.0034e+05          1008            21        "Space Cruiser"
```

Determine the highest unit cost for all products in the table.

```
max(data.unitCost)
```

```
ans = 24
```

Now, import the data using a row filter. The filter condition is that unitCost must be less than 15.

```
rf = rowfilter("unitCost");
rf = rf.unitCost < 15;
data = fetch(conn,sqlquery,"RowFilter",rf);
```

Again, display the first five rows of the imported data.

```
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       "Victorian Doll"
          8          2.1257e+05          1001             5       "Train Set"
          2          4.0031e+05          1002             9       "Painting Set"
          1          4.0034e+05          1001            14       "Building Blocks"
          5          4.0046e+05          1005             3       "Tin Soldier"
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query Using Import Options

Customize import options when importing data from the results of an SQL query on a MySQL® database using the MySQL native interface. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different columns in the SQL query. Import data using the `fetch` function.

This example uses the `employees_database.mat` file, which contains the columns `first_name`, `hire_date`, and `DEPARTMENT_NAME`. The example assumes that you are connecting to a MySQL database version 5.7.22 using the MySQL Connector/C++ driver version 8.0.15.

Create a MySQL native interface database connection to a MySQL database with a data source name, username, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
```

```
conn = mysql(datasource,username,password);
```

Load employee information into the MATLAB® workspace.

```
employeedata = load("employees_database.mat");
```

Create the `employees` and `departments` database tables using the employee information.

```
emps = employeedata.employees;
depts = employeedata.departments;

sqlwrite(conn,"employees",emps)
sqlwrite(conn,"departments",depts)
```

Create an `SQLImportOptions` object using an SQL query and the `databaseImportOptions` function. This query retrieves all information for employees who are sales managers or programmers.

```
% sqlquery = strcat("SELECT * from employees e join departments d ", ...
%     "on (e.department_id = d.department_id) WHERE ", ...
%     "(job_id = 'IT_PROG' or job_id = 'SA_MAN')");
sqlquery = ['SELECT first_name, last_name, hire_date, salary, DEPARTMENT_NAME ' ...
    'from employees e join departments d ' ...
    'on (e.department_id = d.department_id) where job_id ' ...
    'in (''IT_PROG'',''SA_MAN'')'];
opts = databaseImportOptions(conn,sqlquery)

opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'first_name', 'last_name', 'hire_date' ... and 2 more}
               VariableTypes: {'string', 'string', 'datetime' ... and 2 more}
       SelectedVariableNames: {'first_name', 'last_name', 'hire_date' ... and 2 more}
                  FillValues: { <missing>,  <missing>,  NaT  ... and 2 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 5 VariableOptions
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)

varOpts = 
    1x5 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |         (2) |         (3) |      (4) |               (5)
         Name: 'first_name' | 'last_name' | 'hire_date' | 'salary' | 'DEPARTMENT_NAME'
         Type:     'string' |    'string' |  'datetime' | 'double' |          'string'
  MissingRule:       'fill' |      'fill' |      'fill' |   'fill' |            'fill'
    FillValue:    <missing> |   <missing> |         NaT |      NaN |         <missing>

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `hire_date`, `DEPARTMENT_NAME`, and `first_name` variables using the `setoptions` function. Then, display the updated import options. For efficiency, change the data type of the `hire_date` variable to `string`. Because `DEPARTMENT_NAME` designates a finite set of repeating values, change the data type of this variable to `categorical`. Also, change the name of this variable to lowercase. Because `first_name` stores text data, change the data type of this variable to `char`.

```
opts = setoptions(opts,"hire_date","Type","string");
opts = setoptions(opts,"DEPARTMENT_NAME","Name","department_name", ...
    "Type","categorical");
opts = setoptions(opts,"first_name","Type","char");

vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x5 SQLVariableImportOptions array with properties:

   Variable Options:
                       (1) |          (2) |          (3) |        (4) |                 (5)
         Name: 'first_name' | 'last_name' | 'hire_date' | 'salary' | 'department_name'
         Type:        'char' |    'string' |    'string' | 'double' |      'categorical'
  MissingRule:        'fill' |      'fill' |      'fill' |   'fill' |             'fill'
    FillValue:            '' |   <missing> |   <missing> |      NaN |        <undefined>

    To access sub-properties of each variable, use getoptions
```

Select the three modified variables using the `SelectVariableNames` property.

```
opts.SelectedVariableNames = ["first_name","hire_date","department_name"];
```

Set the filter condition to import only the data for the employees hired before January 1, 2006.

```
opts.RowFilter = opts.RowFilter.hire_date < datetime(2006,01,01)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'first_name', 'last_name', 'hire_date' ... and 2 more}
               VariableTypes: {'char', 'string', 'string' ... and 2 more}
       SelectedVariableNames: {'first_name', 'hire_date', 'department_name'}
                  FillValues: {'',  <missing>,  <missing>  ... and 2 more }
                   RowFilter: hire_date < 01-Jan-2006

             VariableOptions: Show all 5 VariableOptions
```

Import and display the results of the SQL query using the `fetch` function.

```
employees_data = fetch(conn,sqlquery,opts)
```

```
employees_data=4×3 table
    first_name       hire_date      department_name
    ___________    _____________    _______________
```

```
    {'David'  }    "25-Jun-2005"        IT
    {'John'   }    "01-Oct-2004"        Sales
    {'Karen'  }    "05-Jan-2005"        Sales
    {'Alberto'}    "10-Mar-2005"        Sales
```

Delete the `employees` and `departments` database tables using the `execute` function.

```
execute(conn,"DROP TABLE employees")
execute(conn,"DROP TABLE departments")
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query as Structure

Specify the data return format and the number of imported rows for the results of an SQL query. Import data using the SQL query and the `fetch` function.

This example assumes that you are connecting to a MySQL® database version 5.7.22 using the MySQL Connector/C++ driver version 8.0.15.

Create a MySQL native interface database connection to a MySQL database with a data source name, user name, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password);
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = 'patients';
sqlwrite(conn,tablename,patients)
```

Select all data from the `patients` database table and import five rows from the table as a structure. Use the `'DataReturnFormat'` name-value pair argument to specify returning the data as a structure. Also, use the `'MaxRows'` name-value pair argument to specify five rows. Display the imported data.

```
sqlquery = strcat("SELECT * FROM ",tablename);
results = fetch(conn,sqlquery,'DataReturnFormat',"structure", ...
    'MaxRows',5)
```

```
results = struct with fields:
                    LastName: [5×1 string]
                      Gender: [5×1 string]
                         Age: [5×1 double]
                    Location: [5×1 string]
```

```
                  Height: [5×1 double]
                  Weight: [5×1 double]
                  Smoker: [5×1 logical]
                Systolic: [5×1 double]
               Diastolic: [5×1 double]
SelfAssessedHealthStatus: [5×1 string]
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Retrieve Metadata Information About Imported Data

Retrieve metadata information when importing data from an SQL query. Import data using the `fetch` function and explore the metadata information by using dot notation.

This example uses the `outages.csv` file, which contains outage data. Also, the example assumes that you are connecting to a MySQL® database version 5.7.22 using the MySQL Connector/C++ driver version 8.0.15.

Create a MySQL native interface database connection to a MySQL database with a data source name, user name, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password);
```

Load outage information into the MATLAB® workspace.

```
outages = readtable("outages.csv");
```

Create the `outages` database table using the outage information. Use the `'ColumnType'` name-value pair argument to customize the data types of the variables in the `outages` table.

```
tablename = "outages";
sqlwrite(conn,tablename,outages, ...
    'ColumnType',["varchar(120)","datetime","numeric(38,16)", ...
    "numeric(38,16)","datetime","varchar(150)"])
```

Import the data into the MATLAB workspace and return metadata information about the imported data.

```
sqlquery = "SELECT * FROM outages";
[results,metadata] = fetch(conn,sqlquery);
```

View the names of the variables in the imported data.

```
metadata.Properties.RowNames
```

```
ans = 6×1 cell
    {'Region'         }
    {'OutageTime'     }
    {'Loss'           }
    {'Customers'      }
    {'RestorationTime'}
    {'Cause'          }
```

View the data type of each variable in the imported data.

```
metadata.VariableType
```

```
ans = 6×1 cell
    {'string'  }
    {'datetime'}
    {'double'  }
    {'double'  }
    {'datetime'}
    {'string'  }
```

View the missing data value for each variable in the imported data.

```
metadata.FillValue
```

```
ans=6×1 cell array
    {1×1 missing}
    {[NaT      ]}
    {[      NaN]}
    {[      NaN]}
    {[NaT      ]}
    {1×1 missing}
```

View the indices of the missing data for each variable in the imported data.

```
metadata.MissingRows
```

```
ans=6×1 cell array
    {   0×1 double}
    {   0×1 double}
    {1208×1 double}
    { 656×1 double}
    {  58×1 double}
    {   0×1 double}
```

Display the first eight rows of the imported data that contain missing restoration time values. `data` contains restoration time values in the fifth variable. Use the numeric indices to find the rows with missing data.

```
index = metadata.MissingRows{5,1};
nullrestoration = results(index,:);
head(nullrestoration)
```

```
ans=8×6 table
      Region           OutageTime          Loss     Customers     RestorationTime         Cause
    __________    ____________________    ______    __________    ______________    __________
```

```
    "SouthEast"    23-Jan-2003 00:49:00    530.14    2.1204e+05          NaT          "winter sto
    "NorthEast"    18-Sep-2004 05:54:00         0             0          NaT          "equipment
    "MidWest"      20-Apr-2002 16:46:00     23141           NaN          NaT          "unknown"
    "NorthEast"    16-Sep-2004 19:42:00      4718           NaN          NaT          "unknown"
    "SouthEast"    14-Sep-2005 15:45:00    1839.2    3.4144e+05          NaT          "severe sto
    "SouthEast"    17-Aug-2004 17:34:00     624.1    1.7879e+05          NaT          "severe sto
    "SouthEast"    28-Jan-2006 23:13:00    498.78           NaN          NaT          "energy eme
    "West"         20-Jun-2003 18:22:00         0             0          NaT          "energy eme
```

Delete the `outages` database table using the `execute` function.

```
sqlstr = "DROP TABLE ";
sqlquery = strcat(sqlstr,tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use the `fetch` function.

Data Types: `char` | `string`

opts — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = fetch(conn,sqlquery,'MaxRows',50,'DataReturnFormat','structure')` imports 50 rows of data as a structure.

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `fetch` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

`DataReturnFormat` — Data return format
`'table'` (default) | `'cellarray'` | `'numeric'` | `'structure'`

Data return format, specified as the comma-separated pair consisting of `'DataReturnFormat'` and one of these values:

- `'table'`
- `'cellarray'`
- `'numeric'`
- `'structure'`

Use the `'DataReturnFormat'` name-value pair argument to specify the data type of the `results` data. To specify integer classes for numeric data, use the `opts` input argument.

You can specify the value using a character vector or string scalar.

Example: `'DataReturnFormat','cellarray'` imports data as a cell array.

`VariableNamingRule` — Variable naming rule
`"preserve"` (default) | `"modify"`

Variable naming rule, specified as the comma-separated pair consisting of `'VariableNamingRule'` and one of these values:

- `"preserve"` — Preserve most variable names when the `fetch` function imports data. For details, see the Limitations section.
- `"modify"` — Remove non-ASCII characters from variable names when the `fetch` function imports data.

Example: `'VariableNamingRule',"modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; fetch(conn,sqlquery,"RowFilter",rf)`

Output Arguments

`results` — Result data
table (default) | cell array | structure | numeric matrix

Result data, returned as a table, cell array, structure, or numeric matrix. The result data contains all rows of data from the executed SQL statement by default.

Use the `'MaxRows'` name-value pair argument to specify the number of rows of data to import. Use the `'DataReturnFormat'` name-value pair argument to specify the data type of the result data.

When the executed SQL statement does not return any rows, the result data is an empty table.

When you import data, the `fetch` function converts the data type of each column from the MySQL database to the MATLAB data type. This table maps the data type of a database column to the converted MATLAB data type.

MySQL Data Type	MATLAB Data Type
BIT	logical
TINYINT	double
SMALLINT	double
BIGINT	double
REAL	double
DOUBLE	double
DECIMAL	double
NUMERIC	double
CHAR	string
VARCHAR	string
LONGVARCHAR	string
TIMESTAMP	datetime
DATE	datetime
TIME	duration
YEAR	double
ENUM	categorical
JSON	char

`metadata` — Metadata information
table

Metadata information, returned as a table with these variables.

Variable Name	Variable Description	Variable Data Type
VariableType	Data type of each variable in the imported data	Cell array of character vectors
FillValue	Value of missing data for each variable in the imported data	Cell array of missing data values
MissingRows	Indices for each occurrence of missing data in each variable of the imported data	Cell array of numeric indices

By default, the fetch function imports text data as a character vector and numeric data as a double. FillValue is an empty character array (for text data) or NaN (for numeric data) by default. To change the missing data value to another value, use the SQLImportOptions object.

The RowNames property of the metadata table contains the names of the variables in the imported data.

Limitations

The name-value argument VariableNamingRule has these limitations:

- The fetch function returns an error if you specify the VariableNamingRule name-value argument and set the DataReturnFormat name-value argument to "cellarray", "structure", or "numeric".
- The fetch function returns a warning if you set the VariableNamingRule property of the SQLImportOptions object to "preserve" and set the DataReturnFormat name-value argument to "structure".
- The fetch function returns an error if you use the VariableNamingRule name-value argument with the SQLImportOptions object opts.
- If you set the VariableNamingRule name-value argument to the value "modify":
  - These variable names are reserved identifiers for the table data type: Properties, RowNames, and VariableNames.
  - The length of each variable name must be less than the number returned by namelengthmax.

The name-value argument RowFilter has this limitation:

- The fetch function returns an error if you specify the RowFilter name-value argument with the SQLImportOptions object opts. It is ambiguous which of the RowFilter object to use in this case, especially if the filter conditions are different.

Alternative Functionality

App

The fetch function imports data using the command line. To import data interactively, use the Database Explorer app.

Version History

Introduced in R2020b

R2023a: Selectively import rows of data based on filter condition

You can use the RowFilter name-value argument to selectively import rows of data from a database table.

See Also

Functions
`close` | `mysql` | `databaseImportOptions` | `getoptions` | `reset` | `setoptions` | `execute`

Topics
"Import Data from MySQL Database Table" on page 6-6
"Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface" on page 6-8
"Import Large Data Using DatabaseDatastore Object and MySQL Native Interface" on page 6-11
"Delete Data from Database Using MySQL Native Interface" on page 6-19

External Websites
MySQL Documentation

isopen

Namespace: `database.mysql`

Determine if MySQL native interface database connection is open

Syntax

```
i = isopen(conn)
```

Description

`i = isopen(conn)` returns `1` if the MySQL native interface database connection is open and `0` if it is closed or invalid.

Examples

Determine If Database Connection Is Open

Connect to a MySQL® database using the MySQL native interface and verify the database connection. Then, import data from the database into MATLAB® using the database table `productTable`. Determine the highest unit cost among the retrieved products in the table. Close the database connection and ensure that the connection is closed.

Create a MySQL native interface database connection using a data source, user name, and password. The MySQL database contains the table `productTable`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Determine if the database connection is open. The `isopen` function returns the logical `1`, which means the database connection is open.

```
i = isopen(conn)
```

```
i = logical
   1
```

Select all the data from `productTable` and sort it by the product number. `data` is a table containing the imported data that results from executing the `SQL SELECT` statement.

```
sqlquery = "SELECT * FROM productTable ORDER BY productNumber";
data = fetch(conn,sqlquery);
```

Display the first three rows of data.

```
head(data,3)
```

```
ans=3×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
```

```
    ______________    ____________    _______________    _________    ____________________

           1          4.0035e+05            1001               14       "Building Blocks"
           2          4.0031e+05            1002                9       "Painting Set"
           3            4.01e+05            1009               17       "Slinky"
```

Determine the highest unit cost in the table.

```
max(data.unitCost)
```

```
ans = 24
```

Close the database connection.

```
close(conn)
```

Determine if the database connection is closed. The `isopen` function returns the logical `0`, which means the database connection is closed. If the database connection is invalid, the `isopen` function returns the same result.

```
i = isopen(conn)
```

```
i = logical
   0
```

Input Arguments

conn — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

Version History

Introduced in R2020b

See Also

`mysql` | `close` | `fetch`

Topics

“Configure MySQL Native Interface Data Source” on page 6-2
“Import Data from MySQL Database Table” on page 6-6

rollback

Namespace: `database.mysql`

Undo changes to MySQL database

Syntax

`rollback(conn)`

Description

`rollback(conn)` reverses changes made to a database using functions such as `sqlwrite`. The `rollback` function reverses all changes made since the last `COMMIT` or `ROLLBACK` operation. To use this function, you must set the `AutoCommit` property of the `connection` object to `off`.

Examples

Reverse Changes Made to MySQL Database

Use a MySQL® native interface database connection to insert product data from MATLAB® into a new table in a MySQL database. Then, reverse the changes made to the database.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Allow manual committing of changes to the database by setting the `AutoCommit` property to `off`.

```
conn.AutoCommit = "off";
```

Create a MATLAB table that contains data for two products. The data is stored in the `productTable` and `suppliers` tables.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new table named `toyTable`.

```
tablename = "toyTable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30            5e+05             1000            25         "Rubik's Cube"
         40            6e+05             2000            30         "Doll House"
```

Reverse the changes made to the database.

```
rollback(conn)
```

Import and display the contents of the database table again. The results are empty.

```
rows = sqlread(conn,tablename)
```

```
rows = 

  0×5 empty table
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

Version History

Introduced in R2020b

See Also

`mysql` | `commit` | `sqlwrite` | `execute`

Topics

"Roll Back Data in Database Using MySQL Native Interface" on page 6-16
"Create Table and Add Column Using MySQL Native Interface" on page 6-18
"Delete Data from Database Using MySQL Native Interface" on page 6-19

sqlfind

Namespace: `database.mysql`

Find information about all table types in MySQL database

Syntax

```
data = sqlfind(conn,pattern)
data = sqlfind(conn,pattern,'Catalog',catalog)
```

Description

`data = sqlfind(conn,pattern)` returns information about all the "Table Types" on page 12-562 in a database where the specified character pattern appears in the name of the table type. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM information_schema.tables`.

`data = sqlfind(conn,pattern,'Catalog',catalog)` finds table types in the specified catalog.

Examples

Find Information About Table Types Using MySQL Native Interface

Use a MySQL® native interface database connection to find information about all database table types in a MySQL database.

Create a MySQL native interface database connection to a MySQL database.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password);
```

Find information about all table types in the database.

```
data = sqlfind(conn,"");
```

Display information about the first three table types.

```
head(data,3)
```

```
ans=3×5 table
    Catalog    Schema         Table            Columns          Type
    _______    ______    _______________    ______________    _______

    "mysql"      ""      "columns_priv"     {1×7  string}    "TABLE"
    "mysql"      ""      "db"               {1×22 string}    "TABLE"
    "mysql"      ""      "engine_cost"      {1×6  string}    "TABLE"
```

`data` contains these variables:

- Catalog name
- Schema name
- Table name
- Columns in the table type
- Table type

Close the database connection.

```
close(conn)
```

Find Information About Table Types in Catalog

Use a MySQL® native interface database connection to find information about all database table types in a MySQL database. Specify the database catalog to search.

Create a MySQL native interface database connection to a MySQL database.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Find information about all table types in the `mysql` database catalog. Use the `'Catalog'` name-value pair argument to specify the catalog. `data` is a table that contains information about all the table types in the specified catalog.

```
data = sqlfind(conn,"",'Catalog',"mysql");
```

Display the first eight table types.

```
head(data)
```

```
ans=8×5 table
    Catalog    Schema         Table             Columns         Type
    _______    ______    ________________    ______________    _______

    "mysql"      ""      "columns_priv"      {1×7  string}     "TABLE"
    "mysql"      ""      "db"                {1×22 string}     "TABLE"
    "mysql"      ""      "engine_cost"       {1×6  string}     "TABLE"
    "mysql"      ""      "event"             {1×22 string}     "TABLE"
    "mysql"      ""      "func"              {1×4  string}     "TABLE"
    "mysql"      ""      "general_log"       {1×6  string}     "TABLE"
    "mysql"      ""      "gtid_executed"     {1×3  string}     "TABLE"
    "mysql"      ""      "help_category"     {1×4  string}     "TABLE"
```

`data` contains these variables:

- Catalog name
- Schema name

- Table name
- Columns in the database table
- Table type

Display the column names in the fourth table type.

```
data.Columns{4}
```

```
ans = 1×22 string
    "db"    "name"    "body"    "definer"    "execute_at"    "interval_value"    "interval_field"
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
connection object

MySQL native interface database connection, specified as a `connection` object.

pattern — Pattern
character vector | string scalar

Pattern, specified as a character vector or string scalar. The `sqlfind` function searches for this text in the names of the table types in a database. To find all table types, specify an empty character vector or string scalar.

Example: "inventory"

Data Types: char | string

catalog — Database catalog name
character vector | string scalar

Database catalog name, specified as a character vector or string scalar. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have numerous catalogs.

Example: 'toy_store'

Data Types: char | string

Output Arguments

data — Table type information
table

Table type information, returned as a table that contains information about the table types in the database, where the table type name partially or fully matches the text in `pattern`. The `data` output contains these variables in a string array.

Variable	Description
`Catalog`	Catalog name where the database table type is stored
`Schema`	Schema name where the database table type is stored
`Table`	Database table name
`Columns`	Column names in the database table type
`Type`	Database table type

More About

Table Types

Table types are a subset of database objects that store or reference data.

The `sqlfind` function recognizes these table types in a database:

- Table
- View
- System table
- System view
- Synonym
- Global temporary table
- Local temporary table

Version History

Introduced in R2020b

See Also

`sqlread` | `mysql` | `close` | `sqlinnerjoin`

Topics

“Import Data from MySQL Database Table” on page 6-6
“Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface” on page 6-8
“Import Large Data Using DatabaseDatastore Object and MySQL Native Interface” on page 6-11
“Create Table and Add Column Using MySQL Native Interface” on page 6-18
“Delete Data from Database Using MySQL Native Interface” on page 6-19

sqlinnerjoin

Namespace: `database.mysql`

Inner join between two MySQL database tables

Syntax

```
data = sqlinnerjoin(conn,lefttable,righttable)
data = sqlinnerjoin(conn,lefttable,righttable,Name,Value)
```

Description

`data = sqlinnerjoin(conn,lefttable,righttable)` returns a table resulting from an inner join between the left and right database tables. This function matches rows using all shared columns, or keys, in both database tables. The inner join retains only the rows that match between the two tables. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM lefttable,righttable INNER JOIN lefttable.key = righttable.key`.

`data = sqlinnerjoin(conn,lefttable,righttable,Name,Value)` uses additional options specified by one or more name-value arguments. For example, specify `Keys = "productNumber"` to use the `productNumber` column as a key for joining the two database tables.

Examples

Join Two Database Tables Using MySQL Native Interface

Use a MySQL® native interface database connection to import product data from an inner join between two MySQL database tables into MATLAB®.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. `data` is a table that contains the matched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlinnerjoin(conn,lefttable,righttable);
```

Display the first three rows of matched data. The columns from the right table (`suppliers`) appear to the right of the columns from the left table (`productTable`).

```
head(data,3)
```

```
ans=3×10 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          8          2.1257e+05          1001             5       "Train Set"              1001
          1          4.0035e+05          1001            14       "Building Blocks"        1001
          2          4.0031e+05          1002             9       "Painting Set"           1002
```

Close the database connection.

```
close(conn)
```

Specify Key for Joining Two Database Tables

Use a MySQL® native interface database connection to import joined product data from two MySQL database tables into MATLAB®. Specify the key to use for joining the tables.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. Specify the key, or shared column, between the tables using the `'Keys'` name-value pair argument. `data` is a table that contains the matched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlinnerjoin(conn,lefttable,righttable,'Keys',"supplierNumber");
```

Display the first three rows of matched data. The columns from the right table (`suppliers`) appear to the right of the columns from the left table (`productTable`).

```
head(data,3)
```

```
ans=3×10 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          8          2.1257e+05          1001             5       "Train Set"              1001
          1          4.0035e+05          1001            14       "Building Blocks"        1001
          2          4.0031e+05          1002             9       "Painting Set"           1002
```

Close the database connection.

```
close(conn)
```

Filter Rows in Joined Data

Use a MySQL® native interface database connection to import joined product data from two MySQL database tables into MATLAB®. Specify the row filter condition to use for joining the tables.

Create a MySQL native interface database connection to a MySQL database using the data source name, username, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Join the two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. The table `data` contains the matched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlinnerjoin(conn,lefttable,righttable);
```

Display the first five rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,5)
```

productNumber	stockNumber	supplierNumber	unitCost	productDescription	SupplierN
1	4.0034e+05	1001	14	"Building Blocks"	1001
1	4.0034e+05	1001	14	"Building Blocks"	1001
2	4.0031e+05	1002	9	"Painting Set"	1002
2	4.0031e+05	1002	9	"Painting Set"	1002
3	4.01e+05	1009	17	"Slinky"	1009

Join the same tables, but this time use a row filter. The filter condition is that `unitCost` must be less than 10. Again, display the first five rows of matched data.

```
rf = rowfilter("unitCost");
rf = rf.unitCost <= 10;
data = sqlinnerjoin(conn,lefttable,righttable,"RowFilter",rf);
head(data,5)
```

productNumber	stockNumber	supplierNumber	unitCost	productDescription	SupplierN
2	4.0031e+05	1002	9	"Painting Set"	1002
2	4.0031e+05	1002	9	"Painting Set"	1002
5	4.0046e+05	1005	3	"Tin Soldier"	1005
5	4.0046e+05	1005	3	"Tin Soldier"	1005
6	4.0088e+05	1004	8	"Sail Boat"	1004

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

`lefttable` — Left table
character vector | string scalar

Left table, specified as a character vector or string scalar. Specify the name of the database table on the left side of the join.

Example: `'inventoryTable'`

Data Types: `char` | `string`

`righttable` — Right table
character vector | string scalar

Right table, specified as a character vector or string scalar. Specify the name of the database table on the right side of the join.

Example: `'productTable'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlinnerjoin(conn,"productTable","suppliers",'LeftCatalog','toy_store','RightCatalog','toy_shop','MaxRows',5)` performs an inner join between left and right tables by specifying the catalog for both tables and returns five matched rows.

`LeftCatalog` — Left catalog
character vector | string scalar

Left catalog, specified as the comma-separated pair consisting of `'LeftCatalog'` and a character vector or string scalar. Specify the database catalog name where the left table of the join is stored.

Example: `'LeftCatalog','toy_store'`

Data Types: `char` | `string`

`RightCatalog` — Right catalog
character vector | string scalar

Right catalog, specified as the comma-separated pair consisting of `'RightCatalog'` and a character vector or string scalar. Specify the database catalog name where the right table of the join is stored.

Example: `'RightCatalog','toy_store'`

Data Types: `char` | `string`

Keys — Keys
character vector | string scalar | cell array of character vectors | string array

Keys, specified as the comma-separated pair consisting of `'Keys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. Use this name-value pair argument to identify the shared keys (columns) between the two tables to join.

You cannot use this name-value pair argument with the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.

Example: `'Keys','MANAGER_ID'`

Data Types: `char` | `string` | `cell`

`LeftKeys` — Left keys
character vector | string scalar | cell array of character vectors | string array

Left keys, specified as the comma-separated pair consisting of `'LeftKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the left table for the join to the right table.

Use this name-value pair argument with the `'RightKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlinnerjoin` function pairs the values of the keys based on their order.

Example: `'LeftKeys',["productNumber" "Price"],'RightKeys',["productNumber" "Price"]`

Data Types: `char` | `string` | `cell`

`RightKeys` — Right keys
character vector | string scalar | cell array of character vectors | string array

Right keys, specified as the comma-separated pair consisting of `'RightKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the right table for the join to the left table.

Use this name-value pair argument with the `'LeftKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlinnerjoin` function pairs the values of the keys based on their order.

Example: `'LeftKeys',["productIdentifier" "Cost"],'RightKeys',["productNumber" "Price"]`

Data Types: `char` | `string` | `cell`

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `sqlinnerjoin` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

`VariableNamingRule` — Variable naming rule
`"preserve"` (default) | `"modify"`

Variable naming rule, specified as the comma-separated pair consisting of `'VariableNamingRule'` and one of these values:

- `"preserve"` — Preserve most variable names when the `sqlinnerjoin` function imports data. For details, see the Limitations section.
- `"modify"` — Remove non-ASCII characters from variable names when the `sqlinnerjoin` function imports data.

Example: `'VariableNamingRule',"modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlinnerjoin(conn,lefttable,righttable,"RowFilter",rf)`

Output Arguments

`data` — Joined data
table

Joined data, returned as a table that contains the matched rows from the join of the left and right tables. `data` also contains a variable for each column in the left and right tables.

When you import data, the `sqlinnerjoin` function converts the data type of each column from the MySQL database to the MATLAB data type. This table maps the data type of a database column to the converted MATLAB data type.

MySQL Data Type	MATLAB Data Type
BIT	logical
TINYINT	double
SMALLINT	double
BIGINT	double
REAL	double
DOUBLE	double
DECIMAL	double
NUMERIC	double
CHAR	string
VARCHAR	string

MySQL Data Type	MATLAB Data Type
LONGVARCHAR	string
TIMESTAMP	datetime
DATE	datetime
TIME	duration
YEAR	double
ENUM	categorical
JSON	char

If the column names are shared between the joined database tables and have the same case, then the `sqlinnerjoin` function adds a unique suffix to the corresponding variable names in `data`.

Limitations

The name-value argument `VariableNamingRule` has these limitations if it is set to the value `"modify"`.

- The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.
- The length of each variable name must be less than the number returned by `namelengthmax`.

Version History

Introduced in R2020b

R2023a: Selectively join data based on filter condition

You can use the `RowFilter` when joining data from database tables.

See Also

`sqlread` | `sqlfind` | `sqlouterjoin` | `mysql` | `close`

Topics

"Import Data from MySQL Database Table" on page 6-6

sqlouterjoin

Namespace: `database.mysql`

Outer join between two MySQL database tables

Syntax

```
data = sqlouterjoin(conn,lefttable,righttable,'Type',type)
data = sqlouterjoin(conn,lefttable,righttable,Name,Value)
```

Description

`data = sqlouterjoin(conn,lefttable,righttable,'Type',type)` returns a table resulting from an outer join between the left and right database tables. Specify the join type to be a left or right join. This function matches rows using all shared columns, or keys, in both database tables. The outer join retains the matched and unmatched rows between the two tables. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM lefttable LEFT JOIN righttable ON lefttable.key = righttable.key` or `SELECT * FROM lefttable RIGHT JOIN righttable ON lefttable.key = righttable.key`.

`data = sqlouterjoin(conn,lefttable,righttable,Name,Value)` uses additional options specified by one or more name-value arguments. For example, specify `Keys = "productNumber"` to use the `productNumber` column as a key for joining the two database tables.

Examples

Join Two Database Tables Using MySQL Native Interface

Use a MySQL® native interface database connection to import product data from an outer join between two MySQL database tables into MATLAB®.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables. Use the `'Type'` name-value pair argument to retrieve records that have matching values in the selected column of both tables, and unmatched records from the left table only. `data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlouterjoin(conn,lefttable,righttable,'Type',"left");
```

Display the first three rows of joined data. The columns from the right table (`suppliers`) appear to the right of the columns from the left table (`productTable`).

```
head(data,3)
```

```
ans=3×10 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription    Supplier
    _____________    ___________    ______________    ________    __________________    ________

          8          2.1257e+05          1001             5       "Train Set"               100
          1          4.0035e+05          1001            14       "Building Blocks"         100
          2          4.0031e+05          1002             9       "Painting Set"            100
```

Close the database connection.

```
close(conn)
```

Specify Key for Joining Two Database Tables

Use a MySQL® native interface database connection to import product data from an outer join between two MySQL database tables into MATLAB®.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables. Use the `'Type'` name-value pair argument to retrieve records that have matching values in the selected column of both tables, and unmatched records from the left table only. Specify the key, or shared column, between the tables using the `'Keys'` name-value pair argument. `data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlouterjoin(conn,lefttable,righttable,'Type',"left",'Keys',"supplierNumber");
```

Display the first three rows of matched data. The columns from the right table (`suppliers`) appear to the right of the columns from the left table (`productTable`).

```
head(data,3)
```

```
ans=3×10 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription    Supplier
    _____________    ___________    ______________    ________    __________________    ________

          8          2.1257e+05          1001             5       "Train Set"               100
          1          4.0035e+05          1001            14       "Building Blocks"         100
```

```
        2         4.0031e+05         1002            9        "Painting Set"           1002
```

Close the database connection.

```
close(conn)
```

Filter Rows in Joined Data

Use a MySQL® native interface database connection to import product data from an outer join between two MySQL database tables into MATLAB®. Specify the row filter condition to use for joining the tables.

Create a MySQL native interface database connection to a MySQL database using the data source name, username, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "MySQLDataSource";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Join the two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlouterjoin` function automatically detects the shared column between the tables. Use `Type` to retrieve records that have matching values in the selected column of both tables, and unmatched records from the left table only. The table `data` contains the matched and unmatched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlouterjoin(conn,lefttable,righttable,"Type","left");
```

Display the first five rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0034e+05          1001            14       "Building Blocks"        1001
          1          4.0034e+05          1001            14       "Building Blocks"        1001
          2          4.0031e+05          1002             9       "Painting Set"           1002
          2          4.0031e+05          1002             9       "Painting Set"           1002
          3            4.01e+05          1009            17       "Slinky"                 1009
```

Join the same tables, but this time use a row filter. The filter condition is that `unitCost` must be less than 10. Again, display the first five rows of matched data.

```
rf = rowfilter("unitCost");
rf = rf.unitCost <= 10;
data = sqlouterjoin(conn,lefttable,righttable, ...
                    "Type","left", ...
                    "RowFilter",rf);
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription    SupplierN
    _____________    ___________    ______________    ________    __________________    _________

          2          4.0031e+05          1002             9         "Painting Set"          1002
          2          4.0031e+05          1002             9         "Painting Set"          1002
          5          4.0046e+05          1005             3         "Tin Soldier"           1005
          5          4.0046e+05          1005             3         "Tin Soldier"           1005
          6          4.0088e+05          1004             8         "Sail Boat"             1004
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

`lefttable` — Left table
character vector | string scalar

Left table, specified as a character vector or string scalar. Specify the name of the database table on the left side of the join.

Example: `'inventoryTable'`

Data Types: `char` | `string`

`righttable` — Right table
character vector | string scalar

Right table, specified as a character vector or string scalar. Specify the name of the database table on the right side of the join.

Example: `'productTable'`

Data Types: `char` | `string`

type — Outer join type
`'left'` | `'right'`

Outer join type, specified as the comma-separated pair consisting of `'Type'` and one of these values:

- `'left'` — A left join retrieves records that have matching values in the selected column of both tables, and unmatched records from the left table only.
- `'right'` — A right join retrieves records that have matching values in the selected column of both tables, and unmatched records from the right table only.

You can specify this value as a character vector or string scalar.

Example: `'Type','left'`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlouterjoin(conn,"productTable","suppliers",'Type','left','MaxRows',5)` performs an outer left join between left and right tables and returns five rows of the joined data.

`LeftCatalog` — Left catalog

character vector | string scalar

Left catalog, specified as the comma-separated pair consisting of `'LeftCatalog'` and a character vector or string scalar. Specify the database catalog name where the left table of the join is stored.

Example: `'LeftCatalog','toy_store'`

Data Types: `char` | `string`

`RightCatalog` — Right catalog

character vector | string scalar

Right catalog, specified as the comma-separated pair consisting of `'RightCatalog'` and a character vector or string scalar. Specify the database catalog name where the right table of the join is stored.

Example: `'RightCatalog','toy_store'`

Data Types: `char` | `string`

`Keys` — Keys

character vector | string scalar | cell array of character vectors | string array

Keys, specified as the comma-separated pair consisting of `'Keys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. Use this name-value pair argument to identify the shared keys (columns) between the two tables to join.

You cannot use this name-value pair argument with the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.

Example: `'Keys','MANAGER_ID'`

Data Types: `char` | `string` | `cell`

`LeftKeys` — Left keys

character vector | string scalar | cell array of character vectors | string array

Left keys, specified as the comma-separated pair consisting of `'LeftKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the left table for the join to the right table.

Use this name-value pair argument with the `'RightKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlouterjoin` function pairs the values of the keys based on their order.

Example: 'LeftKeys',["productNumber" "Price"],'RightKeys',["productNumber" "Price"]

Data Types: char | string | cell

RightKeys — Right keys
character vector | string scalar | cell array of character vectors | string array

Right keys, specified as the comma-separated pair consisting of 'RightKeys' and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the right table for the join to the left table.

Use this name-value pair argument with the 'LeftKeys' name-value pair argument. Both arguments must specify the same number of keys. The sqlouterjoin function pairs the values of the keys based on their order.

Example: 'LeftKeys',["productIdentifier" "Cost"],'RightKeys',["productNumber" "Price"]

Data Types: char | string | cell

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of 'MaxRows' and a positive numeric scalar. By default, the sqlouterjoin function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: 'MaxRows',10

Data Types: double

VariableNamingRule — Variable naming rule
"preserve" (default) | "modify"

Variable naming rule, specified as the comma-separated pair consisting of 'VariableNamingRule' and one of these values:

- "preserve" — Preserve most variable names when the sqlouterjoin function imports data. For details, see the Limitations section.
- "modify" — Remove non-ASCII characters from variable names when the sqlouterjoin function imports data.

Example: 'VariableNamingRule',"modify"

Data Types: string

RowFilter — Row filter condition
<unconstrained> (default) | matlab.io.RowFilter object

Row filter condition, specified as a matlab.io.RowFilter object.

Example: rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlouterjoin(conn,lefttable,righttable,"RowFilter",rf)

Output Arguments

`data` — Joined data
table

Joined data, returned as a table that contains rows matched by keys in the left and right database tables and the retained unmatched rows. `data` also contains a variable for each column in the left and right tables.

When you import data, the `sqlouterjoin` function converts the data type of each column from the MySQL database to the MATLAB data type. This table maps the data type of a database column to the converted MATLAB data type.

MySQL Data Type	MATLAB Data Type
BIT	logical
TINYINT	double
SMALLINT	double
BIGINT	double
REAL	double
DOUBLE	double
DECIMAL	double
NUMERIC	double
CHAR	string
VARCHAR	string
LONGVARCHAR	string
TIMESTAMP	datetime
DATE	datetime
TIME	duration
YEAR	double
ENUM	categorical
JSON	char

If the column names are shared between the joined database tables and have the same case, then the `sqlouterjoin` function adds a unique suffix to the corresponding variable names in `data`.

The variables in `data` that correspond to columns in the left table contain `NULL` values when no matched rows exist in the right database table. Similarly, the variables that correspond to columns in the right table contain `NULL` values when no matched rows exist in the left database table.

Limitations

The name-value argument `VariableNamingRule` has these limitations if it is set to the value `"modify"`.

- The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.

- The length of each variable name must be less than the number returned by `namelengthmax`.

Version History

Introduced in R2020b

R2023a: Selectively join data based on filter condition

You can use the `RowFilter` when joining data from database tables.

See Also

`sqlfind` | `sqlinnerjoin` | `sqlread` | `mysql` | `close`

Topics

"Import Data from MySQL Database Table" on page 6-6

sqlread

Namespace: `database.mysql`

Import data into MATLAB from MySQL database table

Syntax

```
data = sqlread(conn,tablename)
data = sqlread(conn,tablename,opts)
data = sqlread( ___ ,Name,Value)
[data,metadata] = sqlread( ___ )
```

Description

`data = sqlread(conn,tablename)` returns a table by importing data into MATLAB from a MySQL database table. Executing this function is the equivalent of writing a `SELECT * FROM tablename` SQL statement in ANSI SQL.

`data = sqlread(conn,tablename,opts)` customizes options for importing data from a database table using the `SQLImportOptions` object.

`data = sqlread( ___ ,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, specify `Catalog = "cat"` to import data from a database table stored in the `"cat"` catalog.

`[data,metadata] = sqlread( ___ )` also returns the `metadata` table, which contains metadata information about the imported data.

Examples

Import Data from Database Table Using MySQL Native Interface

Use a MySQL® native interface database connection to import product data from a database table into MATLAB® using a MySQL database. Then, perform a simple data analysis.

Create a MySQL native interface database connection to a MySQL database. The database contains the table `productTable`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password);
```

Import data from the database table `productTable`. The `sqlread` function returns a MATLAB table that contains the product data.

```
tablename = "productTable";
data = sqlread(conn,tablename);
```

Display the first five rows of product data.

```
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        "Victorian Doll"
          8          2.1257e+05          1001             5        "Train Set"
          7          3.8912e+05          1007            16        "Engine Kit"
          2          4.0031e+05          1002             9        "Painting Set"
          4          4.0034e+05          1008            21        "Space Cruiser"
```

Now, import the data using a row filter. The filter condition is that `unitCost` must be less than 15.

```
rf = rowfilter("unitCost");
rf = rf.unitCost < 15;
data = sqlread(conn,tablename,"RowFilter",rf);
```

Again, display the first five rows of product data.

```
head(data,5)
```

```
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       "Victorian Doll"
          8          2.1257e+05          1001             5       "Train Set"
          2          4.0031e+05          1002             9       "Painting Set"
          1          4.0034e+05          1001            14       "Building Blocks"
          5          4.0046e+05          1005             3       "Tin Soldier"
```

Close the database connection.

```
close(conn)
```

Import Data from Database Table Using Import Options

Customize import options when importing data from a database table using the MySQL® native interface. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example also uses a MySQL database version 5.7.22 with the MySQL Connector/C++ driver version 8.0.15.

Create a MySQL native interface database connection to a MySQL database.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password);
```

Load patient information into the MATLAB® workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
               VariableTypes: {'string', 'string', 'double' ... and 7 more}
       SelectedVariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
                  FillValues: { <missing>,  <missing>,  NaN  ... and 7 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 10 VariableOptions
```

Display the current import options for the variables in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |       (2) |      (3) |         (4) |      (5) |      (6) |       (7)
         Name: 'LastName' |  'Gender' |    'Age' | 'Location' | 'Height' | 'Weight' |  'Smoker'
         Type:   'string' |  'string' | 'double' |    'string' | 'double' | 'double' | 'logical'
  MissingRule:     'fill' |    'fill' |   'fill' |      'fill' |   'fill' |   'fill' |    'fill'
    FillValue:  <missing> | <missing> |      NaN |  <missing> |      NaN |      NaN |         0

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `Gender`, `Location`, `Smoker`, and `SelfAssessedHealthStatus` variables using the `setoptions` function. Because the `Gender`, `Location`, and `SelfAssessedHealthStatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `double`. Then, display the updated import options.

```
opts = setoptions(opts,{'Gender','Location','SelfAssessedHealthStatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'Smoker','Type','double');

varOpts = getoptions(opts,{'Gender','Location','Smoker', ...
    'SelfAssessedHealthStatus'})
```

```
varOpts =
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                         (1) |             (2) |      (3) |                          (4)
         Name:      'Gender' |      'Location' | 'Smoker' | 'SelfAssessedHealthStatus'
         Type: 'categorical' | 'categorical'   | 'double' |              'categorical'
  MissingRule:        'fill' |          'fill' |   'fill' |                     'fill'
    FillValue:   <undefined> |     <undefined> |        0 |                <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts);
tail(data)
```

```
     LastName      Gender    Age            Location             Height    Weight    Smoker    Sy
    ___________    ______    ___    _________________________    ______    ______    ______    __

    "Foster"       Female    30     St. Mary's Medical Center      70       124        0
    "Gonzales"     Male      48     County General Hospital        71       174        0
    "Bryant"       Female    48     County General Hospital        66       134        0
    "Alexander"    Male      25     County General Hospital        69       171        1
    "Russell"      Male      44     VA Hospital                    69       188        1
    "Griffin"      Male      49     County General Hospital        70       186        0
    "Diaz"         Male      45     County General Hospital        68       172        1
    "Hayes"        Male      48     County General Hospital        66       177        0
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    LastName: 200×1 string

    Gender: 200×1 categorical

        Values:

            Female      106
            Male         94

    Age: 200×1 double

        Values:

            Min          25
            Median       39
            Max          50

    Location: 200×1 categorical

        Values:
```

```
        County General Hospital         78
        St. Mary s Medical Center       48
        VA Hospital                     74

Height: 200×1 double

    Values:

        Min          60
        Median       67
        Max          72

Weight: 200×1 double

    Values:

        Min           111
        Median      142.5
        Max           202

Smoker: 200×1 double

    Values:

        Min          0
        Median       0
        Max          1

Systolic: 200×1 double

    Values:

        Min         109
        Median      122
        Max         138

Diastolic: 200×1 double

    Values:

        Min           68
        Median      81.5
        Max           99

SelfAssessedHealthStatus: 200×1 categorical

    Values:

        Excellent       68
        Fair            30
        Good            80
        Poor            22
```

Now set the filter condition to import only data for patients older than 40 year and not taller than 68 inches.

```
opts.RowFilter = opts.RowFilter.Age > 40 & opts.RowFilter.Height <= 68
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
               VariableTypes: {'string', 'categorical', 'double' ... and 7 more}
       SelectedVariableNames: {'LastName', 'Gender', 'Age' ... and 7 more}
                  FillValues: { <missing>,  <undefined>,  NaN  ... and 7 more }
                   RowFilter: Height <= 68 & Age > 40

             VariableOptions: Show all 10 VariableOptions
```

Again, import the `patients` database table using the `sqlread` function, and display a summary of the imported data.

```
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    LastName: 48×1 string

    Gender: 48×1 categorical

        Values:

            Female       34
            Male         14

    Age: 48×1 double

        Values:

            Min           41
            Median      45.5
            Max           50

    Location: 48×1 categorical

        Values:

            County General Hospital         26
            St. Mary s Medical Center       10
            VA Hospital                     12

    Height: 48×1 double

        Values:

            Min          62
            Median       66
            Max          68

    Weight: 48×1 double
```

```
        Values:

            Min         119
            Median      137
            Max         194

    Smoker: 48×1 double

        Values:

            Min           0
            Median        0
            Max           1

    Systolic: 48×1 double

        Values:

            Min           114
            Median      121.5
            Max           138

    Diastolic: 48×1 double

        Values:

            Min            68
            Median       81.5
            Max            96

    SelfAssessedHealthStatus: 48×1 categorical

        Values:

            Excellent       14
            Fair             6
            Good            20
            Poor             8
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Limit Number of Rows in Imported Data

Use a MySQL® native interface database connection to import a limited number of rows of product data from a database table into MATLAB®. Then, sort and filter the rows in the imported data, and perform a simple data analysis.

Create a MySQL® native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the table `productTable`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Import data from the table `productTable`. Limit the number of rows by setting the `'MaxRows'` name-value pair argument to `10`. The `data` table contains the product data.

```
tablename = "productTable";
data = sqlread(conn,tablename,'MaxRows',10);
```

Display the first few rows of product data.

```
data(1:3,:)
```

```
ans=3×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        "Victorian Doll"
          8          2.1257e+05          1001             5        "Train Set"
          7          3.8912e+05          1007            16        "Engine Kit"
```

Display the first few product descriptions.

```
data.productDescription(1:3)
```

```
ans = 3×1 string
    "Victorian Doll"
    "Train Set"
    "Engine Kit"
```

Sort the rows in `data` by the product description column in alphabetical order.

```
column = "productDescription";
data = sortrows(data,column);
```

Display the first few product descriptions after sorting.

```
data.productDescription(1:3)
```

```
ans = 3×1 string
    "Building Blocks"
    "Engine Kit"
    "Painting Set"
```

Close the database connection.

```
close(conn)
```

Retrieve Metadata Information About Imported Data

Retrieve metadata information when importing data from a database table using the MySQL® native interface. Import data using the `sqlread` function and explore the metadata information by using dot notation.

This example uses the `outages.csv` file, which contains outage data. The example also uses a MySQL database version 5.7.22 with the MySQL Connector/C++ driver version 8.0.15.

Create a MySQL® native interface database connection to a MySQL database using the data source name, user name, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Load outage information into the MATLAB® workspace.

```
outages = readtable("outages.csv");
```

Create the `outages` database table using the outage information. Use the `'ColumnType'` name-value pair argument to specify the data types of the variables in the MATLAB® table.

```
tablename = "outages";
sqlwrite(conn,tablename,outages, ...
    'ColumnType',["varchar(120)","datetime","numeric(38,16)", ...
    "numeric(38,16)","datetime","varchar(150)"])
```

Import the data into the MATLAB workspace and return metadata information about the imported data.

```
[data,metadata] = sqlread(conn,tablename);
```

View the names of the variables in the imported data.

```
metadata.Properties.RowNames
```

```
ans = 6×1 cell
    {'Region'         }
    {'OutageTime'     }
    {'Loss'           }
    {'Customers'      }
    {'RestorationTime'}
    {'Cause'          }
```

View the data type of each variable in the imported data.

```
metadata.VariableType
```

```
ans = 6×1 cell
    {'string'  }
    {'datetime'}
    {'double'  }
    {'double'  }
    {'datetime'}
    {'string'  }
```

View the missing data value for each variable in the imported data.

```
metadata.FillValue
```

```
ans=6×1 cell array
    {1×1 missing}
    {[NaT      ]}
    {[      NaN]}
    {[      NaN]}
    {[NaT      ]}
    {1×1 missing}
```

View the indices of the missing data for each variable in the imported data.

```
metadata.MissingRows
```

```
ans=6×1 cell array
    {  0×1 double}
    {  0×1 double}
    {604×1 double}
    {328×1 double}
    { 29×1 double}
    {  0×1 double}
```

Display the first eight rows of the imported data that contain missing restoration time values. `data` contains restoration time values in the fifth variable. Use the numeric indices to find the rows with missing data.

```
index = metadata.MissingRows{5,1};
nullrestoration = data(index,:);
head(nullrestoration)
```

```
ans=8×6 table
      Region             OutageTime            Loss     Customers     RestorationTime         Cause
    ___________    ____________________    ______    __________    _______________    ___________

    "SouthEast"    23-Jan-2003 00:49:00    530.14    2.1204e+05          NaT          "winter sto
    "NorthEast"    18-Sep-2004 05:54:00         0             0          NaT          "equipment
    "MidWest"      20-Apr-2002 16:46:00     23141           NaN          NaT          "unknown"
    "NorthEast"    16-Sep-2004 19:42:00      4718           NaN          NaT          "unknown"
    "SouthEast"    14-Sep-2005 15:45:00    1839.2    3.4144e+05          NaT          "severe sto
    "SouthEast"    17-Aug-2004 17:34:00     624.1    1.7879e+05          NaT          "severe sto
    "SouthEast"    28-Jan-2006 23:13:00    498.78           NaN          NaT          "energy eme
    "West"         20-Jun-2003 18:22:00         0             0          NaT          "energy eme
```

Delete the `outages` database table using the `execute` function.

```
sqlstr = "DROP TABLE ";
sqlquery = strcat(sqlstr,tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

`conn` — MySQL native interface database connection
`connection` object

MySQL native interface database connection, specified as a `connection` object.

`tablename` — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

`opts` — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlread(conn,'inventoryTable','Catalog','toy_store','MaxRows',5)` imports five rows of data from the database table `inventoryTable` stored in the `toy_store` catalog.

`Catalog` — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `sqlread` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

`VariableNamingRule` — Variable naming rule
`"preserve"` (default) | `"modify"`

Variable naming rule, specified as the comma-separated pair consisting of 'VariableNamingRule' and one of these values:

- "preserve" — Preserve most variable names when the sqlread function imports data. For details, see the Limitations section.
- "modify" — Remove non-ASCII characters from variable names when the sqlread function imports data.

Example: 'VariableNamingRule',"modify"

Data Types: string

RowFilter — Row filter condition
<unconstrained> (default) | matlab.io.RowFilter object

Row filter condition, specified as a matlab.io.RowFilter object.

Example: rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlread(conn,tablename,"RowFilter",rf)

Output Arguments

data — Imported data
table

Imported data, returned as a table. The rows of the table correspond to the rows in the database table tablename. The variables in the table correspond to each column in the database table.

If the database table contains no data to import, then data is an empty table.

When you import data, the sqlread function converts the data type of each column from the MySQL database to the MATLAB data type. This table maps the data type of a database column to the converted MATLAB data type.

MySQL Data Type	MATLAB Data Type
BIT	logical
TINYINT	double
SMALLINT	double
BIGINT	double
REAL	double
DOUBLE	double
DECIMAL	double
NUMERIC	double
CHAR	string
VARCHAR	string
LONGVARCHAR	string
TIMESTAMP	datetime
DATE	datetime

MySQL Data Type	MATLAB Data Type
TIME	duration
YEAR	double
ENUM	categorical
JSON	char

metadata — Metadata information
table

Metadata information, returned as a table with these variables.

Variable Name	Variable Description	Variable Data Type
VariableType	Data type of each variable in the imported data	Cell array of character vectors
FillValue	Value of missing data for each variable in the imported data	Cell array of missing data values
MissingRows	Indices for each occurrence of missing data in each variable of the imported data	Cell array of numeric indices

By default, the sqlread function imports text data as a character vector and numeric data as a double. FillValue is an empty character array (for text data) or NaN (for numeric data) by default. To change the missing data value to another value, use the SQLImportOptions object.

The RowNames property of the metadata table contains the names of the variables in the imported data.

Limitations

- The sqlread function returns an error when you use the VariableNamingRule name-value argument with the SQLImportOptions object opts.
- When the VariableNamingRule name-value pair argument is set to the value "modify":
  - The variable names Properties, RowNames, and VariableNames are reserved identifiers for the table data type.
  - The length of each variable name must be less than the number returned by namelengthmax.
- The sqlread function returns an error if you specify the RowFilter name-value argument with the SQLImportOptions object opts. It is ambiguous which of the RowFilter object to use in this case, especially if the filter conditions are different.

Version History

Introduced in R2020b

R2023a: Selectively import rows of data based on filter condition

You can use the RowFilter name-value argument to selectively import rows of data from a database table.

See Also

Functions

`sqlfind` | `fetch` | `sqlinnerjoin` | `sqlouterjoin` | `mysql` | `close` | `execute` | `databaseImportOptions` | `setoptions` | `getoptions` | `reset`

Topics

“Import Data from MySQL Database Table” on page 6-6
“Customize Options for Importing Data from Database into MATLAB Using MySQL Native Interface” on page 6-8

sqlupdate

Namespace: `database.mysql`

Update rows in MySQL database table

Syntax

```
sqlupdate(conn,tablename,data,filter)
sqlupdate(___,Name,Value)
```

Description

`sqlupdate(conn,tablename,data,filter)` updates rows in the MySQL database table (`tablename`) with the rows from the MATLAB table (`data`) based on filter conditions (`filter`).

`sqlupdate(___,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, `Catalog = "cat"` updates data from a database table stored in the `"cat"` catalog.

Examples

Update Database Rows

Update rows in the MySQL native interface database based on filter conditions specified with row filters.

This example uses the `patients.xls` file, which contains the columns `LastName`, `Gender`, `Age`, `Location`, `Height`, `Weight`, `Smoker`, `Systolic`, `Diastolic`, and `SelfAssessedHealthStatus`. The example also uses a MySQL database version 5.7.22 with the MySQL Connector/C++ driver version 8.0.15.

Create a MySQL native interface database connection to a MySQL database.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";

conn = mysql(datasource,username,password);
```

Load patient information into the MATLAB workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Use the SQL `ALTER` statement to add the column `HighRisk` to the table `patients`.

```
sqlquery = 'ALTER TABLE patients ADD HighRisk bit';
execute(conn,sqlquery)
```

Import the `patients` database table using the `sqlread` function, and return metadata information about the imported data.

```
[data,metadata] = sqlread(conn,tablename);
```

Display the first 10 rows of the table. In MATLAB, all the values in the `HighRisk` column appear as `false`.

```
head(data,10)
```

```
     LastName       Gender      Age              Location               Height    Weight    Smoker
    __________    ________    ___    ___________________________    ______    ______    ______

    "Smith"       "Male"      38     "County General Hospital"        71        176     true
    "Johnson"     "Male"      43     "VA Hospital"                    69        163     false
    "Williams"    "Female"    38     "St. Mary's Medical Center"      64        131     false
    "Jones"       "Female"    40     "VA Hospital"                    67        133     false
    "Brown"       "Female"    49     "County General Hospital"        64        119     false
    "Davis"       "Female"    46     "St. Mary's Medical Center"      68        142     false
    "Miller"      "Female"    33     "VA Hospital"                    64        142     true
    "Wilson"      "Male"      40     "VA Hospital"                    68        180     false
    "Moore"       "Male"      28     "St. Mary's Medical Center"      68        183     false
    "Taylor"      "Female"    31     "County General Hospital"        66        132     false
```

Displaying the metadata shows that the values are `NULL` (missing elements) in the database.

```
metadata
```

```
metadata=11×3 table
                                VariableType      FillValue        MissingRows
                                ____________    _____________    ______________

    LastName                    {'string' }     {[<missing>]}    {  0×1 double}
    Gender                      {'string' }     {[<missing>]}    {  0×1 double}
    Age                         {'double' }     {[      NaN]}    {  0×1 double}
    Location                    {'string' }     {[<missing>]}    {  0×1 double}
    Height                      {'double' }     {[      NaN]}    {  0×1 double}
    Weight                      {'double' }     {[      NaN]}    {  0×1 double}
    Smoker                      {'logical'}     {[        0]}    {  0×1 double}
    Systolic                    {'double' }     {[      NaN]}    {  0×1 double}
    Diastolic                   {'double' }     {[      NaN]}    {  0×1 double}
    SelfAssessedHealthStatus    {'string' }     {[<missing>]}    {  0×1 double}
    HighRisk                    {'logical'}     {[        0]}    {100×1 double}
```

Now, identify patients who are considered high risk for developing some hypothetical health issue based on their age and their smoker status. First, create a table containing the new data to write to the database. This table requires only `1` (`true`) and `0` (`false`) values.

```
t = table([1;0],"VariableNames","HighRisk");
head(t)
```

```
    HighRisk
    ________
```

```
1
0
```

Create a row filter using the filter condition that a patient must be older than 35 years and a smoker to be considered high-risk.

```
rf = rowfilter(["Age","Smoker"]);
rf = rf.Age > 35 & rf.Smoker == 1
```

```
rf = 
  RowFilter with constraints:

    Age > 35 & Smoker == 1

  VariableNames: Age, Smoker
```

Update the `HighRisk` column using this filter to set the values to `1` (`true`) and using the `~rf` value of the filter to set the value to `0` (`false`).

```
sqlupdate(conn,"patients",t,{rf;~rf});
```

Again, import the `patients` database table using the `sqlread` function, and display the first 10 rows.

```
data = sqlread(conn,tablename);
head(data,10)
```

```
     LastName      Gender     Age              Location               Height    Weight    Smoker
    __________    ________    ___    _____________________________    ______    ______    ______

    "Smith"       "Male"      38     "County General Hospital"          71       176      true  
    "Johnson"     "Male"      43     "VA Hospital"                      69       163      false 
    "Williams"    "Female"    38     "St. Mary's Medical Center"        64       131      false 
    "Jones"       "Female"    40     "VA Hospital"                      67       133      false 
    "Brown"       "Female"    49     "County General Hospital"          64       119      false 
    "Davis"       "Female"    46     "St. Mary's Medical Center"        68       142      false 
    "Miller"      "Female"    33     "VA Hospital"                      64       142      true  
    "Wilson"      "Male"      40     "VA Hospital"                      68       180      false 
    "Moore"       "Male"      28     "St. Mary's Medical Center"        68       183      false 
    "Taylor"      "Female"    31     "County General Hospital"          66       132      false 
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
connection object

MySQL native interface database connection, specified as a `connection` object.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

data — Updated data
MATLAB table

Updated data, specified as a MATLAB table. The table can contain one or more rows with updated data. The names of the variables in the table must be a subset of the column names of the database table.

Example: `data = table([1;0],"VariableNames","NewName")`

Data Types: `table`

filter — Row filter condition
`matlab.io.RowFilter` object | cell array of `matlab.io.RowFilter` objects

Row filter condition, specified as a `matlab.io.RowFilter` object or cell array of `matlab.io.RowFilter` objects. Filters determine which database rows `sqlupdate` must update with which data. If multiple database rows match a filter, `sqlupdate` updates them with the same data. If a single database row matches multiple filters, its final state matches the data corresponding to the last matching filter.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5;`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `sqlupdate(conn,'inventoryTable',data,rf,Catalog = "toy_store",Schema = "dbo")` updates the database `inventoryTable` stored in the `toy_store` catalog and the `dbo` schema.

Catalog — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

Schema — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

Version History

Introduced in R2023a

See Also

`sqlfind` | `fetch` | `sqlread` | `sqlinnerjoin` | `sqlouterjoin` | `mysql` | `close` | `execute` | `databaseImportOptions` | `setoptions` | `getoptions` | `reset`

sqlwrite

Namespace: `database.mysql`

Insert MATLAB data into MySQL database table

Syntax

```
sqlwrite(conn,tablename,data)
sqlwrite(conn,tablename,data,Name,Value)
```

Description

`sqlwrite(conn,tablename,data)` inserts data from a MATLAB table into a database table. If the table exists in the database, this function appends the data from the MATLAB table as rows in the existing database table. If the table does not exist in the database, this function creates a table with the specified table name and then inserts the data as rows in the new table. This syntax is the equivalent of executing SQL statements that contain the `CREATE TABLE` and `INSERT INTO` ANSI SQL syntaxes.

`sqlwrite(conn,tablename,data,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Catalog','toy_store'` inserts data into a database table that is located in the database catalog named `toy_store`.

Examples

Append Data into Existing Table Using MySQL Native Interface

Use a MySQL® native interface database connection to append product data from a MATLAB® table into an existing table in a MySQL database.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the table `productTable`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

To view the existing database table `productTable` before appending data, import its contents into MATLAB and display the last few rows.

```
tablename = "productTable";
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans=3×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          6          4.0088e+05          1004             8           "Sail Boat"
```

```
         3          4.01e+05         1009          17           "Slinky"
        10        8.8865e+05         1006          24           "Teddy Bear"
```

Create a MATLAB table that contains the data for one product.

```
data = table(30,500000,1000,25,"Rubik's Cube", ...
    'VariableNames',["productNumber" "stockNumber" ...
    "supplierNumber" "unitCost" "productDescription"]);
```

Append the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans=4×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

          6          4.0088e+05          1004             8         "Sail Boat"
          3            4.01e+05          1009            17         "Slinky"
         10          8.8865e+05          1006            24         "Teddy Bear"
         30               5e+05          1000            25         "Rubik's Cube"
```

Close the database connection.

```
close(conn)
```

Insert Data into New Table

Use a MySQL® native interface database connection to insert product data from MATLAB® into a new table in a MySQL database.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password. The database contains the table `productTable`.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new database table named `toyTable`.

```
tablename = "toyTable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________

         30            5e+05             1000            25         "Rubik's Cube"
         40            6e+05             2000            30         "Doll House"
```

Close the database connection.

```
close(conn)
```

Specify Column Types When Inserting Data into New Table

Use a MySQL® native interface database connection to insert product data from MATLAB® into a new table in a MySQL database. Specify the data types of the columns in the new database table.

Create a MySQL native interface database connection to a MySQL database using the data source name, user name, and password.

```
datasource = "MySQLNative";
username = "root";
password = "matlab";
conn = mysql(datasource,username,password);
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new database table named `toyTable`. Use the '`ColumnType`' name-value pair argument and a string array to specify the data types of all the columns in the database table.

```
tablename = "toyTable";
coltypes = ["numeric" "numeric" "numeric" "numeric" "varchar(255)"];
sqlwrite(conn,tablename,data,'ColumnType',coltypes)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productNumber    stockNumber    supplierNumber    unitCost    productDescription
    _____________    ___________    ______________    ________    __________________
```

```
    30          5e+05          1000          25          "Rubik's Cube"
    40          6e+05          2000          30          "Doll House"
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — MySQL native interface database connection
connection object

MySQL native interface database connection, specified as a `connection` object.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: "employees"

Data Types: string | char

data — Data to insert
table

Data to insert into a database table, specified as a table.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of numeric arrays
- Cell array of character vectors
- String array
- Datetime array
- Duration array
- Logical array
- Cell array of logical arrays

The numeric array can contain these data types:

- `int8`
- `uint8`
- `int16`
- `uint16`
- `int32`
- `uint32`
- `int64`

- `uint64`
- `single`
- `double`

For date and time data, supported formats are:

- Date — `'yyyy-MM-dd'`
- Time — `'hh:mm:ss'`
- Timestamp — `'yyyy-MM-dd HH:mm:ss'`

If the date and time data is specified in an invalid format, then the `sqlwrite` function automatically converts the data to a supported format.

If the cell array of character vectors or string array is specified in an invalid format, then the `sqlwrite` function enables the database driver to check the format. If the format is unexpected, then the database driver throws an error.

You can insert data in an existing database table or a new database table. The data types of variables in `data` vary depending on whether the database table exists. For valid data types, see “Data Types for Existing Table” on page 12-0 and “Data Types for New Table” on page 12-0.

Note The `sqlwrite` function supports only the `table` data type for the `data` input argument. To insert data stored in a structure, cell array, or numeric matrix, convert the data to a `table` by using the `struct2table`, `cell2table`, and `array2table` functions, respectively.

To insert missing data, see “Accepted Missing Data” on page 12-0.

Example: `table([10;20],{'M';'F'})`

Data Types for Existing Table

The variable names of the MATLAB table must match the column names in the database table. The `sqlwrite` function is case-sensitive.

When you insert data into a database table, use the data types shown in the following table to ensure that the data has the correct data type. This table matches the valid data types of the MATLAB table variable to the data types of the database column. For example, when you insert data into a database column that has the `BIT` data type, ensure that the corresponding variable in the MATLAB table is a logical array or cell array of logical arrays.

Data Type of MATLAB Table Variable	Data Type of Existing Database Column
Numeric array or cell array of numeric arrays	• `INTEGER` • `SMALLINT` • `DECIMAL` • `NUMERIC` • `FLOAT` • `REAL` • `DOUBLE PRECISION`

Data Type of MATLAB Table Variable	Data Type of Existing Database Column
Cell array of character vectors, string array, datetime array, or duration array	• `DATE` • `TIME` • `TIMESTAMP`
Logical array or cell array of logical arrays	`BIT`
Cell array of character vectors or string array	• `CHAR` • `VARCHAR`

Data Types for New Table

The specified table name for the new database table must be unique across all tables in the database.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of character vectors
- String array
- Datetime array
- Duration array
- Logical array

The `sqlwrite` function ignores any invalid data types and inserts only the valid variables from MATLAB as columns in a new database table.

The `sqlwrite` function converts the data type of the variable into the default data type of the column in the database table. The following table matches the valid data types of the MATLAB table variable to the default data types of the database column.

Data Type of MATLAB Table Variable	Default Data Type of Database Column
`int8` array	`TINYINT`
`int16` array	`SMALLINT`
`int32` array	`INTEGER`
`int64` array	`BIGINT`
`logical` array	`BIT`
`single` or `double` array	`NUMERIC`
`datetime` array	`TIMESTAMP`
`duration` array	`TIME`
cell array of character vectors or string array	`VARCHAR` **Note** The size of this column equals the sum of the maximum length of a string in the string array and 100.

To specify database-specific column data types instead of the defaults, use the `'ColumnType'` name-value pair argument. For example, you can specify `'ColumnType',"bigint"` to create a `BIGINT` column in the new database table.

Also, using the `'ColumnType'` name-value pair argument, you can specify other data types that are not in the default list. For example, to insert images, specify `'ColumnType',"image"`.

Accepted Missing Data

The accepted missing data for inserting data into a database depends on the data type of the MATLAB table variable and the data type of the column in the database. The following table matches the data type of the MATLAB table variable to the data type of the database column and specifies the accepted missing data to use in each case.

Data Type of MATLAB Table Variable	Data Type of Database Column	Accepted Missing Data
`datetime` array	`Date` or `Timestamp`	`NaT`
`duration` array	`Time`	`NaN`
`double` or `single` array or cell array of `double` or `single` arrays	`Numeric`	`NaN`, `[]`, or `''`
cell array of character vectors	`Date` or `Timestamp`	`'NaT'` or `''`
cell array of character vectors	`Time`	`'NaN'` or `''`
cell array of character vectors	`Char`, `Varchar`, or other text data type	`''`
string array	`Date` or `Timestamp`	`""`, `"NaT"`, or `missing`
string array	`Time`	`""`, `"NaN"`, or `missing`
string array	`Char`, `Varchar`, or other text data type	`missing`

Data Types: `table`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `sqlwrite(conn,"tablename",data,'ColumnType',["numeric" "timestamp" "image"])` inserts data into a new database table named `tablename` by specifying data types for all columns in the new database table.

`Catalog` — Database catalog name

string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`ColumnType` — Database column types

character vector | string scalar | cell array of character vectors | string array

Database column types, specified as the comma-separated pair consisting of `'ColumnType'` and a character vector, string scalar, cell array of character vectors, or string array. Use this name-value pair argument to define custom data types for the columns in a database table. Specify a column type for each column in the table.

Example: `'ColumnType',["numeric" "varchar(400)"]`

Data Types: `char` | `string` | `cell`

Version History

Introduced in R2020b

See Also

`sqlread` | `mysql` | `close` | `cell2table` | `array2table` | `struct2table`

Topics

“Import Data from MySQL Database Table” on page 6-6
“Delete Data from Database Using MySQL Native Interface” on page 6-19
“Roll Back Data in Database Using MySQL Native Interface” on page 6-16

connection

PostgreSQL native interface database connection

Description

Create a connection to a PostgreSQL database using the PostgreSQL native interface. Configure a PostgreSQL native interface data source using the `databaseConnectionOptions` function.

Creation

Create a `connection` object by using the `postgresql` function.

Properties

`DataSource` — Data source name
string scalar

This property is read-only.

Data source name, specified as a string scalar.

Example: `"PostgreSQLDataSource"`

Data Types: `string`

`Database` — Database name
`""` (default) | string scalar

This property is read-only.

Database name, specified as a string scalar.

If you use the `'DatabaseName'` name-value pair argument of the `postgresql` function, the `postgresql` function sets the `Database` property of the `connection` object to the specified value.

Example: `"toystore_doc"`

Data Types: `string`

`Server` — Server name
`localhost` (default) | string scalar

This property is read-only.

Server name, specified as a string scalar.

If you use the `'Server'` name-value pair argument of the `postgresql` function, the `postgresql` function sets the `Server` property of the `connection` object to the specified value.

Example: `"dbtb00"`

Data Types: `string`

`PortNumber` — Port number
`5432` (default) | numeric scalar

This property is read-only.

Port number, specified as a numeric scalar.

If you use the `'PortNumber'` name-value pair argument of the `postgresql` function, the `postgresql` function sets the `PortNumber` property of the `connection` object to the specified value.

Example: `5432`

Data Types: `double`

`UserName` — User name
`""` (default) | string scalar

This property is read-only.

User name, specified as a string scalar.

Data Types: `string`

`DefaultCatalog` — Default catalog
`""` (default) | string scalar

This property is read-only.

Default catalog, specified as a string scalar.

Example: `"toy_store"`

Data Types: `string`

`Catalogs` — Catalogs in database
`""` (default) | string array

This property is read-only.

Catalogs in the database, specified as a string array.

Example: `["information", "postgresql"]`

Data Types: `string`

`Schemas` — Schemas in database
`""` (default) | string array

This property is read-only.

Schemas in the database, specified as a string array.

Example: `["information_schema", "toys"]`

Data Types: `string`

`AutoCommit` — Flag to autocommit transactions
string scalar

Flag to autocommit transactions, specified as one of these values:

- `"on"` — Database transactions are automatically committed to the database.
- `"off"` — Database transactions must be committed to the database manually.

You can set this property by using dot notation.

`LoginTimeout` — Login timeout
`0` (default) | positive numeric scalar

This property is read-only.

Login timeout, specified as a positive numeric scalar. The login timeout specifies the number of seconds that the driver waits while trying to connect to a database before throwing an error.

When no login timeout for the connection attempt is specified, the value is `0`.

When a login timeout is not supported by the database, the value is `-1`.

Data Types: `double`

`MaxDatabaseConnections` — Maximum number of database connections
`-1` (default) | positive numeric scalar

This property is read-only.

Maximum number of database connections, specified as a positive numeric scalar.

When the database has no upper limit to the maximum number of database connections, the value is `0`.

When a maximum number of database connections is not supported by the database, the value is `-1`.

Data Types: `double`

`DatabaseProductName` — Database product name
`""` (default) | string scalar

This property is read-only.

Database product name, specified as a string scalar.

When the database connection is invalid, the value is an empty string scalar `""`.

Example: `"PostgreSQL"`

Data Types: `string`

`DatabaseProductVersion` — Database product version
`""` (default) | string scalar

This property is read-only.

Database product version, specified as a string scalar.

When the database connection is invalid, the value is an empty string scalar "".

Example: "9.4.5"

Data Types: string

DriverName — Driver name
"" (default) | string scalar

This property is read-only.

Driver name of the PostgreSQL driver, specified as a string scalar.

When the database connection is invalid, the value is an empty string scalar "".

Example: "libpq"

Data Types: string

DriverVersion — Driver version
"" (default) | string scalar

This property is read-only.

Driver version of the PostgreSQL driver, specified as a string scalar.

When the database connection is invalid, the value is an empty string scalar "".

Example: "10.12"

Data Types: string

Object Functions

Manage PostgreSQL Database Connection

close	Close PostgreSQL native interface database connection
isopen	Determine if PostgreSQL native interface database connection is open

Import Data from PostgreSQL Database

fetch	Import results of SQL statement in PostgreSQL database into MATLAB
sqlinnerjoin	Inner join between two PostgreSQL database tables
sqlouterjoin	Outer join between two PostgreSQL database tables
sqlfind	Find information about all table types in PostgreSQL database
sqlread	Import data into MATLAB from PostgreSQL database table
executeSQLScript	Execute SQL script on PostgreSQL database

Export Data to PostgreSQL Database

sqlwrite	Insert MATLAB data into PostgreSQL database table

PostgreSQL Database Operations

execute	Execute SQL statement using PostgreSQL native interface database connection
commit	Make changes to PostgreSQL database permanent
rollback	Undo changes to PostgreSQL database

sqlupdate Update rows in PostgreSQL database table

Examples

Connect to PostgreSQL Database Using PostgreSQL Native Interface

Create a PostgreSQL native interface connection to a PostgreSQL database. Then, import data from the database into MATLAB® and perform simple data analysis. Close the database connection.

This example assumes that you are connecting to a PostgreSQL database version 9.405 using the libpq driver version 10.12.

Connect to the database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password)
```

```
conn = 
  connection with properties:

                DataSource: "PostgreSQLDataSource"
                  UserName: "dbdev"

  Database Properties:

                AutoCommit: "on"
              LoginTimeout: 0
    MaxDatabaseConnections: 100

  Catalog and Schema Information:

            DefaultCatalog: "toystore_doc"
                  Catalogs: "toystore_doc"
                   Schemas: ["pg_toast", "pg_temp_1", "pg_toast_temp_1" ... and 3 more]

  Database and Driver Information:

       DatabaseProductName: "PostgreSQL"
    DatabaseProductVersion: "9.405"
                DriverName: "libpq"
             DriverVersion: "10.12"
```

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `sqlread` function. Display the first three rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
ans=3×4 table
    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          1            1700      14.5     "2014-09-23 09:38:34"
          2            1200         9     "2014-07-08 22:50:45"
          3             356        17     "2014-05-14 07:14:28"
```

Determine the highest product quantity from the table.

```
max(data.quantity)
```

```
ans = 9000
```

Close the database connection `conn`.

```
close(conn)
```

Version History

Introduced in R2020b

See Also

`close` | `fetch` | `sqlread` | `sqlupdate`

Topics

"Import Data from PostgreSQL Database Table" on page 7-11

postgresql

Create PostgreSQL native interface database connection

Syntax

```
conn = postgresql(datasource,username,password)
conn = postgresql(username,password,Name,Value)
```

Description

`conn = postgresql(datasource,username,password)` creates a PostgreSQL native interface database connection using the specified data source, user name, and password. `conn` is a `connection` object.

`conn = postgresql(username,password,Name,Value)` creates a PostgreSQL native interface database connection using the specified user name and password, with additional options specified by one or more name-value pair arguments. For example, `"Server","dbtb00"` specifies the database server name as `dbtb00`.

Examples

Connect to PostgreSQL Database Using PostgreSQL Native Interface

Create a PostgreSQL native interface connection to a PostgreSQL database. Then, import data from the database into MATLAB® and perform simple data analysis. Close the database connection.

This example assumes that you are connecting to a PostgreSQL database version 9.405 using the libpq driver version 10.12.

Connect to the database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password)
```

```
conn =
  connection with properties:

                DataSource: "PostgreSQLDataSource"
                  UserName: "dbdev"

  Database Properties:

                AutoCommit: "on"
              LoginTimeout: 0
    MaxDatabaseConnections: 100

  Catalog and Schema Information:
```

```
              DefaultCatalog: "toystore_doc"
                    Catalogs: "toystore_doc"
                     Schemas: ["pg_toast", "pg_temp_1", "pg_toast_temp_1" ... and 3 more]

  Database and Driver Information:

         DatabaseProductName: "PostgreSQL"
      DatabaseProductVersion: "9.405"
                  DriverName: "libpq"
               DriverVersion: "10.12"
```

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `sqlread` function. Display the first three rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
ans=3×4 table
    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          1            1700      14.5     "2014-09-23 09:38:34"
          2            1200         9     "2014-07-08 22:50:45"
          3             356        17     "2014-05-14 07:14:28"
```

Determine the highest product quantity from the table.

```
max(data.quantity)
```

```
ans = 9000
```

Close the database connection `conn`.

```
close(conn)
```

Connect to PostgreSQL Database Using PostgreSQL Native Interface and Additional Options

Create a PostgreSQL native interface connection to a PostgreSQL database using name-value pair arguments. Then, import data from the database into MATLAB® and perform simple data analysis. Close the database connection.

This example assumes that you are connecting to a PostgreSQL database version 9.405 using the libpq driver version 10.12.

Connect to the database using the user name and password shown. Specify the database server name `dbtb00`, database name `toystore_doc`, and port number `5432` by setting the corresponding name-value pair arguments.

```
username = "dbdev";
password = "matlab";

conn = postgresql(username,password,'Server',"dbtb00", ...
    'DatabaseName',"toystore_doc",'PortNumber',5432)
```

```
conn = 
  connection with properties:

                  Database: "toystore_doc"
                  UserName: "dbdev"

  Database Properties:

                AutoCommit: "on"
              LoginTimeout: 0
    MaxDatabaseConnections: 100

  Catalog and Schema Information:

            DefaultCatalog: "toystore_doc"
                  Catalogs: "toystore_doc"
                   Schemas: ["pg_toast", "pg_temp_1", "pg_toast_temp_1" ... and 3 more]

  Database and Driver Information:

       DatabaseProductName: "PostgreSQL"
    DatabaseProductVersion: "9.405"
                DriverName: "libpq"
             DriverVersion: "10.12"
```

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `sqlread` function. Display the first three rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
ans=3×4 table
    productnumber    quantity    price        inventorydate     
    _____________    ________    _____    _____________________

          1            1700      14.5     "2014-09-23 09:38:34"
          2            1200         9     "2014-07-08 22:50:45"
          3             356        17     "2014-05-14 07:14:28"
```

Determine the highest product quantity from the table.

```
max(data.quantity)
```

```
ans = 9000
```

Close the database connection `conn`.

```
close(conn)
```

Input Arguments

`datasource` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing data source.

Example: `"myDataSource"`

Data Types: `char` | `string`

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `conn = postgresql(username,password,"Server","dbtb00","PortNumber",5432,"DatabaseName","toystore_doc")` creates a PostgreSQL native interface database connection using the database server `dbtb00`, port number `5432`, and database name `toystore_doc`.

`Server` — Database server name
`"localhost"` (default) | string scalar | character vector

Database server name or address, specified as the comma-separated pair consisting of `'Server'` and a string scalar or character vector.

Example: "dbtb00"

Data Types: char | string

PortNumber — Port number
5432 (default) | numeric scalar

Port number, specified as the comma-separated pair consisting of 'PortNumber' and a numeric scalar.

Example: 5432

Data Types: double

DatabaseName — Database name
"" (default) | string scalar | character vector

Database name, specified as the comma-separated pair consisting of 'DatabaseName' and a string scalar or character vector. If you do not specify a database name, the postgresql function connects to the default database on the database server.

Example: "toystore_doc"

Data Types: char | string

Version History

Introduced in R2020b

See Also

databaseConnectionOptions | close | isopen | sqlread

Topics

"Configure PostgreSQL Native Interface Data Source" on page 7-2
"Import Data from PostgreSQL Database Table" on page 7-11
"Insert Data into Database Table Using PostgreSQL Native Interface" on page 7-19

close

Namespace: `database.postgre`

Close PostgreSQL native interface database connection

Syntax

```
close(conn)
```

Description

`close(conn)` closes and invalidates the PostgreSQL native interface database connection to free up database and driver resources.

Examples

Connect to PostgreSQL Database Using PostgreSQL Native Interface

Create a PostgreSQL native interface connection to a PostgreSQL database. Then, import data from the database into MATLAB® and perform simple data analysis. Close the database connection.

This example assumes that you are connecting to a PostgreSQL database version 9.405 using the libpq driver version 10.12.

Connect to the database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password)
```

```
conn = 
  connection with properties:

                DataSource: "PostgreSQLDataSource"
                  UserName: "dbdev"

  Database Properties:

                AutoCommit: "on"
              LoginTimeout: 0
    MaxDatabaseConnections: 100

  Catalog and Schema Information:

            DefaultCatalog: "toystore_doc"
                  Catalogs: "toystore_doc"
                   Schemas: ["pg_toast", "pg_temp_1", "pg_toast_temp_1" ... and 3 more]

  Database and Driver Information:
```

```
      DatabaseProductName: "PostgreSQL"
   DatabaseProductVersion: "9.405"
               DriverName: "libpq"
            DriverVersion: "10.12"
```

The property sections of the `connection` object are:

- `Database Properties` — Information about the database configuration
- `Catalog and Schema Information` — Names of catalogs and schemas in the database
- `Database and Driver Information` — Names and versions of the database and driver

Import all data from the table `inventoryTable` into MATLAB using the `sqlread` function. Display the first three rows of data.

```
tablename = "inventoryTable";
data = sqlread(conn,tablename);
head(data,3)
```

```
ans=3×4 table
    productnumber    quantity    price        inventorydate
    _____________    ________    _____    _____________________

          1            1700      14.5     "2014-09-23 09:38:34"
          2            1200         9     "2014-07-08 22:50:45"
          3             356        17     "2014-05-14 07:14:28"
```

Determine the highest product quantity from the table.

```
max(data.quantity)
```

```
ans = 9000
```

Close the database connection `conn`.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

Version History

Introduced in R2020b

See Also

`postgresql` | `fetch`

Topics

"Configure PostgreSQL Native Interface Data Source" on page 7-2
"Import Data from PostgreSQL Database Table" on page 7-11

commit

Namespace: `database.postgre`

Make changes to PostgreSQL database permanent

Syntax

```
commit(conn)
```

Description

`commit(conn)` makes changes to the database connection `conn` permanent, specifically any changes made since the last `commit` or `rollback` function has been run. To use the `commit` function, you must set the `AutoCommit` property of the `connection` object to `off`.

Examples

Commit Data to PostgreSQL Database

Use a PostgreSQL native interface database connection to insert product data from MATLAB® into a new table in a PostgreSQL database. Then, commit the changes to the database.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Allow manual committing of changes to the database by setting the `AutoCommit` property to `off`.

```
conn.AutoCommit = "off";
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new database table `toytable`.

```
tablename = "toytable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

         30             5e+05            1000            25         "Rubik's Cube"
         40             6e+05            2000            30         "Doll House"
```

Commit the changes to the database.

```
commit(conn)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

Version History

Introduced in R2020b

See Also

`postgresql` | `execute` | `rollback` | `sqlwrite`

Topics

“Insert Data into Database Table Using PostgreSQL Native Interface” on page 7-19
“Create Table and Add Column Using PostgreSQL Native Interface” on page 7-23
“Delete Data from Database Using PostgreSQL Native Interface” on page 7-24
“Roll Back Data in Database Using PostgreSQL Native Interface” on page 7-21

SQLConnectionOptions

Define PostgreSQL native interface database connection options

Description

Create database connection options for a PostgreSQL native interface connection.

First, create an `SQLConnectionOptions` object, set the connection options, test the connection, and save the data source. Then, create a PostgreSQL native interface connection using the saved data source. The connection options include the options required to make a database connection. You can also define additional connection options for a specific database driver.

Creation

Create an `SQLConnectionOptions` object using the `databaseConnectionOptions` function.

Properties

`DataSourceName` — Data source name
string scalar

Data source name, specified as a string scalar. You can use the data source name in the `postgresql` function to create a database connection for the PostgreSQL native interface.

Example: `"PostgreSQLDataSource"`

Data Types: `string`

`Vendor` — Database vendor
string scalar

This property is read-only.

Database vendor, specified as a string scalar. Specify this property using the `vendor` input argument in the `databaseConnectionOptions` function. After the `SQLConnectionOptions` object exists, you cannot set this property to another value.

Example: `"PostgreSQL"`

Data Types: `string`

`DatabaseName` — Database name
string scalar

Database name, specified as a string scalar. Set this property using the `setoptions` function.

Example: `"toystore_doc"`

Data Types: `string`

`Server` — Database server name or address
`"localhost"` (default) | string scalar

Database server name or address, specified as a string scalar. Set this property using the `setoptions` function.

Data Types: `string`

`PortNumber` — Server port number where the server is listening
5432 (default) | numeric scalar

Server port number where the server is listening, specified as a numeric scalar. Set this property using the `setoptions` function.

Data Types: `double`

Object Functions

rmoptions	Remove PostgreSQL native interface connection options
saveAsDataSource	Save PostgreSQL native interface data source
setoptions	Set PostgreSQL native interface connection options
reset	Reset PostgreSQL native interface connection options to defaults
testConnection	Test PostgreSQL native interface database connection

Examples

Create PostgreSQL Native Interface Data Source

Create, configure, test, and save a PostgreSQL native interface data source for a PostgreSQL database.

Create a PostgreSQL native interface data source for a PostgreSQL native interface database connection.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "PostgreSQL"

                DatabaseName: ""
                      Server: "localhost"
                  PortNumber: 5432
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server

- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `PostgreSQLDataSource`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "PostgreSQLDataSource"
                    Vendor: "PostgreSQL"

              DatabaseName: "toystore_doc"
                    Server: "dbtb00"
                PortNumber: 5432
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `postgresql` function or the Database Explorer app.

Version History

Introduced in R2020b

See Also

`databaseConnectionOptions` | `deleteDataSource`

Topics

“Configure PostgreSQL Native Interface Data Source” on page 7-2
“Import Data from PostgreSQL Database Table” on page 7-11

reset

Namespace: `database.options.native.postgresql`

Reset PostgreSQL native interface connection options to defaults

Syntax

```
opts = reset(opts)
```

Description

`opts = reset(opts)` resets all connection options to their default values for all properties of the `SQLConnectionOptions` object. The `reset` function also removes any additional driver-specific properties from the `SQLConnectionOptions` object.

Examples

Reset Connection Options to Default Values

Create, configure, and test a PostgreSQL native interface data source for a PostgreSQL database. Reset the database connection options to their default values. Then configure, test, and save the data source with different database connection options.

Create a PostgreSQL native interface data source for a PostgreSQL database connection.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts =
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "PostgreSQL"

              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 5432
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `PostgreSQLDataSource`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "PostgreSQLDataSource"
                      Vendor: "PostgreSQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb00"
                  PortNumber: 5432
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Reset the database connection options to their default values.

```
opts = reset(opts)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "PostgreSQL"

                DatabaseName: ""
                      Server: "localhost"
                  PortNumber: 5432
```

Configure the data source again by setting the database connection options for the data source `PostgreSQLDataSource`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`. Also, set a driver-specific connection option to specify a timeout value for establishing the database connection.

```
opts = setoptions(opts, ...
    "DataSourceName","PostgreSQLDataSource", ...
    "DatabaseName","toystore_doc", ...
    "Server","dbtb00","PortNumber",5432, ...
    "connect_timeout",20)
```

```
opts = 
  SQLConnectionOptions with properties:

             DataSourceName: "PostgreSQLDataSource"
                     Vendor: "PostgreSQL"

               DatabaseName: "toystore_doc"
                     Server: "dbtb00"
                 PortNumber: 5432

    Additional Connection Options:

            connect_timeout: 20
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object. The driver-specific connection option appears below the other connection options.

Test the database connection again.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

Input Arguments

opts — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as an `SQLConnectionOptions` object.

Output Arguments

opts — Database connection options
`SQLConnectionOptions` object

Database connection options, returned as an `SQLConnectionOptions` object.

Version History

Introduced in R2020b

See Also

Objects
SQLConnectionOptions

Functions
databaseConnectionOptions | rmoptions | saveAsDataSource | setoptions | testConnection | deleteDataSource

Topics
“Import Data from PostgreSQL Database Table” on page 7-11
“Customize Options for Importing Data from PostgreSQL Database into MATLAB” on page 7-13

rmoptions

Namespace: `database.options.native.postgresql`

Remove PostgreSQL native interface connection options

Syntax

```
opts = rmoptions(opts,option)
```

Description

`opts = rmoptions(opts,option)` removes one or more specified connection options from the `SQLConnectionOptions` object `opts`.

Examples

Remove Driver-Specific Connection Option

Edit an existing PostgreSQL native interface data source for a PostgreSQL database. Set an additional driver-specific option, and test the database connection. Then, remove the additional driver-specific option, and test and save the data source.

Retrieve the existing PostgreSQL native interface data source.

```
datasource = "PostgreSQLDataSource";
opts = databaseConnectionOptions(datasource)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "PostgreSQLDataSource"
                      Vendor: "PostgreSQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb00"
                  PortNumber: 5432
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Add a driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. `opts` contains a new property for the additional connection option.

```
opts = setoptions(opts,"connect_timeout",20)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "PostgreSQLDataSource"
                      Vendor: "PostgreSQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb00"
                  PortNumber: 5432

    Additional Connection Options:

             connect_timeout: 20
```

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Remove the driver-specific option for specifying a timeout value. The `opts` object no longer contains the `connect_timeout` property.

```
opts = rmoptions(opts,"connect_timeout")
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "PostgreSQLDataSource"
                      Vendor: "PostgreSQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb00"
                  PortNumber: 5432
```

Test the database connection again.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the data source.

```
saveAsDataSource(opts)
```

Input Arguments

opts — Database connection options
SQLConnectionOptions object

Database connection options, specified as an SQLConnectionOptions object.

option — PostgreSQL native interface connection option
character vector | string scalar | cell array of character vectors | string array

PostgreSQL native interface connection option, specified as a character vector, string scalar, cell array of character vectors, or string array. Specify the name of one or more PostgreSQL native interface connection options or driver-specific connection options.

Example: ["DatabaseName" "Server" "PortNumber"]

Example: "connect_timeout"

Data Types: char | string | cell

Output Arguments

opts — Database connection options
SQLConnectionOptions object

Database connection options, returned as an SQLConnectionOptions object.

Version History

Introduced in R2020b

See Also

Objects
SQLConnectionOptions

Functions
databaseConnectionOptions | postgresql | saveAsDataSource | setoptions | reset | testConnection | deleteDataSource

Topics
“Import Data from PostgreSQL Database Table” on page 7-11
“Customize Options for Importing Data from PostgreSQL Database into MATLAB” on page 7-13

saveAsDataSource

Namespace: `database.options.native.postgresql`

Save PostgreSQL native interface data source

Syntax

`saveAsDataSource(opts)`

Description

`saveAsDataSource(opts)` saves the PostgreSQL native interface data source specified by the `SQLConnectionOptions` object `opts`.

Examples

Create PostgreSQL Native Interface Data Source

Create, configure, test, and save a PostgreSQL native interface data source for a PostgreSQL database.

Create a PostgreSQL native interface data source for a PostgreSQL native interface database connection.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "PostgreSQL"

              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 5432
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `PostgreSQLDataSource`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "PostgreSQLDataSource"
                      Vendor: "PostgreSQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb00"
                  PortNumber: 5432
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `postgresql` function or the Database Explorer app.

Input Arguments

opts — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as an `SQLConnectionOptions` object.

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `postgresql` | `rmoptions` | `setoptions` | `reset` | `testConnection` | `deleteDataSource`

Topics
"Import Data from PostgreSQL Database Table" on page 7-11
"Customize Options for Importing Data from PostgreSQL Database into MATLAB" on page 7-13

setoptions

Namespace: `database.options.native.postgresql`

Set PostgreSQL native interface connection options

Syntax

`opts = setoptions(opts,Option1,OptionValue1,...,OptionN,OptionValueN)`

Description

`opts = setoptions(opts,Option1,OptionValue1,...,OptionN,OptionValueN)` sets connection options using the `SQLConnectionOptions` object `opts`.

Examples

Create PostgreSQL Native Interface Data Source

Create, configure, test, and save a PostgreSQL native interface data source for a PostgreSQL database.

Create a PostgreSQL native interface data source for a PostgreSQL native interface database connection.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "PostgreSQL"

              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 5432
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `PostgreSQLDataSource`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "PostgreSQLDataSource"
                      Vendor: "PostgreSQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb00"
                  PortNumber: 5432
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `postgresql` function or the Database Explorer app.

Edit Existing PostgreSQL Native Interface Data Source

Edit an existing PostgreSQL native interface data source for a PostgreSQL database. Set an additional driver-specific option and save the data source.

Retrieve the existing PostgreSQL data source `PostgreSQLDataSource`.

```
datasource = "PostgreSQLDataSource";
opts = databaseConnectionOptions(datasource)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "PostgreSQLDataSource"
                      Vendor: "PostgreSQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb00"
```

```
              PortNumber: 5432
```

opts is an SQLConnectionOptions object with these properties:

- DataSourceName — Name of the data source
- Vendor — Database vendor name
- DatabaseName — Name of the database
- Server — Name of the database server
- PortNumber — Port number

Add a driver-specific connection option by using a name-value pair argument. The option specifies a timeout value for establishing the database connection. opts contains a new section of properties for the additional connection option.

```
opts = setoptions(opts,"connect_timeout",20)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: "PostgreSQLDataSource"
                    Vendor: "PostgreSQL"

              DatabaseName: "toystore_doc"
                    Server: "dbtb00"
                PortNumber: 5432

    Additional Connection Options:

           connect_timeout: 20
```

Test the database connection with a user name and password. The testConnection function returns the logical 1, which indicates the database connection is successful.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the updated data source.

```
saveAsDataSource(opts)
```

Input Arguments

opts — Database connection options
SQLConnectionOptions object

Database connection options, specified as an SQLConnectionOptions object.

`Option1,OptionValue1,...,OptionN,OptionValueN` — PostgreSQL native interface connection options
name-value pair arguments

PostgreSQL native interface connection options, specified as one or more name-value pair arguments. `Option` is a character vector or string scalar that specifies the name of a PostgreSQL native interface connection option. `OptionValue` specifies the value of the option. `OptionValue` can be a character vector, string scalar, logical scalar, or numeric scalar. You can specify any PostgreSQL native interface connection option that is a property of the `SQLConnectionOptions` object.

Example: `'DataSourceName',"myDataSource",'Server',"localhost",'PortNumber',5432` configures a PostgreSQL native interface data source named `myDataSource` that is located on the local server with the port number `5432`.

Output Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, returned as an `SQLConnectionOptions` object.

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `postgresql` | `rmoptions` | `reset` | `saveAsDataSource` | `testConnection` | `deleteDataSource`

Topics
“Import Data from PostgreSQL Database Table” on page 7-11
“Customize Options for Importing Data from PostgreSQL Database into MATLAB” on page 7-13

testConnection

Namespace: `database.options.native.postgresql`

Test PostgreSQL native interface database connection

Syntax

```
status = testConnection(opts,username,password)
[status,message] = testConnection(opts,username,password)
```

Description

`status = testConnection(opts,username,password)` tests the PostgreSQL native interface database connection specified by the `SQLConnectionOptions` object `opts`, a user name, and a password.

`[status,message] = testConnection(opts,username,password)` also returns the error message associated with testing the database connection.

Examples

Create PostgreSQL Native Interface Data Source

Create, configure, test, and save a PostgreSQL native interface data source for a PostgreSQL database.

Create a PostgreSQL native interface data source for a PostgreSQL native interface database connection.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "PostgreSQL"

              DatabaseName: ""
                    Server: "localhost"
                PortNumber: 5432
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server

- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `PostgreSQLDataSource`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432)
```

```
opts = 
  SQLConnectionOptions with properties:

              DataSourceName: "PostgreSQLDataSource"
                      Vendor: "PostgreSQL"

                DatabaseName: "toystore_doc"
                      Server: "dbtb00"
                  PortNumber: 5432
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection with a user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "dbdev";
password = "matlab";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

You can connect to the new data source using the `postgresql` function or the Database Explorer app.

Retrieve Message for PostgreSQL Native Interface Database Connection Test

Create and configure a PostgreSQL native interface data source to a PostgreSQL database. Test the database connection to the PostgreSQL native interface data source and retrieve the error message.

Create a PostgreSQL native interface data source for a PostgreSQL database connection.

```
vendor = "PostgreSQL";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  SQLConnectionOptions with properties:
```

```
               DataSourceName: ""
                       Vendor: "PostgreSQL"

                 DatabaseName: ""
                       Server: "localhost"
                   PortNumber: 5432
```

`opts` is an `SQLConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `DatabaseName` — Name of the database
- `Server` — Name of the database server
- `PortNumber` — Port number

Configure the data source by setting the database connection options for the data source `PostgreSQLDataSource`, database name `toystore_doc`, database server `dbtb00`, and port number `5432`.

```
opts = setoptions(opts, ...
    'DataSourceName',"PostgreSQLDataSource", ...
    'DatabaseName',"toystore_doc",'Server',"dbtb00", ...
    'PortNumber',5432)
```

```
opts = 
  SQLConnectionOptions with properties:

               DataSourceName: "PostgreSQLDataSource"
                       Vendor: "PostgreSQL"

                 DatabaseName: "toystore_doc"
                       Server: "dbtb00"
                   PortNumber: 5432
```

The `setoptions` function sets the `DataSourceName`, `DatabaseName`, `Server`, and `PortNumber` properties in the `SQLConnectionOptions` object.

Test the database connection using an incorrect user name and password. The `testConnection` function returns the logical `0`, which indicates the database connection fails. Retrieve and display the error message for the failed connection.

```
username = "wronguser";
password = "wrongpassword";
[status,message] = testConnection(opts,username,password)
```

```
status = logical
   0

message = 
    'Driver Error: FATAL:  password authentication failed for user "wronguser"'
```

```
FATAL:  password authentication failed for user "wronguser"
'
```

Input Arguments

`opts` — Database connection options
`SQLConnectionOptions` object

Database connection options, specified as an `SQLConnectionOptions` object.

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

Output Arguments

`status` — Connection status
logical

Connection status, returned as a logical `true` if the connection test passes or `false` if the connection test fails.

`message` — Error message
character vector

Error message, returned as a character vector. If the connection test passes, then the error message is an empty character vector. Otherwise, the error message contains text describing the failed database connection.

Version History

Introduced in R2020b

See Also

Objects
`SQLConnectionOptions`

Functions
`databaseConnectionOptions` | `postgresql` | `rmoptions` | `reset` | `setoptions` | `saveAsDataSource` | `deleteDataSource`

Topics

"Import Data from PostgreSQL Database Table" on page 7-11
"Customize Options for Importing Data from PostgreSQL Database into MATLAB" on page 7-13

execute

Namespace: `database.postgre`

Execute SQL statement using PostgreSQL native interface database connection

Syntax

`execute(conn,sqlquery)`

Description

`execute(conn,sqlquery)` executes an SQL query that contains a non-`SELECT` SQL statement by using the relational database connection.

Examples

Execute Non-SELECT SQL Statement

Using the PostgreSQL native interface, create and execute a non-`SELECT` SQL statement that deletes a database table. The `PostgreSQLDataSource` data source configures a database connection to a PostgreSQL database.

This example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Connect to the database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password);
```

Load patient information into the MATLAB® workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Import the data from the `patients` database table.

```
data = sqlread(conn,tablename);
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Ensure that the table no longer exists.

```
data = sqlfind(conn,tablename)
```

```
data =

  0×5 empty table
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid non-`SELECT` SQL statement.

The SQL statement can be a stored procedure that does not return any result sets. For stored procedures that return one or more result sets, use the `fetch` function.

For information about the SQL query language, see the PostgreSQL Documentation.

Example: `"DROP TABLE patients"`

Data Types: `char` | `string`

Version History

Introduced in R2020b

See Also

`postgresql` | `close` | `fetch` | `sqlread`

Topics

“Create Table and Add Column Using PostgreSQL Native Interface” on page 7-23
“Delete Data from Database Using PostgreSQL Native Interface” on page 7-24

External Websites

PostgreSQL Documentation

executeSQLScript

Namespace: `database.postgre`

Execute SQL script on PostgreSQL database

Syntax

```
results = executeSQLScript(conn,scriptfile)
results = executeSQLScript(conn,scriptfile,Name,Value)
```

Description

`results = executeSQLScript(conn,scriptfile)` uses the database connection `conn` to return a structure array that contains results as a table (by default) for each executed SQL `SELECT` statement in the SQL script file. For any non-`SELECT` SQL statements, the corresponding table is empty. The `executeSQLScript` function executes all SQL statements in the SQL script file.

`results = executeSQLScript(conn,scriptfile,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'DataReturnFormat',"cellarray"` stores the results of an executed SQL statement as a cell array. The results are stored in the `Data` field of the `results` structure array.

Examples

Execute SQL Script Using PostgreSQL Native Interface

Connect to a PostgreSQL database. Then, run two SQL `SELECT` statements from the SQL script file `compare_sales.sql`, import the results, and perform simple sales data analysis. The file contains two SQL queries: the first retrieves sales of products from US suppliers, and the second retrieves sales of products from foreign suppliers.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Execute the SQL script. The SQL script contains two SQL queries that retrieve sales data from US and foreign suppliers, respectively.

```
scriptfile = "compare_sales.sql";
results = executeSQLScript(conn,scriptfile)
```

```
results=1×2 struct array with fields:
    SQLQuery
    Data
```

```
    Message
```

The `executeSQLScript` function returns a structure array that contains two tables in the `Data` field. The first table contains the results of executing the first SQL query in the SQL script file. The second table contains the results of executing the second SQL query.

Display the first eight rows of imported data for the second SQL query in the SQL script file. The data shows sales results from foreign suppliers.

```
data = head(results(2).Data)
```

```
data=4×6 table
    productdescription         suppliername            city       jan_sales    feb_sales    mar_sa
    __________________    _____________________    __________    _________    _________    ______

     "Victorian Doll"     "Wacky Widgets"          "Adelaide"      1400         1100          981
     "Painting Set"       "Terrific Toys"          "London"        3000         2400         1800
     "Sail Boat"          "Incredible Machines"    "Dublin"        3000         2400         1500
     "Slinky"             "Doll's Galore"          "London"        3000         1500         1000
```

Retrieve the variable names in the table.

```
names = data.Properties.VariableNames
```

```
names = 1×6 cell
    {'productdescription'}    {'suppliername'}    {'city'}    {'jan_sales'}    {'feb_sales'}    {
```

Determine the highest sales amount in January.

```
max(data.jan_sales)
```

```
ans = 3000
```

Close the database connection.

```
close(conn)
```

Execute SQL Script and Return Results as Structures

Connect to a PostgreSQL database. Then, run two SQL `SELECT` statements from the SQL script file `compare_sales.sql`. Import the results from the SQL queries as structures and perform simple sales data analysis. The file contains two SQL queries: the first retrieves sales of products from US suppliers, and the second retrieves sales of products from foreign suppliers.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Execute the SQL script. The SQL script contains two SQL queries that retrieve sales data from US and foreign suppliers, respectively. Specify `structure` as the data return format for the query results.

```
scriptfile = "compare_sales.sql";
results = executeSQLScript(conn,scriptfile, ...
    'DataReturnFormat',"structure")
```

```
results=1×2 struct array with fields:
    SQLQuery
    Data
    Message
```

The `executeSQLScript` function returns a structure array that contains two structures in the `Data` field. The first structure contains the results of executing the first SQL query in the SQL script file. The second structure contains the results of executing the second SQL query.

Display the imported data for the second SQL query in the SQL script file. The data contains sales results from foreign suppliers.

```
data = results(2).Data
```

```
data=4×1 struct array with fields:
    productdescription
    suppliername
    city
    jan_sales
    feb_sales
    mar_sales
```

Determine the highest sales amount in January.

```
for i = 1:length(data)
    jan_sales(i,1) = data(i).jan_sales;
end
max(jan_sales)
```

```
ans = 3000
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

`scriptfile` — Name of SQL script file
character vector | string scalar

Name of SQL script file that contains one or more SQL statements to run, specified as a character vector or string scalar. The file must be a text file and can contain comments in addition to SQL queries. Start single-line comments with `--`. Enclose multiline comments in `/*...*/`.

The SQL script file can contain one or more SQL statements terminated by either a semicolon or the keyword `GO`. The following is an example of two SQL `SELECT` statements.

```
SELECT productdescription, suppliername
FROM suppliers a, producttable b
WHERE a.auppliernumber = b.suppliernumber;

SELECT suppliername, country
FROM suppliers;
```

Example: `'C:\work\sql_file.sql'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = executeSQLScript(conn,scriptfile,'DataReturnFormat',"numeric",'ErrorHandling',"store")` returns query results as a numeric matrix in the `Data` field of the `results` structure array and stores any error message in the `Message` field of `results`.

`DataReturnFormat` — Data return format
`"table"` (default) | `"cellarray"` | `"numeric"` | `"structure"`

Data return format, specified as the comma-separated pair consisting of `'DataReturnFormat'` and one of these values:

- `"table"`
- `"cellarray"`
- `"numeric"`
- `"structure"`

You can specify the value using a character vector or string scalar.

The `'DataReturnFormat'` name-value pair argument specifies the data type of the `Data` field in the `results` structure array.

Example: `'DataReturnFormat',"structure"` returns a structure array that contains query results stored in structures.

`ErrorHandling` — Error handling
`"report"` (default) | `"store"`

Error handling, specified as the comma-separated pair consisting of `'ErrorHandling'` and one of these values:

- `"report"` — When an SQL statement fails to execute, stop execution of the remaining SQL statements in the SQL script file and display an error message at the command line.
- `"store"` — When an SQL statement fails to execute, store an error message in the `Message` field of the `results` structure array.

You can specify the value using a character vector or string scalar.

Example: `'ErrorHandling',"report"` displays an error message at the command line.

Output Arguments

`results` — Query results
structure array

Query results from executed SQL statements in the SQL script file, returned as a structure array with these fields.

Field Name	Field Data Type	Field Description
`SQLQuery`	character vector	Stores the SQL statement or statements executed in the SQL script file.
`Data`	• table (default) • cell array • numeric matrix • structure	Stores the results of executed SQL `SELECT` statements. The `'DataReturnFormat'` name-value pair argument specifies the data type of the `Data` field. For non-`SELECT` SQL statements, the `Data` field is an empty table, which means the executed SQL query has no results.
`Message`	character vector	Stores an error message for the respective SQL statement that fails to execute. The `Message` field contains an error message only if you specify the `'ErrorHandling'` name-value pair argument with the value `"store"`.

The number of elements in the structure array is equal to the number of SQL statements in the SQL script file. `results(M)` contains the results from executing the `M`th SQL statement in the SQL script file. If the SQL statement returns query results, then the results are stored in `results(M).Data`.

For details about accessing structure arrays, see “Structure Arrays”.

Limitations

- Use the `executeSQLScript` function to import data into MATLAB, especially if you have long and complex SQL queries that are difficult to convert into MATLAB character vectors or string scalars. The `executeSQLScript` function does not support SQL scripts containing continuous PL/SQL blocks with `BEGIN` and `END`, such as stored procedure definitions or trigger definitions. However, `executeSQLScript` does support table definitions.

- An SQL script containing either of the following can produce unexpected results:
  - Apostrophes that are not escaped, including those in comments. For example, write the character vector `'Here's the code'` as `'Here''s the code'`.
  - Nested comments.
- An SQL script containing more than 25,000 characters causes the `executeSQLScript` function to return an error.

Version History

Introduced in R2020b

See Also

`postgresql` | `close` | `commit` | `rollback`

Topics

“Import Data from PostgreSQL Database Table” on page 7-11
“Generate SQL Query and MATLAB Script” on page 4-20

External Websites

PostgreSQL Documentation

fetch

Namespace: `database.postgre`

Import results of SQL statement in PostgreSQL database into MATLAB

Syntax

```
results = fetch(conn,sqlquery)
results = fetch(conn,sqlquery,opts)
results = fetch( ___ ,Name,Value)
[results,metadata] = fetch( ___ )
```

Description

`results = fetch(conn,sqlquery)` returns all rows of data after executing the SQL statement `sqlquery` for the `connection` object. `fetch` imports data in batches.

`results = fetch(conn,sqlquery,opts)` customizes options for importing data from an executed SQL query by using the `SQLImportOptions` object.

`results = fetch( ___ ,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, specify `MaxRows = 5` to import five rows of data.

`[results,metadata] = fetch( ___ )` also returns the `metadata` table, which contains metadata information about the imported data.

Examples

Import All Data Using PostgreSQL Native Interface

Import all product data from a PostgreSQL database table into MATLAB® using the PostgreSQL native interface and the `fetch` function. Betermine the highest unit cost among products in the table. Then, use a row filter to import only the data for products with a unit cost less than 15.

Create a PostgreSQL native interface database connection to a PostgreSQL database using a data source, username, and password. The database contains the table `productTable`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Import all the data from `productTable` by using the connection object and SQL query. Then, display the first five rows of the imported data.

```
sqlquery = "SELECT * FROM productTable";
data = fetch(conn,sqlquery);
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        "Victorian Doll"
          8          2.1257e+05          1001             5        "Train Set"
          7          3.8912e+05          1007            16        "Engine Kit"
          2          4.0031e+05          1002             9        "Painting Set"
          4          4.0034e+05          1008            21        "Space Cruiser"
```

Determine the highest unit cost for all products in the table.

```
max(data.unitcost)
```

```
ans = 24
```

Now, import the data using a row filter. The filter condition is that `unitcost` must be less than 15.

```
rf = rowfilter("unitcost");
rf = rf.unitcost < 15;
data = fetch(conn,sqlquery,"RowFilter",rf);
```

Again, display the first five rows of the imported data.

```
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       "Victorian Doll"
          8          2.1257e+05          1001             5       "Train Set"
          2          4.0031e+05          1002             9       "Painting Set"
          1          4.0034e+05          1001            14       "Building Blocks"
          5          4.0046e+05          1005             3       "Tin Soldier"
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query Using Import Options

Customize import options when importing data from the results of an SQL query on a PostgreSQL database using the PostgreSQL native interface. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different columns in the SQL query. Import data using the `fetch` function.

This example uses the `employees_database.mat` file, which contains the columns `first_name`, `hire_date`, and `department_name`. The example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Create a PostgreSQL native interface database connection to a PostgreSQL database with a data source name, username, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
```

```
conn = postgresql(datasource,username,password);
```

Load employee information into the MATLAB® workspace.

```
employeedata = load("employees_database.mat");
```

Create the `employees` and `departments` database tables using the employee information.

```
emps = employeedata.employees;
depts = employeedata.departments;

sqlwrite(conn,"employees",emps)
sqlwrite(conn,"departments",depts)
```

Create an `SQLImportOptions` object using an SQL query and the `databaseImportOptions` function. This query retrieves all information for employees who are sales managers or programmers.

```
sqlquery = strcat("SELECT * from employees e join departments d ", ...
    "on (e.department_id = d.department_id) WHERE ", ...
    "(job_id = 'IT_PROG' or job_id = 'SA_MAN')");
opts = databaseImportOptions(conn,sqlquery)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
               VariableTypes: {'double', 'string', 'string' ... and 13 more}
       SelectedVariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
                  FillValues: { NaN,  <missing>,  <missing>  ... and 13 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 16 VariableOptions
```

Display the current import options for the variables selected in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:

   Variable Options:
                           (1) |          (2) |         (3) |       (4) |             (5) | 
         Name: 'employee_id' | 'first_name' | 'last_name' |   'email' | 'phone_number' | 'hire_da
         Type:      'double' |     'string' |    'string' |  'string' |        'string' |  'dateti
  MissingRule:        'fill' |       'fill' |      'fill' |    'fill' |          'fill' |      'fi
    FillValue:           NaN |    <missing> |   <missing> | <missing> |       <missing> | 

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `hire_date`, `department_name`, and `first_name` variables using the `setoptions` function. Then, display the updated import options. For efficiency, change the data type

of the `hire_date` variable to `string`. Because `department_name` designates a finite set of repeating values, change the data type of this variable to `categorical`. Because `first_name` stores text data, change the data type of this variable to `char`.

```
opts = setoptions(opts,"hire_date","Type","string");
opts = setoptions(opts,"department_name","Type","categorical");
opts = setoptions(opts,"first_name","Type","char");

vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts = 
    1x16 SQLVariableImportOptions array with properties:

   Variable Options:
                           (1) |           (2) |          (3) |       (4) |              (5) |
         Name: 'employee_id' | 'first_name' | 'last_name' |   'email' | 'phone_number' | 'hire_da
         Type:      'double' |       'char' |    'string' |  'string' |       'string' |    'stri
  MissingRule:        'fill' |       'fill' |      'fill' |    'fill' |         'fill' |      'fi
    FillValue:           NaN |           '' |   <missing> | <missing> |      <missing> |   <missi

    To access sub-properties of each variable, use getoptions
```

Select the three modified variables using the `SelectVariableNames` property.

```
opts.SelectedVariableNames = ["first_name","hire_date","department_name"];
```

Set the filter condition to import only the data for the employees hired before January 1, 2006.

```
opts.RowFilter = opts.RowFilter.hire_date < datetime(2006,01,01)
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'employee_id', 'first_name', 'last_name' ... and 13 more}
               VariableTypes: {'double', 'char', 'string' ... and 13 more}
       SelectedVariableNames: {'first_name', 'hire_date', 'department_name'}
                  FillValues: { NaN, '',  <missing>  ... and 13 more }
                   RowFilter: hire_date < 01-Jan-2006

             VariableOptions: Show all 16 VariableOptions
```

Import and display the results of the SQL query using the `fetch` function.

```
employees_data = fetch(conn,sqlquery,opts)
```

```
employees_data=4×3 table
    first_name           hire_date          department_name
    ___________    _____________________    _______________

    {'David'  }    "2005-06-25 00:00:00"         IT        
    {'Alberto'}    "2005-03-10 00:00:00"         Sales     
    {'Karen'  }    "2005-01-05 00:00:00"         Sales     
    {'John'   }    "2004-10-01 00:00:00"         Sales     
```

Delete the `employees` and `departments` database tables using the `execute` function.

```
execute(conn,"DROP TABLE employees")
execute(conn,"DROP TABLE departments")
```

Close the database connection.

```
close(conn)
```

Import Data from SQL Query as Structure

Specify the data return format and the number of imported rows for the results of an SQL query. Import data using the SQL query and the `fetch` function.

This example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Create a PostgreSQL native interface database connection to a PostgreSQL database with a data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password);
```

Load patient information into the MATLAB® workspace.

```
patients = readtable('patients.xls');
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Select all data from the `patients` database table and import five rows from the table as a structure. Use the `'DataReturnFormat'` name-value pair argument to specify returning the data as a structure. Also, use the `'MaxRows'` name-value pair argument to specify five rows. Display the imported data.

```
sqlquery = strcat("SELECT * FROM ",tablename);
results = fetch(conn,sqlquery,'DataReturnFormat',"structure", ...
    'MaxRows',5)
```

```
results=5×1 struct array with fields:
    lastname
    gender
    age
    location
    height
    weight
    smoker
    systolic
    diastolic
    selfassessedhealthstatus
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Retrieve Metadata Information About Imported Data

Retrieve metadata information when importing data from an SQL query. Import data using the `fetch` function and explore the metadata information by using dot notation.

This example uses the `outages.csv` file, which contains outage data. Also, the example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Create a PostgreSQL native interface database connection to a PostgreSQL database with a data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password);
```

Load outage information into the MATLAB® workspace.

```
outages = readtable("outages.csv");
```

Create the `outages` database table using the outage information. Use the `'ColumnType'` name-value pair argument to customize the data types of the variables in the `outages` table.

```
tablename = "outages";
sqlwrite(conn,tablename,outages, ...
    'ColumnType',["varchar(120)","timestamp","numeric(38,16)", ...
    "numeric(38,16)","timestamp","varchar(150)"])
```

Import the data into the MATLAB workspace and return metadata information about the imported data.

```
sqlquery = "SELECT * FROM outages";
[results,metadata] = fetch(conn,sqlquery);
```

View the names of the variables in the imported data.

```
metadata.Properties.RowNames
```

```
ans = 6×1 cell
    {'region'         }
    {'outagetime'     }
    {'loss'           }
    {'customers'      }
    {'restorationtime'}
    {'cause'          }
```

View the data type of each variable in the imported data.

```
metadata.VariableType
```

```
ans = 6×1 cell
    {'string'  }
    {'datetime'}
    {'double'  }
    {'double'  }
    {'datetime'}
    {'string'  }
```

View the missing data value for each variable in the imported data.

```
metadata.FillValue
```

```
ans=6×1 cell array
    {1×1 missing}
    {[NaT      ]}
    {[      NaN]}
    {[      NaN]}
    {[NaT      ]}
    {1×1 missing}
```

View the indices of the missing data for each variable in the imported data.

```
metadata.MissingRows
```

```
ans=6×1 cell array
    {  0×1 double}
    {  0×1 double}
    {604×1 double}
    {328×1 double}
    { 29×1 double}
    {  0×1 double}
```

Display the first eight rows of the imported data that contain missing restoration time values. `data` contains restoration time values in the fifth variable. Use the numeric indices to find the rows with missing data.

```
index = metadata.MissingRows{5,1};
nullrestoration = results(index,:);
head(nullrestoration)
```

```
ans=8×6 table
      region           outagetime          loss     customers     restorationtime        cause
    ___________    ____________________    ______    __________    _______________    ___________

    "SouthEast"    23-Jan-2003 00:49:00    530.14    2.1204e+05          NaT          "winter sto
    "NorthEast"    18-Sep-2004 05:54:00         0             0          NaT          "equipment 
    "MidWest"      20-Apr-2002 16:46:00     23141           NaN          NaT          "unknown"
    "NorthEast"    16-Sep-2004 19:42:00      4718           NaN          NaT          "unknown"
    "SouthEast"    14-Sep-2005 15:45:00    1839.2    3.4144e+05          NaT          "severe sto
    "SouthEast"    17-Aug-2004 17:34:00     624.1    1.7879e+05          NaT          "severe sto
    "SouthEast"    28-Jan-2006 23:13:00    498.78           NaN          NaT          "energy eme
```

```
    "West"         20-Jun-2003 18:22:00         0             0          NaT          "energy eme
```

Delete the `outages` database table using the `execute` function.

```
sqlstr = "DROP TABLE ";
sqlquery = strcat(sqlstr,tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

sqlquery — SQL statement
character vector | string scalar

SQL statement, specified as a character vector or string scalar. The SQL statement can be any valid SQL statement, including nested queries. The SQL statement can be a stored procedure, such as `{call sp_name (parm1,parm2,...)}`. For stored procedures that return one or more result sets, use the `fetch` function.

Data Types: `char` | `string`

opts — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = fetch(conn,sqlquery,'MaxRows',50,'DataReturnFormat','structure')` imports 50 rows of data as a structure.

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `fetch` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

`DataReturnFormat` — Data return format
`'table'` (default) | `'cellarray'` | `'numeric'` | `'structure'`

Data return format, specified as the comma-separated pair consisting of `'DataReturnFormat'` and one of these values:

- `'table'`
- `'cellarray'`
- `'numeric'`
- `'structure'`

Use the `'DataReturnFormat'` name-value pair argument to specify the data type of the `results` data. To specify integer classes for numeric data, use the `opts` input argument.

You can specify the value using a character vector or string scalar.

Example: `'DataReturnFormat','cellarray'` imports data as a cell array.

`VariableNamingRule` — Variable naming rule
`"preserve"` (default) | `"modify"`

Variable naming rule, specified as the comma-separated pair consisting of `'VariableNamingRule'` and one of these values:

- `"preserve"` — Preserve most variable names when the `fetch` function imports data. For details, see the Limitations section.
- `"modify"` — Remove non-ASCII characters from variable names when the `fetch` function imports data.

Example: `'VariableNamingRule',"modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; fetch(conn,sqlquery,"RowFilter",rf)`

Output Arguments

`results` — Result data
table (default) | cell array | structure | numeric matrix

Result data, returned as a table, cell array, structure, or numeric matrix. The result data contains all rows of data from the executed SQL statement by default.

Use the `'MaxRows'` name-value pair argument to specify the number of rows of data to import. Use the `'DataReturnFormat'` name-value pair argument to specify the data type of the result data.

When the executed SQL statement does not return any rows, the result data is an empty table.

When you import data, the `fetch` function converts the data type of each column from the PostgreSQL database to the MATLAB data type. This table maps the data type of a database column to the converted MATLAB data type.

PostgreSQL Data Type	MATLAB Data Type
Boolean	logical
Smallint	double
Integer	double
Bigint	double
Decimal	double
Numeric	double
Real	double
Double precision	double
Smallserial	double
Serial	double
Bigserial	double
Money	double
Varchar	string
Char	string
Text	string
Bytea	string
Timestamp	datetime
Timestampz	datetime
Abstime	datetime
Date	datetime
Time	duration
Timez	duration
Interval	calendarDuration
Reltime	calendarDuration
Enum	categorical
Cidr	string
Inet	string
Macaddr	string
Uuid	string
Xml	string

`metadata` — Metadata information
table

Metadata information, returned as a table with these variables.

Variable Name	Variable Description	Variable Data Type
VariableType	Data type of each variable in the imported data	Cell array of character vectors
FillValue	Value of missing data for each variable in the imported data	Cell array of missing data values
MissingRows	Indices for each occurrence of missing data in each variable of the imported data	Cell array of numeric indices

By default, the fetch function imports text data as a character vector and numeric data as a double. FillValue is an empty character array (for text data) or NaN (for numeric data) by default. To change the missing data value to another value, use the SQLImportOptions object.

The RowNames property of the metadata table contains the names of the variables in the imported data.

Limitations

The name-value argument VariableNamingRule has these limitations:

- The fetch function returns an error if you specify the VariableNamingRule name-value argument and set the DataReturnFormat name-value argument to "cellarray", "structure", or "numeric".
- The fetch function returns a warning if you set the VariableNamingRule property of the SQLImportOptions object to "preserve" and set the DataReturnFormat name-value argument to "structure".
- The fetch function returns an error if you use the VariableNamingRule name-value argument with the SQLImportOptions object opts.
- If you set the VariableNamingRule name-value argument to the value "modify":
  - These variable names are reserved identifiers for the table data type: Properties, RowNames, and VariableNames.
  - The length of each variable name must be less than the number returned by namelengthmax.

The name-value argument RowFilter has this limitation:

- The fetch function returns an error if you specify the RowFilter name-value argument with the SQLImportOptions object opts. It is ambiguous which of the RowFilter object to use in this case, especially if the filter conditions are different.

Alternative Functionality

App

The fetch function imports data using the command line. To import data interactively, use the Database Explorer app.

Version History

Introduced in R2020b

R2023a: Selectively import rows of data based on filter condition

You can use the `RowFilter` name-value argument to selectively import rows of data from a database table.

See Also

Functions
`postgresql` | `close` | `databaseImportOptions` | `getoptions` | `reset` | `setoptions` | `execute`

Topics
"Import Data from PostgreSQL Database Table" on page 7-11
"Customize Options for Importing Data from PostgreSQL Database into MATLAB" on page 7-13
"Import Large PostgreSQL Data Using DatabaseDatastore Object" on page 7-16

External Websites
PostgreSQL Documentation

isopen

Namespace: `database.postgre`

Determine if PostgreSQL native interface database connection is open

Syntax

```
i = isopen(conn)
```

Description

`i = isopen(conn)` returns `1` if the PostgreSQL native interface database connection is open and `0` if it is closed or invalid.

Examples

Determine If Database Connection Is Open

Connect to a PostgreSQL database using the PostgreSQL native interface and verify the database connection. Then, import data from the database into MATLAB® using the database table `productTable`. Determine the highest unit cost among the retrieved products in the table. Close the database connection and ensure that the connection is closed.

Create a PostgreSQL native interface database connection using a data source, user name, and password. The PostgreSQL database contains the table `productTable`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Determine if the database connection is open. The `isopen` function returns the logical `1`, which means the database connection is open.

```
i = isopen(conn)
```

```
i = logical
   1
```

Select all the data from `productTable` and sort it by the product number. `data` is a table containing the imported data that results from executing the `SQL SELECT` statement.

```
sqlquery = "SELECT * FROM productTable ORDER BY productNumber";
data = fetch(conn,sqlquery);
```

Display the first three rows of data.

```
head(data,3)
```

```
ans=3×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
```

```
    _____________    ___________    ______________    ________    __________________

          1          4.0035e+05          1001            14       "Building Blocks"
          2          4.0031e+05          1002             9       "Painting Set"
          3            4.01e+05          1009            17       "Slinky"
```

Determine the highest unit cost in the table.

```
max(data.unitcost)
```

```
ans = 24
```

Close the database connection.

```
close(conn)
```

Determine if the database connection is closed. The `isopen` function returns the logical `0`, which means the database connection is closed. If the database connection is invalid, the `isopen` function returns the same result.

```
i = isopen(conn)
```

```
i = logical
   0
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

Version History

Introduced in R2020b

See Also

`fetch` | `postgresql` | `close`

Topics

“Configure PostgreSQL Native Interface Data Source” on page 7-2
“Import Data from PostgreSQL Database Table” on page 7-11

External Websites

PostgreSQL Documentation

rollback

Namespace: database.postgre

Undo changes to PostgreSQL database

Syntax

```
rollback(conn)
```

Description

rollback(conn) reverses changes made to a database using functions such as sqlwrite. The rollback function reverses all changes made since the last COMMIT or ROLLBACK operation. To use this function, you must set the AutoCommit property of the connection object to off.

Examples

Reverse Changes Made to PostgreSQL Database

Use a PostgreSQL native interface database connection to insert product data from MATLAB® into a new table in a PostgreSQL database. Then, reverse the changes made to the database.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the tables productTable and suppliers.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Allow manual committing of changes to the database by setting the AutoCommit property to off.

```
conn.AutoCommit = "off";
```

Create a MATLAB table that contains data for two products. The data is stored in the productTable and suppliers tables.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productNumber" ...
    "stockNumber" "supplierNumber" "unitCost" "productDescription"]);
```

Insert the product data into a new table named toytable.

```
tablename = "toytable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

         30             5e+05            1000            25         "Rubik's Cube"
         40             6e+05            2000            30         "Doll House"
```

Reverse the changes made to the database.

```
rollback(conn)
```

Search for the table. The table no longer exists.

```
data = sqlfind(conn,tablename)
```

```
data =

  0×5 empty table
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

Version History

Introduced in R2020b

See Also

`postgresql` | `sqlwrite` | `commit` | `execute`

Topics

"Insert Data into Database Table Using PostgreSQL Native Interface" on page 7-19
"Create Table and Add Column Using PostgreSQL Native Interface" on page 7-23
"Delete Data from Database Using PostgreSQL Native Interface" on page 7-24
"Roll Back Data in Database Using PostgreSQL Native Interface" on page 7-21

sqlfind

Namespace: `database.postgre`

Find information about all table types in PostgreSQL database

Syntax

```
data = sqlfind(conn,pattern)
data = sqlfind(conn,pattern,Name,Value)
```

Description

`data = sqlfind(conn,pattern)` returns information about all the "Table Types" on page 12-670 in a database where the specified character pattern appears in the name of the table type. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM information_schema.tables`.

`data = sqlfind(conn,pattern,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Catalog',"cat"` finds all table types in the `"cat"` catalog.

Examples

Find Information About Table Types Using PostgreSQL Native Interface

Use a PostgreSQL native interface database connection to find information about all database table types in a PostgreSQL database.

Create a PostgreSQL native interface database connection to a PostgreSQL database.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password);
```

Find information about all table types in the database.

```
data = sqlfind(conn,"");
```

Display information about the first three table types.

```
head(data,3)
```

```
ans=3×5 table
       Catalog              Schema                       Table                    Columns         Ty
    _______________    ______________________    ______________________________    _____________    ___

    "toystore_doc"     "information_schema"     "_pg_foreign_data_wrappers"     {1×7 string}     "VI
    "toystore_doc"     "information_schema"     "_pg_foreign_servers"           {1×9 string}     "VI
```

```
    "toystore_doc"    "information_schema"    "_pg_foreign_table_columns"    {1×4 string}    "VI
```

`data` contains these variables:

- Catalog name
- Schema name
- Table name
- Columns in the table type
- Table type

Close the database connection.

```
close(conn)
```

Find Information About Table Types in Catalog

Use a PostgreSQL native interface database connection to find information about all database table types in a PostgreSQL database. Specify the database catalog to search.

Create a PostgreSQL native interface database connection to a PostgreSQL database.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Find information about all table types in the `toystore_doc` database catalog. Use the `'Catalog'` name-value pair argument to specify the catalog. `data` is a table that contains information about all the table types in the specified catalog.

```
data = sqlfind(conn,"",'Catalog',"toystore_doc");
```

Display the first eight table types.

```
head(data)
```

```
ans=8×5 table
       Catalog               Schema                          Table                          Columns
    ______________    ____________________    ___________________________________    ___________

    "toystore_doc"    "information_schema"    "_pg_foreign_data_wrappers"            {1×7  strin
    "toystore_doc"    "information_schema"    "_pg_foreign_servers"                  {1×9  strin
    "toystore_doc"    "information_schema"    "_pg_foreign_table_columns"            {1×4  strin
    "toystore_doc"    "information_schema"    "_pg_foreign_tables"                   {1×7  strin
    "toystore_doc"    "information_schema"    "_pg_user_mappings"                    {1×7  strin
    "toystore_doc"    "information_schema"    "administrable_role_authorizations"    {1×3  strin
    "toystore_doc"    "information_schema"    "applicable_roles"                     {1×3  strin
    "toystore_doc"    "information_schema"    "attributes"                           {1×31 strin
```

`data` contains these variables:

- Catalog name
- Schema name
- Table name
- Columns in the database table
- Table type

Display the column names in the fourth table type.

```
data.Columns{4}
```

```
ans = 1×7 string
    "foreign_table_catalog"    "foreign_table_schema"    "foreign_table_name"    "ftoptions"    "
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
connection object

PostgreSQL native interface database connection, specified as a `connection` object.

pattern — Pattern
character vector | string scalar

Pattern, specified as a character vector or string scalar. The `sqlfind` function searches for this text in the names of the table types in a database. To find all table types, specify an empty character vector or string scalar.

Example: "inventory"

Data Types: char | string

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlfind(conn,pattern,'Catalog',"toystore_doc",'Schema',"dbo")` returns information about table types, stored in the specified catalog and schema, that match the name of the table type with the specified pattern.

Catalog — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`Schema` — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

Output Arguments

`data` — Table type information
table

Table type information, returned as a table that contains information about the table types in the database, where the table type name partially or fully matches the text in `pattern`. The `data` output contains these variables in a cell array of character vectors.

Variable	Description
`Catalog`	Catalog name where the database table type is stored
`Schema`	Schema name where the database table type is stored
`Table`	Database table name
`Columns`	Column names in the database table type
`Type`	Database table type

More About

Table Types

Table types are a subset of database objects that store or reference data.

The `sqlfind` function recognizes these table types in a database:

- Base table
- View
- Foreign table
- Local temporary

Version History

Introduced in R2020b

See Also

`postgresql` | `close` | `sqlread` | `sqlinnerjoin`

Topics

"Import Data from PostgreSQL Database Table" on page 7-11
"Customize Options for Importing Data from PostgreSQL Database into MATLAB" on page 7-13
"Insert Data into Database Table Using PostgreSQL Native Interface" on page 7-19

sqlinnerjoin

Namespace: `database.postgre`

Inner join between two PostgreSQL database tables

Syntax

```
data = sqlinnerjoin(conn,lefttable,righttable)
data = sqlinnerjoin(conn,lefttable,righttable,Name,Value)
```

Description

`data = sqlinnerjoin(conn,lefttable,righttable)` returns a table resulting from an inner join between the left and right database tables. This function matches rows using all shared columns, or keys, in both database tables. The inner join retains only the rows that match between the two tables. Executing this function is the equivalent of writing the SQL statement `SELECT * FROM lefttable,righttable INNER JOIN lefttable.key = righttable.key`.

`data = sqlinnerjoin(conn,lefttable,righttable,Name,Value)` uses additional options specified by one or more name-value arguments. For example, specify `Keys = "productNumber"` to use the `productNumber` column as a key for joining the two database tables.

Examples

Join Two Database Tables Using PostgreSQL Native Interface

Use a PostgreSQL native interface database connection to import product data from an inner join between two PostgreSQL database tables into MATLAB®.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The `sqlinnerjoin` function automatically detects the shared column between the tables. `data` is a table that contains the matched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlinnerjoin(conn,lefttable,righttable);
```

Display the first three rows of matched data. The columns from the right table (`suppliers`) appear to the right of the columns from the left table (`productTable`).

```
head(data,3)
```

```
ans=3×10 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription    supplierr
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       "Building Blocks"         100
          2          4.0031e+05          1002             9       "Painting Set"            100
          3            4.01e+05          1009            17       "Slinky"                  100
```

Close the database connection.

```
close(conn)
```

Specify Key for Joining Two Database Tables

Use a PostgreSQL native interface database connection to import joined product data from two PostgreSQL database tables into MATLAB®. Specify the key to use for joining the tables.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. Specify the key, or shared column, between the tables using the `'Keys'` name-value pair argument. `data` is a table that contains the matched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlinnerjoin(conn,lefttable,righttable,'Keys',"supplierNumber");
```

Display the first three rows of matched data. The columns from the right table (`suppliers`) appear to the right of the columns from the left table (`productTable`).

```
head(data,3)
```

```
ans=3×10 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription    supplierr
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       "Building Blocks"         100
          2          4.0031e+05          1002             9       "Painting Set"            100
          3            4.01e+05          1009            17       "Slinky"                  100
```

Close the database connection.

```
close(conn)
```

Filter Rows in Joined Data

Use a PostgreSQL native interface database connection to import joined product data from two PostgreSQL database tables into MATLAB®. Specify the row filter condition to use for joining the tables.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, username, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Join the two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The table `data` contains the matched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlinnerjoin(conn,lefttable,righttable);
```

Display the first five rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription    supplierr
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0034e+05          1001            14       "Building Blocks"          10(
          2          4.0031e+05          1002             9       "Painting Set"             10(
          3            4.01e+05          1009            17       "Slinky"                   10(
          4          4.0034e+05          1008            21       "Space Cruiser"            10(
          5          4.0046e+05          1005             3       "Tin Soldier"              10(
```

Join the same tables, but this time use a row filter. The filter condition is that `unitCost` must be less than 15. Again, display the first five rows of matched data.

```
rf = rowfilter("unitCost");
rf = rf.unitCost <= 15;
data = sqlinnerjoin(conn,lefttable,righttable,"RowFilter",rf);
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription    supplierr
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0034e+05          1001            14       "Building Blocks"          10(
          2          4.0031e+05          1002             9       "Painting Set"             10(
          5          4.0046e+05          1005             3       "Tin Soldier"              10(
          6          4.0088e+05          1004             8       "Sail Boat"                10(
          8          2.1257e+05          1001             5       "Train Set"                10(
```

Close the database connection.

```
close(conn)
```

Input Arguments

`conn` — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

`lefttable` — Left table
character vector | string scalar

Left table, specified as a character vector or string scalar. Specify the name of the database table on the left side of the join.

Example: `'inventoryTable'`

Data Types: `char` | `string`

`righttable` — Right table
character vector | string scalar

Right table, specified as a character vector or string scalar. Specify the name of the database table on the right side of the join.

Example: `'productTable'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlinnerjoin(conn,"productTable","suppliers",'LeftCatalog',"toystore_doc",'LeftSchema',"dbo",'RightCatalog',"toy_shop",'RightSchema',"toys",'MaxRows',5)` performs an inner join between left and right tables by specifying the catalog and schema for both tables and returns five matched rows.

`LeftCatalog` — Left catalog
character vector | string scalar

Left catalog, specified as the comma-separated pair consisting of `'LeftCatalog'` and a character vector or string scalar. Specify the database catalog name where the left table of the join is stored.

Example: `'LeftCatalog','toy_store'`

Data Types: `char` | `string`

`RightCatalog` — Right catalog
character vector | string scalar

Right catalog, specified as the comma-separated pair consisting of `'RightCatalog'` and a character vector or string scalar. Specify the database catalog name where the right table of the join is stored.

Example: `'RightCatalog','toy_store'`

Data Types: `char` | `string`

`LeftSchema` — Left schema
character vector | string scalar

Left schema, specified as the comma-separated pair consisting of `'LeftSchema'` and a character vector or string scalar. Specify the database schema name where the left table of the join is stored.

Example: `'LeftSchema','dbo'`

Data Types: `char` | `string`

`RightSchema` — Right schema
character vector | string scalar

Right schema, specified as the comma-separated pair consisting of `'RightSchema'` and a character vector or string scalar. Specify the database schema name where the right table of the join is stored.

Example: `'RightSchema','dbo'`

Data Types: `char` | `string`

`Keys` — Keys
character vector | string scalar | cell array of character vectors | string array

Keys, specified as the comma-separated pair consisting of `'Keys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. Use this name-value pair argument to identify the shared keys (columns) between the two tables to join.

You cannot use this name-value pair argument with the `'LeftKeys'` and `'RightKeys'` name-value pair arguments.

Example: `'Keys','MANAGER_ID'`

Data Types: `char` | `string` | `cell`

`LeftKeys` — Left keys
character vector | string scalar | cell array of character vectors | string array

Left keys, specified as the comma-separated pair consisting of `'LeftKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the left table for the join to the right table.

Use this name-value pair argument with the `'RightKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlinnerjoin` function pairs the values of the keys based on their order.

Example: `'LeftKeys',["productNumber" "Price"],'RightKeys',["productNumber" "Price"]`

Data Types: `char` | `string` | `cell`

RightKeys — Right keys
character vector | string scalar | cell array of character vectors | string array

Right keys, specified as the comma-separated pair consisting of `'RightKeys'` and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the right table for the join to the left table.

Use this name-value pair argument with the `'LeftKeys'` name-value pair argument. Both arguments must specify the same number of keys. The `sqlinnerjoin` function pairs the values of the keys based on their order.

Example: `'LeftKeys',["productIdentifier" "Cost"],'RightKeys',["productNumber" "Price"]`

Data Types: `char` | `string` | `cell`

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `sqlinnerjoin` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

VariableNamingRule — Variable naming rule
`"preserve"` (default) | `"modify"`

Variable naming rule, specified as the comma-separated pair consisting of `'VariableNamingRule'` and one of these values:

- `"preserve"` — Preserve most variable names when the `sqlinnerjoin` function imports data. For details, see the Limitations section.
- `"modify"` — Remove non-ASCII characters from variable names when the `sqlinnerjoin` function imports data.

Example: `'VariableNamingRule',"modify"`

Data Types: `string`

RowFilter — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlinnerjoin(conn,lefttable,righttable,"RowFilter",rf)`

Output Arguments

data — Joined data
table

Joined data, returned as a table that contains the matched rows from the join of the left and right tables. `data` also contains a variable for each column in the left and right tables.

If the column names are shared between the joined database tables and have the same case, then the `sqlinnerjoin` function adds a unique suffix to the corresponding variable names in `data`.

When you import data, the `sqlinnerjoin` function converts the data type of each column from the PostgreSQL database to the MATLAB data type. This table maps the data type of a database column to the converted MATLAB data type.

PostgreSQL Data Type	MATLAB Data Type
Boolean	logical
Smallint	double
Integer	double
Bigint	double
Decimal	double
Numeric	double
Real	double
Double precision	double
Smallserial	double
Serial	double
Bigserial	double
Money	double
Varchar	string
Char	string
Text	string
Bytea	string
Timestamp	datetime
Timestampz	datetime
Abstime	datetime
Date	datetime
Time	duration
Timez	duration
Interval	calendarDuration
Reltime	calendarDuration
Enum	categorical
Cidr	string
Inet	string
Macaddr	string
Uuid	string
Xml	string

Limitations

The name-value argument `VariableNamingRule` has these limitations if it is set to the value `"modify"`:

- The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.
- The length of each variable name must be less than the number returned by `namelengthmax`.

Version History

Introduced in R2020b

R2023a: Selectively join data based on filter condition

You can use the `RowFilter` when joining data from database tables.

See Also

`postgresql` | `close` | `sqlread` | `sqlouterjoin` | `sqlfind`

Topics

"Import Data from PostgreSQL Database Table" on page 7-11
"Customize Options for Importing Data from PostgreSQL Database into MATLAB" on page 7-13

sqlouterjoin

Namespace: database.postgre

Outer join between two PostgreSQL database tables

Syntax

```
data = sqlouterjoin(conn,lefttable,righttable)
data = sqlouterjoin(conn,lefttable,righttable,Name,Value)
```

Description

data = sqlouterjoin(conn,lefttable,righttable) returns a table resulting from an outer join between the left and right database tables. This function matches rows using all shared columns, or keys, in both database tables. The outer join retains the matched and unmatched rows between the two tables. Executing this function is the equivalent of writing the SQL statement SELECT * FROM lefttable,righttable OUTER JOIN lefttable.key = righttable.key.

data = sqlouterjoin(conn,lefttable,righttable,Name,Value) uses additional options specified by one or more name-value arguments. For example, specify Keys = "productNumber" to use the productNumber column as a key for joining the two database tables.

Examples

Join Two Database Tables Using PostgreSQL Native Interface

Use a PostgreSQL native interface database connection to import product data from an outer join between two PostgreSQL database tables into MATLAB®.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the tables productTable and suppliers.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Join two database tables, productTable and suppliers. The productTable table is the left table of the join, and the suppliers table is the right table of the join. The sqlouterjoin function automatically detects the shared column between the tables. The sqlouterjoin function automatically detects the shared column between the tables. data is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlouterjoin(conn,lefttable,righttable);
```

Display the first three rows of joined data. The columns from the right table (suppliers) appear to the right of the columns from the left table (productTable).

```
head(data,3)
```

```
ans=3×10 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription    supplierr
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       "Building Blocks"          10(
          2          4.0031e+05          1002             9       "Painting Set"             10(
          3            4.01e+05          1009            17       "Slinky"                   10(
```

Close the database connection.

```
close(conn)
```

Specify Key for Joining Two Database Tables

Use a PostgreSQL native interface database connection to import joined product data from two PostgreSQL database tables into MATLAB®. Specify the key to use for joining the tables.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Join two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. Specify the key, or shared column, between the tables using the `'Keys'` name-value pair argument. `data` is a table that contains the matched and unmatched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlouterjoin(conn,lefttable,righttable,'Keys',"supplierNumber");
```

Display the first three rows of matched data. The columns from the right table (`suppliers`) appear to the right of the columns from the left table (`productTable`).

```
head(data,3)
```

```
ans=3×10 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription    supplierr
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0035e+05          1001            14       "Building Blocks"          10(
          2          4.0031e+05          1002             9       "Painting Set"             10(
          3            4.01e+05          1009            17       "Slinky"                   10(
```

Close the database connection.

```
close(conn)
```

Filter Rows in Joined Data

Use a PostgreSQL native interface database connection to import joined product data from two PostgreSQL database tables into MATLAB®. Specify the row filter condition to use for joining the tables.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, username, and password. The database contains the tables `productTable` and `suppliers`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Join the two database tables, `productTable` and `suppliers`. The `productTable` table is the left table of the join, and the `suppliers` table is the right table of the join. The table `data` contains the matched and unmatched rows from the two tables.

```
lefttable = "productTable";
righttable = "suppliers";
data = sqlouterjoin(conn,lefttable,righttable);
```

Display the first five rows of matched data. The columns from the right table appear to the right of the columns from the left table.

```
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription    supplierr
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0034e+05          1001            14       "Building Blocks"          10(
          2          4.0031e+05          1002             9       "Painting Set"             10(
          3            4.01e+05          1009            17       "Slinky"                   10(
          4          4.0034e+05          1008            21       "Space Cruiser"            10(
          5          4.0046e+05          1005             3       "Tin Soldier"              10(
```

Join the same tables, but this time use a row filter. The filter condition is that `unitCost` must be less than 15. Again, display the first five rows of matched data.

```
rf = rowfilter("unitCost");
rf = rf.unitCost <= 15;
data = sqlouterjoin(conn,lefttable,righttable,"RowFilter",rf);
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription    supplierr
    _____________    ___________    ______________    ________    __________________    _________

          1          4.0034e+05          1001            14       "Building Blocks"          10(
          2          4.0031e+05          1002             9       "Painting Set"             10(
          5          4.0046e+05          1005             3       "Tin Soldier"              10(
          6          4.0088e+05          1004             8       "Sail Boat"                10(
          8          2.1257e+05          1001             5       "Train Set"                10(
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

`lefttable` — Left table
character vector | string scalar

Left table, specified as a character vector or string scalar. Specify the name of the database table on the left side of the join.

Example: `'inventoryTable'`

Data Types: `char` | `string`

`righttable` — Right table
character vector | string scalar

Right table, specified as a character vector or string scalar. Specify the name of the database table on the right side of the join.

Example: `'productTable'`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlouterjoin(conn,"productTable","suppliers",'Type','left','MaxRows',5)` performs an outer left join between left and right tables and returns five rows of the joined data.

`LeftCatalog` — Left catalog
character vector | string scalar

Left catalog, specified as the comma-separated pair consisting of `'LeftCatalog'` and a character vector or string scalar. Specify the database catalog name where the left table of the join is stored.

Example: `'LeftCatalog','toy_store'`

Data Types: `char` | `string`

`RightCatalog` — Right catalog
character vector | string scalar

Right catalog, specified as the comma-separated pair consisting of `'RightCatalog'` and a character vector or string scalar. Specify the database catalog name where the right table of the join is stored.

Example: 'RightCatalog','toy_store'

Data Types: char | string

LeftSchema — Left schema
character vector | string scalar

Left schema, specified as the comma-separated pair consisting of 'LeftSchema' and a character vector or string scalar. Specify the database schema name where the left table of the join is stored.

Example: 'LeftSchema','dbo'

Data Types: char | string

RightSchema — Right schema
character vector | string scalar

Right schema, specified as the comma-separated pair consisting of 'RightSchema' and a character vector or string scalar. Specify the database schema name where the right table of the join is stored.

Example: 'RightSchema','dbo'

Data Types: char | string

Keys — Keys
character vector | string scalar | cell array of character vectors | string array

Keys, specified as the comma-separated pair consisting of 'Keys' and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. Use this name-value pair argument to identify the shared keys (columns) between the two tables to join.

You cannot use this name-value pair argument with the 'LeftKeys' and 'RightKeys' name-value pair arguments.

Example: 'Keys','MANAGER_ID'

Data Types: char | string | cell

LeftKeys — Left keys
character vector | string scalar | cell array of character vectors | string array

Left keys, specified as the comma-separated pair consisting of 'LeftKeys' and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the left table for the join to the right table.

Use this name-value pair argument with the 'RightKeys' name-value pair argument. Both arguments must specify the same number of keys. The sqlouterjoin function pairs the values of the keys based on their order.

Example: 'LeftKeys',["productNumber" "Price"],'RightKeys',["productNumber" "Price"]

Data Types: char | string | cell

RightKeys — Right keys
character vector | string scalar | cell array of character vectors | string array

Right keys, specified as the comma-separated pair consisting of 'RightKeys' and a character vector, string scalar, cell array of character vectors, or string array. Specify a character vector or string scalar to indicate one key. For multiple keys, specify a cell array of character vectors or a string array. This name-value pair argument identifies the keys in the right table for the join to the left table.

Use this name-value pair argument with the 'LeftKeys' name-value pair argument. Both arguments must specify the same number of keys. The sqlouterjoin function pairs the values of the keys based on their order.

Example: 'LeftKeys',["productIdentifier" "Cost"],'RightKeys',["productNumber" "Price"]

Data Types: char | string | cell

MaxRows — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of 'MaxRows' and a positive numeric scalar. By default, the sqlouterjoin function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: 'MaxRows',10

Data Types: double

Type — Outer join type
'full' (default) | 'left' | 'right'

Outer join type, specified as the comma-separated pair consisting of 'Type' and one of these values:

- 'full' — A full join retrieves records that have matching values in the selected column of both tables, and unmatched records from both the left and right tables.
- 'left' — A left join retrieves records that have matching values in the selected column of both tables, and unmatched records from the left table only.
- 'right' — A right join retrieves records that have matching values in the selected column of both tables, and unmatched records from the right table only.

You can specify this value as a character vector or string scalar.

Example: 'Type','left'

VariableNamingRule — Variable naming rule
"preserve" (default) | "modify"

Variable naming rule, specified as the comma-separated pair consisting of 'VariableNamingRule' and one of these values:

- "preserve" — Preserve most variable names when the sqlouterjoin function imports data. For details, see the Limitations section.
- "modify" — Remove non-ASCII characters from variable names when the sqlouterjoin function imports data.

Example: 'VariableNamingRule',"modify"

Data Types: string

RowFilter — Row filter condition
<unconstrained> (default) | matlab.io.RowFilter object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlouterjoin(conn,lefttable,righttable,"RowFilter",rf)`

Output Arguments

data — Joined data
table

Joined data, returned as a table that contains rows matched by keys in the left and right database tables and the retained unmatched rows. `data` also contains a variable for each column in the left and right tables.

By default, the variable data types are `double` for columns that have `numeric` data types in the database table.

If the column names are shared between the joined database tables and have the same case, then the `sqlouterjoin` function adds a unique suffix to the corresponding variable names in `data`.

The variables in `data` that correspond to columns in the left table contain `NULL` values when no matched rows exist in the right database table. Similarly, the variables that correspond to columns in the right table contain `NULL` values when no matched rows exist in the left database table.

When you import data, the `sqlouterjoin` function converts the data type of each column from the PostgreSQL database to the MATLAB data type. This table maps the data type of a database column to the converted MATLAB data type.

PostgreSQL Data Type	MATLAB Data Type
Boolean	logical
Smallint	double
Integer	double
Bigint	double
Decimal	double
Numeric	double
Real	double
Double precision	double
Smallserial	double
Serial	double
Bigserial	double
Money	double
Varchar	string
Char	string
Text	string

PostgreSQL Data Type	MATLAB Data Type
Bytea	string
Timestamp	datetime
Timestampz	datetime
Abstime	datetime
Date	datetime
Time	duration
Timez	duration
Interval	calendarDuration
Reltime	calendarDuration
Enum	categorical
Cidr	string
Inet	string
Macaddr	string
Uuid	string
Xml	string

Limitations

The name-value argument `VariableNamingRule` has these limitations if it is set to the value `"modify"`:

- The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.
- The length of each variable name must be less than the number returned by `namelengthmax`.

Version History

Introduced in R2020b

R2023a: Selectively join data based on filter condition

You can use the `RowFilter` when joining data from database tables.

See Also

`postgresql` | `close` | `sqlread` | `sqlfind` | `sqlinnerjoin`

Topics

“Import Data from PostgreSQL Database Table” on page 7-11
“Customize Options for Importing Data from PostgreSQL Database into MATLAB” on page 7-13

sqlread

Namespace: database.postgre

Import data into MATLAB from PostgreSQL database table

Syntax

```
data = sqlread(conn,tablename)
data = sqlread(conn,tablename,opts)
data = sqlread( ___ ,Name,Value)
[data,metadata] = sqlread( ___ )
```

Description

`data = sqlread(conn,tablename)` returns a table by importing data into MATLAB from a PostgreSQL database table. Executing this function is the equivalent of writing a `SELECT * FROM tablename` SQL statement in ANSI SQL.

`data = sqlread(conn,tablename,opts)` customizes options for importing data from a database table using the `SQLImportOptions` object.

`data = sqlread( ___ ,Name,Value)` specifies additional options using one or more name-value pair arguments and any of the previous input argument combinations. For example, specify `Catalog = "cat"` to import data from a database table stored in the `"cat"` catalog.

`[data,metadata] = sqlread( ___ )` also returns the `metadata` table, which contains metadata information about the imported data.

Examples

Import Data from Database Table Using PostgreSQL Native Interface

Use a PostgreSQL native interface database connection to import product data from a database table into MATLAB® using a PostgreSQL database. Then, perform a simple data analysis.

Create a PostgreSQL native interface database connection to a PostgreSQL database. The database contains the table `productTable`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password);
```

Import data from the database table `productTable`. The `sqlread` function returns a MATLAB table that contains the product data.

```
tablename = "productTable";
data = sqlread(conn,tablename);
```

Display the first five rows of product data.

```
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13        "Victorian Doll"
          8          2.1257e+05          1001             5        "Train Set"
          7          3.8912e+05          1007            16        "Engine Kit"
          2          4.0031e+05          1002             9        "Painting Set"
          4          4.0034e+05          1008            21        "Space Cruiser"
```

Now, import the data using a row filter. The filter condition is that `unitcost` must be less than 15.

```
rf = rowfilter("unitcost");
rf = rf.unitcost < 15;
data = sqlread(conn,tablename,"RowFilter",rf);
```

Again, display the first five products.

```
head(data,5)
```

```
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       "Victorian Doll"
          8          2.1257e+05          1001             5       "Train Set"
          2          4.0031e+05          1002             9       "Painting Set"
          1          4.0034e+05          1001            14       "Building Blocks"
          5          4.0046e+05          1005             3       "Tin Soldier"
```

Close the database connection.

```
close(conn)
```

Import Data from Database Table Using Import Options

Customize import options when importing data from a database table using the PostgreSQL native interface. Control the import options by creating an `SQLImportOptions` object. Then, customize import options for different database columns. Import data using the `sqlread` function.

This example uses the `patients.xls` file, which contains the columns `Gender`, `Location`, `SelfAssessedHealthStatus`, and `Smoker`. The example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Create a PostgreSQL native interface database connection to a PostgreSQL database.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password);
```

Load patient information into the MATLAB® workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Create an `SQLImportOptions` object using the `patients` database table and the `databaseImportOptions` function.

```
opts = databaseImportOptions(conn,tablename)
```

```
opts =
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'lastname', 'gender', 'age' ... and 7 more}
               VariableTypes: {'string', 'string', 'double' ... and 7 more}
       SelectedVariableNames: {'lastname', 'gender', 'age' ... and 7 more}
                  FillValues: { <missing>,  <missing>,  NaN  ... and 7 more }
                   RowFilter: <unconstrained>

             VariableOptions: Show all 10 VariableOptions
```

Display the current import options for the variables in the `SelectedVariableNames` property of the `SQLImportOptions` object.

```
vars = opts.SelectedVariableNames;
varOpts = getoptions(opts,vars)
```

```
varOpts =
    1x10 SQLVariableImportOptions array with properties:

   Variable Options:
                      (1) |       (2) |      (3) |         (4) |       (5) |       (6) |        (7)
         Name: 'lastname' |  'gender' |    'age' | 'location' | 'height' | 'weight' |  'smoker'
         Type:   'string' |  'string' | 'double' |    'string' | 'double' | 'double' | 'logical'
  MissingRule:     'fill' |    'fill' |   'fill' |      'fill' |   'fill' |   'fill' |    'fill'
    FillValue:  <missing> | <missing> |      NaN |  <missing> |       NaN |       NaN |          0

    To access sub-properties of each variable, use getoptions
```

Change the data types for the `gender`, `location`, `smoker`, and `selfassessedhealthstatus` variables using the `setoptions` function. Because the `gender`, `location`, and `selfassessedhealthstatus` variables indicate a finite set of repeating values, change their data type to `categorical`. Because the `Smoker` variable stores the values `0` and `1`, change its data type to `double`. Then, display the updated import options.

```
opts = setoptions(opts,{'gender','location','selfassessedhealthstatus'}, ...
    'Type','categorical');
opts = setoptions(opts,'smoker','Type','double');

varOpts = getoptions(opts,{'gender','location','smoker', ...
    'selfassessedhealthstatus'})
```

```
varOpts = 
    1x4 SQLVariableImportOptions array with properties:

   Variable Options:
                       (1) |           (2) |      (3) |                          (4)
         Name:      'gender' |    'location' | 'smoker' | 'selfassessedhealthstatus'
         Type: 'categorical' | 'categorical' | 'double' |              'categorical'
  MissingRule:        'fill' |        'fill' |   'fill' |                     'fill'
    FillValue:   <undefined> |   <undefined> |        0 |                <undefined>

    To access sub-properties of each variable, use getoptions
```

Import the `patients` database table using the `sqlread` function, and display the last eight rows of the table.

```
data = sqlread(conn,tablename,opts);
tail(data)
```

```
     lastname      gender    age          location            height    weight    smoker    sy
    ___________    ______    ___    _________________________    ______    ______    ______    _

    "Foster"       Female    30     St. Mary's Medical Center      70       124         0
    "Gonzales"     Male      48     County General Hospital        71       174         0
    "Bryant"       Female    48     County General Hospital        66       134         0
    "Alexander"    Male      25     County General Hospital        69       171         1
    "Russell"      Male      44     VA Hospital                    69       188         1
    "Griffin"      Male      49     County General Hospital        70       186         0
    "Diaz"         Male      45     County General Hospital        68       172         1
    "Hayes"        Male      48     County General Hospital        66       177         0
```

Display a summary of the imported data. The `sqlread` function applies the import options to the variables in the imported data.

```
summary(data)
```

```
Variables:

    lastname: 100×1 string

    gender: 100×1 categorical

        Values:

            Female       53
            Male         47

    age: 100×1 double

        Values:

            Min          25
            Median       39
            Max          50

    location: 100×1 categorical

        Values:
```

```
        County General Hospital         39
        St. Mary s Medical Center       24
        VA Hospital                     37

height: 100×1 double

    Values:

        Min          60
        Median       67
        Max          72

weight: 100×1 double

    Values:

        Min           111
        Median      142.5
        Max           202

smoker: 100×1 double

    Values:

        Min          0
        Median       0
        Max          1

systolic: 100×1 double

    Values:

        Min         109
        Median      122
        Max         138

diastolic: 100×1 double

    Values:

        Min           68
        Median      81.5
        Max           99

selfassessedhealthstatus: 100×1 categorical

    Values:

        Excellent       34
        Fair            15
        Good            40
        Poor            11
```

Now set the filter condition to import only data for patients older than 40 year and not taller than 68 inches.

```
opts.RowFilter = opts.RowFilter.Age > 40 & opts.RowFilter.Height <= 68
```

```
opts = 
  SQLImportOptions with properties:

           ExcludeDuplicates: false
          VariableNamingRule: 'preserve'

               VariableNames: {'lastname', 'gender', 'age' ... and 7 more}
               VariableTypes: {'string', 'categorical', 'double' ... and 7 more}
       SelectedVariableNames: {'lastname', 'gender', 'age' ... and 7 more}
                  FillValues: { <missing>,  <undefined>,  NaN  ... and 7 more }
                   RowFilter: height <= 68 & age > 40

             VariableOptions: Show all 10 VariableOptions
```

Again, import the `patients` database table using the `sqlread` function, and display a summary of the imported data.

```
data = sqlread(conn,tablename,opts);
summary(data)
```

```
Variables:

    lastname: 24×1 string

    gender: 24×1 categorical

        Values:

            Female       17
            Male          7

    age: 24×1 double

        Values:

            Min           41
            Median      45.5
            Max           50

    location: 24×1 categorical

        Values:

            County General Hospital         13
            St. Mary s Medical Center        5
            VA Hospital                      6

    height: 24×1 double

        Values:

            Min          62
            Median       66
            Max          68

    weight: 24×1 double
```

```
        Values:

            Min         119
            Median      137
            Max         194

    smoker: 24×1 double

        Values:

            Min          0
            Median       0
            Max          1

    systolic: 24×1 double

        Values:

            Min          114
            Median     121.5
            Max          138

    diastolic: 24×1 double

        Values:

            Min           68
            Median      81.5
            Max           96

    selfassessedhealthstatus: 24×1 categorical

        Values:

            Excellent       7
            Fair            3
            Good           10
            Poor            4
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Limit Number of Rows in Imported Data

Use a PostgreSQL native interface database connection to import a limited number of rows of product data from a database table into MATLAB®. Then, sort and filter the rows in the imported data, and perform a simple data analysis.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the table `productTable`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Import data from the table `productTable`. Limit the number of rows by setting the `'MaxRows'` name-value pair argument to `10`. The `data` table contains the product data.

```
tablename = "productTable";
data = sqlread(conn,tablename,'MaxRows',10);
```

Display the first few rows of product data.

```
head(data,3)
```

```
ans=3×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          9          1.2597e+05          1003            13       "Victorian Doll"
          8          2.1257e+05          1001             5       "Train Set"
          7          3.8912e+05          1007            16       "Engine Kit"
```

Display the first few product descriptions.

```
data.productdescription(1:3)
```

```
ans = 3×1 string
    "Victorian Doll"
    "Train Set"
    "Engine Kit"
```

Sort the rows in `data` by the product description column in alphabetical order.

```
column = "productdescription";
data = sortrows(data,column);
```

Display the first few product descriptions after sorting.

```
data.productdescription(1:3)
```

```
ans = 3×1 string
    "Building Blocks"
    "Engine Kit"
    "Painting Set"
```

Close the database connection.

```
close(conn)
```

Retrieve Metadata Information About Imported Data

Retrieve metadata information when importing data from a database table using the PostgreSQL native interface. Import data using the `sqlread` function and explore the metadata information by using dot notation.

This example uses the `outages.csv` file, which contains outage data. The example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Load outage information into the MATLAB® workspace.

```
outages = readtable("outages.csv");
```

Create the `outages` database table using the outage information. Use the `'ColumnType'` name-value pair argument to specify the data types of the variables in the MATLAB® table.

```
tablename = "outages";
sqlwrite(conn,tablename,outages, ...
    'ColumnType',["varchar(120)","timestamp","numeric(38,16)", ...
    "numeric(38,16)","timestamp","varchar(150)"])
```

Import the data into the MATLAB workspace and return metadata information about the imported data.

```
[data,metadata] = sqlread(conn,tablename);
```

View the names of the variables in the imported data.

```
metadata.Properties.RowNames
```

```
ans = 6×1 cell
    {'region'         }
    {'outagetime'     }
    {'loss'           }
    {'customers'      }
    {'restorationtime'}
    {'cause'          }
```

View the data type of each variable in the imported data.

```
metadata.VariableType
```

```
ans = 6×1 cell
    {'string'  }
    {'datetime'}
    {'double'  }
    {'double'  }
    {'datetime'}
    {'string'  }
```

View the missing data value for each variable in the imported data.

```
metadata.FillValue
```

```
ans=6×1 cell array
    {1×1 missing}
    {[NaT      ]}
    {[      NaN]}
    {[      NaN]}
    {[NaT      ]}
    {1×1 missing}
```

View the indices of the missing data for each variable in the imported data.

```
metadata.MissingRows
```

```
ans=6×1 cell array
    {  0×1 double}
    {  0×1 double}
    {604×1 double}
    {328×1 double}
    { 29×1 double}
    {  0×1 double}
```

Display the first eight rows of the imported data that contain missing restoration time values. `data` contains restoration time values in the fifth variable. Use the numeric indices to find the rows with missing data.

```
index = metadata.MissingRows{5,1};
nullrestoration = data(index,:);
head(nullrestoration)
```

```
ans=8×6 table
      region            outagetime          loss     customers     restorationtime        cause
    ___________    ____________________    ______    __________    _______________    ____________

    "SouthEast"    23-Jan-2003 00:49:00    530.14    2.1204e+05          NaT          "winter sto
    "NorthEast"    18-Sep-2004 05:54:00         0             0          NaT          "equipment 
    "MidWest"      20-Apr-2002 16:46:00     23141           NaN          NaT          "unknown"
    "NorthEast"    16-Sep-2004 19:42:00      4718           NaN          NaT          "unknown"
    "SouthEast"    14-Sep-2005 15:45:00    1839.2    3.4144e+05          NaT          "severe sto
    "SouthEast"    17-Aug-2004 17:34:00     624.1    1.7879e+05          NaT          "severe sto
    "SouthEast"    28-Jan-2006 23:13:00    498.78           NaN          NaT          "energy eme
    "West"         20-Jun-2003 18:22:00         0             0          NaT          "energy eme
```

Delete the `outages` database table using the `execute` function.

```
sqlstr = "DROP TABLE ";
sqlquery = strcat(sqlstr,tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
connection object

PostgreSQL native interface database connection, specified as a `connection` object.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

opts — Database import options
`SQLImportOptions` object

Database import options, specified as an `SQLImportOptions` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `data = sqlread(conn,"inventoryTable",'Catalog',"toystore_doc",'Schema',"dbo",'MaxRows',5)` imports five rows of data from the database table `inventoryTable` stored in the `toystore_doc` catalog and the `dbo` schema.

Catalog — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

Schema — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

`MaxRows` — Maximum number of rows to return
positive numeric scalar

Maximum number of rows to return, specified as the comma-separated pair consisting of `'MaxRows'` and a positive numeric scalar. By default, the `sqlread` function returns all rows from the executed SQL query. Use this name-value pair argument to limit the number of rows imported into MATLAB.

Example: `'MaxRows',10`

Data Types: `double`

`VariableNamingRule` — Variable naming rule
`"preserve"` (default) | `"modify"`

Variable naming rule, specified as the comma-separated pair consisting of `'VariableNamingRule'` and one of these values:

- `"preserve"` — Preserve most variable names when the `sqlread` function imports data. For details, see the Limitations section.
- `"modify"` — Remove non-ASCII characters from variable names when the `sqlread` function imports data.

Example: `'VariableNamingRule',"modify"`

Data Types: `string`

`RowFilter` — Row filter condition
`<unconstrained>` (default) | `matlab.io.RowFilter` object

Row filter condition, specified as a `matlab.io.RowFilter` object.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; sqlread(conn,tablename,"RowFilter",rf)`

Output Arguments

`data` — Imported data
table

Imported data, returned as a table. The rows of the table correspond to the rows in the database table `tablename`. The variables in the table correspond to each column in the database table.

If the database table contains no data to import, then `data` is an empty table.

When you import data, the `sqlread` function converts the data type of each column from the PostgreSQL database to the MATLAB data type. This table maps the data type of a database column to the converted MATLAB data type.

PostgreSQL Data Type	MATLAB Data Type
Boolean	logical
Smallint	double
Integer	double
Bigint	double

PostgreSQL Data Type	MATLAB Data Type
Decimal	double
Numeric	double
Real	double
Double precision	double
Smallserial	double
Serial	double
Bigserial	double
Money	double
Varchar	string
Char	string
Text	string
Bytea	string
Timestamp	datetime
Timestampz	datetime
Abstime	datetime
Date	datetime
Time	duration
Timez	duration
Interval	calendarDuration
Reltime	calendarDuration
Enum	categorical
Cidr	string
Inet	string
Macaddr	string
Uuid	string
Xml	string

metadata — Metadata information
table

Metadata information, returned as a table with these variables.

Variable Name	Variable Description	Variable Data Type
VariableType	Data type of each variable in the imported data	Cell array of character vectors
FillValue	Value of missing data for each variable in the imported data	Cell array of missing data values
MissingRows	Indices for each occurrence of missing data in each variable of the imported data	Cell array of numeric indices

By default, the `sqlread` function imports text data as a character vector and numeric data as a double. `FillValue` is an empty character array (for text data) or `NaN` (for numeric data) by default. To change the missing data value to another value, use the `SQLImportOptions` object.

The `RowNames` property of the `metadata` table contains the names of the variables in the imported data.

Limitations

- The `sqlread` function returns an error when you use the `VariableNamingRule` name-value argument with the `SQLImportOptions` object `opts`.
- When the `VariableNamingRule` name-value pair argument is set to the value `"modify"`:
  - The variable names `Properties`, `RowNames`, and `VariableNames` are reserved identifiers for the `table` data type.
  - The length of each variable name must be less than the number returned by `namelengthmax`.
- The `sqlread` function returns an error if you specify the `RowFilter` name-value argument with the `SQLImportOptions` object `opts`. It is ambiguous which of the `RowFilter` object to use in this case, especially if the filter conditions are different.

Version History

Introduced in R2020b

R2023a: Selectively import rows of data based on filter condition

You can use the `RowFilter` name-value argument to selectively import rows of data from a database table.

See Also

Functions

`postgresql` | `close` | `sqlfind` | `sqlinnerjoin` | `sqlouterjoin` | `fetch` | `databaseImportOptions` | `getoptions` | `setoptions` | `reset` | `execute`

Topics

"Import Data from PostgreSQL Database Table" on page 7-11
"Customize Options for Importing Data from PostgreSQL Database into MATLAB" on page 7-13

sqlupdate

Namespace: `database.postgre`

Update rows in PostgreSQL database table

Syntax

```
sqlupdate(conn,tablename,data,filter)
sqlupdate( ___ ,Name,Value)
```

Description

`sqlupdate(conn,tablename,data,filter)` updates rows in the PostgreSQL database table (`tablename`) with the rows from the MATLAB table (`data`) based on filter conditions (`filter`).

`sqlupdate( ___ ,Name,Value)` specifies additional options using one or more name-value arguments with any of the previous input argument combinations. For example, `Catalog = "cat"` updates data from a database table stored in the `"cat"` catalog.

Examples

Update Database Rows

Update rows in the PostgreSQL native interface database based on filter conditions specified with row filters.

This example uses the `patients.xls` file, which contains the columns `LastName`, `Gender`, `Age`, `Location`, `Height`, `Weight`, `Smoker`, `Systolic`, `Diastolic`, and `SelfAssessedHealthStatus`. The example uses a PostgreSQL database version 9.405 database and the libpq driver version 10.12.

Create a PostgreSQL native interface database connection to a PostgreSQL database.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";

conn = postgresql(datasource,username,password);
```

Load patient information into the MATLAB workspace.

```
patients = readtable("patients.xls");
```

Create the `patients` database table using the patient information.

```
tablename = "patients";
sqlwrite(conn,tablename,patients)
```

Use the SQL `ALTER` statement to add the column `HighRisk` to the table `patients`.

```
sqlquery = 'ALTER TABLE patients ADD HighRisk boolean';
execute(conn,sqlquery)
```

Import the `patients` database table using the `sqlread` function, and return metadata information about the imported data.

```
[data,metadata] = sqlread(conn,tablename);
```

Display the first 10 rows of the table. In MATLAB, all the values in the `HighRisk` column appear as `false`.

```
head(data,10)
```

```
     lastname      gender      age              location              height    weight    smoker
    __________    ________    ___    _____________________________    ______    ______    ______

    "Smith"       "Male"      38     "County General Hospital"          71       176      true  
    "Johnson"     "Male"      43     "VA Hospital"                      69       163      false 
    "Williams"    "Female"    38     "St. Mary's Medical Center"        64       131      false 
    "Jones"       "Female"    40     "VA Hospital"                      67       133      false 
    "Brown"       "Female"    49     "County General Hospital"          64       119      false 
    "Davis"       "Female"    46     "St. Mary's Medical Center"        68       142      false 
    "Miller"      "Female"    33     "VA Hospital"                      64       142      true  
    "Wilson"      "Male"      40     "VA Hospital"                      68       180      false 
    "Moore"       "Male"      28     "St. Mary's Medical Center"        68       183      false 
    "Taylor"      "Female"    31     "County General Hospital"          66       132      false 
```

Displaying the metadata shows that the values are `NULL` (missing elements) in the database.

```
metadata
```

```
metadata=11×3 table
                                VariableType      FillValue       MissingRows  
                                ____________    ______________    ______________

    lastname                    {'string' }     {1×1 missing}    {  0×1 double}
    gender                      {'string' }     {1×1 missing}    {  0×1 double}
    age                         {'double' }     {[      NaN]}    {  0×1 double}
    location                    {'string' }     {1×1 missing}    {  0×1 double}
    height                      {'double' }     {[      NaN]}    {  0×1 double}
    weight                      {'double' }     {[      NaN]}    {  0×1 double}
    smoker                      {'logical'}     {[        0]}    {  0×1 double}
    systolic                    {'double' }     {[      NaN]}    {  0×1 double}
    diastolic                   {'double' }     {[      NaN]}    {  0×1 double}
    selfassessedhealthstatus    {'string' }     {1×1 missing}    {  0×1 double}
    highrisk                    {'logical'}     {[        0]}    {100×1 double}
```

Now, identify patients who are considered high risk for developing some hypothetical health issue based on their age and their smoker status. First, create a table containing the new data to write to the database. This table requires only `true` and `false` values.

```
t = table([true;false],"VariableNames","HighRisk");
head(t)
```

```
    HighRisk
    ________

     true   
     false  
```

Create a row filter using the filter condition that a patient must be older than 35 years and a smoker to be considered high-risk.

```
rf = rowfilter(["Age","Smoker"]);
rf = rf.Age > 35 & rf.Smoker == true
```

```
rf = 
  RowFilter with constraints:

    Age > 35 & Smoker == true

  VariableNames: Age, Smoker
```

Update the `HighRisk` column using this filter to set the values to `true` and using the `~rf` value of the filter to set the value to `false`.

```
sqlupdate(conn,"patients",t,{rf;~rf});
```

Again, import the `patients` database table using the `sqlread` function, and display the first 10 rows.

```
data = sqlread(conn,tablename);
head(data,10)
```

```
     lastname      gender     age            location             height    weight    smoker
    __________    ________    ___    _________________________    ______    ______    ______

    "Smith"       "Male"      38     "County General Hospital"      71       176      true
    "White"       "Male"      39     "VA Hospital"                  72       202      true
    "Martin"      "Male"      48     "VA Hospital"                  71       181      true
    "Lee"         "Female"    44     "County General Hospital"      66       146      true
    "Wright"      "Female"    45     "VA Hospital"                  70       126      true
    "Baker"       "Male"      44     "VA Hospital"                  71       192      true
    "Mitchell"    "Male"      39     "County General Hospital"      71       164      true
    "Roberts"     "Male"      44     "VA Hospital"                  70       169      true
    "Turner"      "Male"      37     "VA Hospital"                  70       194      true
    "Collins"     "Male"      42     "County General Hospital"      67       179      true
```

Delete the `patients` database table using the `execute` function.

```
sqlquery = strcat("DROP TABLE ",tablename);
execute(conn,sqlquery)
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — Database connection
`connection` object

Database connection, specified as an ODBC `connection` object or JDBC `connection` object created using the `database` function.

`tablename` — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

`data` — Updated data
MATLAB table

Updated data, specified as a MATLAB table. The table can contain one or more rows with updated data. The names of the variables in the table must be a subset of the column names of the database table.

Example: `data = table([1;0],"VariableNames","NewName")`

Data Types: `table`

`filter` — Row filter condition
`matlab.io.RowFilter` object | cell array of `matlab.io.RowFilter` objects

Row filter condition, specified as a `matlab.io.RowFilter` object or cell array of `matlab.io.RowFilter` objects. Filters determine which database rows `sqlupdate` must update with which data. If multiple database rows match a filter, `sqlupdate` updates them with the same data. If a single database row matches multiple filters, its final state matches the data corresponding to the last matching filter.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5;`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `sqlupdate(conn,'inventoryTable',data,rf,Catalog = "toy_store",Schema = "dbo")` updates the database `inventoryTable` stored in the `toy_store` catalog and the `dbo` schema.

`Catalog` — Database catalog name
string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`Schema` — Database schema name
string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

Version History

Introduced in R2023a

See Also

`postgresql` | `close` | `sqlread` | `sqlfind` | `sqlinnerjoin` | `sqlouterjoin` | `fetch` | `databaseImportOptions` | `getoptions` | `setoptions` | `reset` | `execute`

sqlwrite

Namespace: database.postgre

Insert MATLAB data into PostgreSQL database table

Syntax

```
sqlwrite(conn,tablename,data)
sqlwrite(conn,tablename,data,Name,Value)
```

Description

`sqlwrite(conn,tablename,data)` inserts data from a MATLAB table into a database table. If the table exists in the database, this function appends the data from the MATLAB table as rows in the existing database table. If the table does not exist in the database, this function creates a table with the specified table name and then inserts the data as rows in the new table. This syntax is the equivalent of executing SQL statements that contain the `CREATE TABLE` and `INSERT INTO` ANSI SQL syntaxes.

`sqlwrite(conn,tablename,data,Name,Value)` uses additional options specified by one or more name-value pair arguments. For example, `'Catalog',"toystore_doc"` inserts data into a database table that is located in the database catalog named `toystore_doc`.

Examples

Append Data into Existing Table Using PostgreSQL Native Interface

Use a PostgreSQL native interface database connection to append product data from a MATLAB® table into an existing table in a PostgreSQL database.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password. The database contains the table `productTable`.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

To view the existing database table `productTable` before appending data, import its contents into MATLAB and display the last few rows.

```
tablename = "productTable";
rows = sqlread(conn,tablename);
tail(rows,3)
```

```
ans=3×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          6          4.0088e+05          1004             8           "Sail Boat"
```

```
         3         4.01e+05         1009          17          "Slinky"
        10       8.8865e+05         1006          24          "Teddy Bear"
```

Create a MATLAB table that contains the data for one product.

```
data = table(30,500000,1000,25,"Rubik's Cube", ...
    'VariableNames',["productnumber" "stocknumber" ...
    "suppliernumber" "unitcost" "productdescription"]);
```

Append the product data into the database table `productTable`.

```
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB again and display the last few rows. The results contain a new row for the inserted product.

```
rows = sqlread(conn,tablename);
tail(rows,4)
```

```
ans=4×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

          6          4.0088e+05          1004             8          "Sail Boat"
          3            4.01e+05          1009            17          "Slinky"
         10          8.8865e+05          1006            24          "Teddy Bear"
         30               5e+05          1000            25          "Rubik's Cube"
```

Close the database connection.

```
close(conn)
```

Insert Data into New Table

Use a PostgreSQL native interface database connection to insert product data from MATLAB® into a new table in a PostgreSQL database.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productnumber" ...
    "stocknumber" "suppliernumber" "unitcost" "productdescription"]);
```

Insert the product data into a new database table named `toytable`.

```
tablename = "toytable";
sqlwrite(conn,tablename,data)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________

         30            5e+05             1000            25          "Rubik's Cube"
         40            6e+05             2000            30          "Doll House"
```

Close the database connection.

```
close(conn)
```

Specify Column Types When Inserting Data into New Table

Use a PostgreSQL native interface database connection to insert product data from MATLAB® into a new table in a PostgreSQL database. Specify the data types of the columns in the new database table.

Create a PostgreSQL native interface database connection to a PostgreSQL database using the data source name, user name, and password.

```
datasource = "PostgreSQLDataSource";
username = "dbdev";
password = "matlab";
conn = postgresql(datasource,username,password);
```

Create a MATLAB table that contains data for two products.

```
data = table([30;40],[500000;600000],[1000;2000],[25;30], ...
    ["Rubik's Cube";"Doll House"],'VariableNames',["productnumber" ...
    "stocknumber" "suppliernumber" "unitcost" "productdescription"]);
```

Insert the product data into a new database table named `toytable`. Use the '`ColumnType`' name-value pair argument and a string array to specify the data types of all the columns in the database table.

```
tablename = "toytable";
coltypes = ["numeric" "numeric" "numeric" "numeric" "varchar(255)"];
sqlwrite(conn,tablename,data,'ColumnType',coltypes)
```

Import the contents of the database table into MATLAB and display the rows. The results contain two rows for the inserted products.

```
rows = sqlread(conn,tablename)
```

```
rows=2×5 table
    productnumber    stocknumber    suppliernumber    unitcost    productdescription
    _____________    ___________    ______________    ________    __________________
```

```
        30              5e+05          1000            25          "Rubik's Cube"
        40              6e+05          2000            30          "Doll House"
```

Close the database connection.

```
close(conn)
```

Input Arguments

conn — PostgreSQL native interface database connection
`connection` object

PostgreSQL native interface database connection, specified as a `connection` object.

tablename — Database table name
string scalar | character vector

Database table name, specified as a string scalar or character vector denoting the name of a table in the database.

Example: `"employees"`

Data Types: `string` | `char`

data — Data to insert
table

Data to insert into a database table, specified as a table.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of numeric arrays
- Cell array of character vectors
- String array
- Datetime array
- Duration array
- Calendar duration array
- Logical array
- Cell array of logical arrays

The numeric array can contain these data types:

- `int8`
- `uint8`
- `int16`
- `uint16`
- `int32`
- `uint32`

- `int64`
- `uint64`
- `single`
- `double`

For date and time data, supported formats are:

- Date — `'yyyy-MM-dd'`
- Time — `'hh:mm:ss'`
- Timestamp — `'yyyy-MM-dd HH:mm:ss'`

If the date and time data is specified in an invalid format, then the `sqlwrite` function automatically converts the data to a supported format.

If the cell array of character vectors or string array is specified in an invalid format, then the `sqlwrite` function enables the database driver to check the format. If the format is unexpected, then the database driver throws an error.

You can insert data in an existing database table or a new database table. The data types of variables in `data` vary depending on whether the database table exists. For valid data types, see "Data Types for Existing Table" on page 12-0 and "Data Types for New Table" on page 12-0.

Note The `sqlwrite` function supports only the `table` data type for the `data` input argument. To insert data stored in a structure, cell array, or numeric matrix, convert the data to a `table` by using the `struct2table`, `cell2table`, and `array2table` functions, respectively.

To insert missing data, see "Accepted Missing Data" on page 12-0.

Example: `table([10;20],{'M';'F'})`

Data Types for Existing Table

The variable names of the MATLAB table must match the column names in the database table. The `sqlwrite` function is case-sensitive.

When you insert data into a database table, use the data types shown in the following table to ensure that the data has the correct data type. This table matches the valid data types of the MATLAB table variable to the data types of the database column. For example, when you insert data into a database column that has the `BIT` data type, ensure that the corresponding variable in the MATLAB table is a logical array or cell array of logical arrays.

Data Type of MATLAB Table Variable	Data Type of Existing Database Column
Numeric array or cell array of numeric arrays	• `smallint` • `integer` • `bigint` • `decimal` • `numeric` • `real` • `double precision` • `smallserial` • `serial` • `bigserial`
Cell array of character vectors, string array, datetime array, or duration array	• `date` • `time` • `timestamp`
Calendar duration array	`interval`
Logical array or cell array of logical arrays	`bit`
Cell array of character vectors or string array	• `char` • `varchar`

Data Types for New Table

The specified table name for the new database table must be unique across all tables in the database.

The valid data types in a MATLAB table are:

- Numeric array
- Cell array of character vectors
- String array
- Datetime array
- Duration array
- Calendar duration array
- Logical array

The `sqlwrite` function ignores any invalid data types and inserts only the valid variables from MATLAB as columns in a new database table.

The `sqlwrite` function converts the data type of the variable into the default data type of the column in the database table. The following table matches the valid data types of the MATLAB table variable to the default data types of the database column.

Data Type of MATLAB Table Variable	Default Data Type of Database Column
`int8` array	`smallint`
`int16` array	`smallint`

Data Type of MATLAB Table Variable	Default Data Type of Database Column
`int32` array	`integer`
`int64` array	`bigint`
`logical` array	`boolean`
`single` or `double` array	`numeric`
`datetime` array	`timestamp`
`duration` array	`time`
`calendarDuration` array	`interval`
cell array of character vectors or string array	`varchar` **Note** The size of this column equals the sum of the maximum length of a string in the string array and 100.

To specify database-specific column data types instead of the defaults, use the `'ColumnType'` name-value pair argument. For example, you can specify `'ColumnType',"bigint"` to create a `bigint` column in the new database table.

Also, using the `'ColumnType'` name-value pair argument, you can specify other data types that are not in the default list. For example, to insert currency, specify `'ColumnType',"money"`.

Accepted Missing Data

The accepted missing data for inserting data into a database depends on the data type of the MATLAB table variable and the data type of the column in the database. The following table matches the data type of the MATLAB table variable to the data type of the database column and specifies the accepted missing data to use in each case.

Data Type of MATLAB Table Variable	Data Type of Database Column	Accepted Missing Data
`datetime` array	`date` or `timestamp`	`NaT`
`duration` array	`time`	`NaN`
`calendarDuration` array	`interval`	`NaN`
`double` or `single` array or cell array of `double` or `single` arrays	`numeric`	`NaN`, `[]`, or `''`
cell array of character vectors	`date` or `timestamp`	`'NaT'` or `''`
cell array of character vectors	`time`	`'NaN'` or `''`
cell array of character vectors	`char`, `varchar`, or other text data type	`''`
string array	`date` or `timestamp`	`""`, `"NaT"`, or `missing`
string array	`time`	`""`, `"NaN"`, or `missing`
string array	`char`, `varchar`, or other text data type	`missing`

Data Types: `table`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `sqlwrite(conn,"tablename",data,'ColumnType',["numeric" "timestamp" "money"])` inserts data into a new database table named `tablename` by specifying data types for all columns in the new database table.

`Catalog` — Database catalog name

string scalar | character vector

Database catalog name, specified as a string scalar or character vector. A catalog serves as the container for the schemas in a database and contains related metadata information. A database can have multiple catalogs.

Example: `Catalog = "toy_store"`

Data Types: `string` | `char`

`Schema` — Database schema name

string scalar | character vector

Database schema name, specified as a string scalar or character vector. A schema defines the database tables, views, relationships among tables, and other elements. A database catalog can have numerous schemas.

Example: `Schema = "dbo"`

Data Types: `string` | `char`

`ColumnType` — Database column types

character vector | string scalar | cell array of character vectors | string array

Database column types, specified as the comma-separated pair consisting of `'ColumnType'` and a character vector, string scalar, cell array of character vectors, or string array. Use this name-value pair argument to define custom data types for the columns in a database table. Specify a column type for each column in the table.

Example: `'ColumnType',["numeric" "varchar(400)"]`

Data Types: `char` | `string` | `cell`

Version History

Introduced in R2020b

See Also

`sqlread` | `postgresql` | `close` | `cell2table` | `array2table` | `struct2table`

Topics

"Insert Data into Database Table Using PostgreSQL Native Interface" on page 7-19

Neo4jConnect

Neo4j database connection

Description

Create a Neo4j database connection using the MATLAB interface to Neo4j with the REST API. With the Neo4j database connection, you can explore the graph database, update the graph database, store a MATLAB directed graph, and perform graph analytics using the MATLAB directed graph.

You can also create a Neo4j database connection using the Database Toolbox Interface for Neo4j Bolt Protocol. To use this interface, you must install the Database Toolbox Interface for Neo4j Bolt Protocol. For details, see “Database Toolbox Interface for Neo4j Bolt Protocol Installation” on page 10-37.

With a `Neo4jConnect` object, you can perform these tasks:

- Explore the graph database for nodes and relationships.
- Search the graph database for nodes, relationships, or a subgraph.
- Store a directed graph.
- Update nodes and relationships in the graph database.
- Execute a Cypher query.

Creation

Create a `Neo4jConnect` object using `neo4j`.

Properties

URL — Neo4j database connection URL
character vector

This property is read-only.

Neo4j database connection URL that contains the server, port number, and web location of the Neo4j database, specified as a character vector.

If you specify a Bolt database connection URL using the Database Toolbox Interface for Neo4j Bolt Protocol, then the `neo4j` function creates a Bolt connection instead.

Example: `http://localhost:7474/db/data` specifies using the HTTP protocol where `localhost` is the server, `7474` is the port number, and `/db/data` is the web location of the database.

Example: `bolt://localhost:7687/db/data` specifies using the Bolt protocol where `localhost` is the server, `7687` is the port number, and `/db/data` is the web location of the database.

Data Types: `char`

`UserName` — User name
character vector

This property is read-only.

User name for accessing the Neo4j database, specified as a character vector.

Data Types: `char`

`Message` — Error message
character vector

This property is read-only.

Error message, specified as a character vector. If this property is empty, the database connection is successful.

Data Types: `char`

Object Functions

Graph Database Connection

close	Close Neo4j database connection

Traverse the Graph

nodeLabels	All node labels in Neo4j database
relationTypes	All relationship types in Neo4j database
propertyKeys	All property keys in Neo4j database
searchNodeByID	Search Neo4j database nodes by node identifier
searchNode	Search Neo4j database nodes by label or by property key and value
searchRelation	Search relationships for Neo4j database node
searchRelationByID	Search Neo4j relationship by relationship identifier
searchGraph	Search for subgraph or entire graph in Neo4j database

Update the Graph

createNode	Create nodes in Neo4j database
createRelation	Create relationships between nodes in Neo4j database
deleteNode	Delete nodes from Neo4j database
deleteRelation	Delete relationships from Neo4j database

Update Labels and Properties in Graph

addNodeLabel	Add labels to nodes in Neo4j database
removeNodeLabel	Remove labels from nodes in Neo4j database
removeNodeProperty	Remove properties from nodes in Neo4j database
removeRelationProperty	Remove properties from relationships in Neo4j database
setNodeProperty	Set properties for nodes in Neo4j database
setRelationProperty	Set properties for relationships in Neo4j database
updateNode	Update node labels and properties in Neo4j database
updateRelation	Update relationship properties in Neo4j database

Store Directed Graph

storeDigraph   Store directed graph in Neo4j database

Execute Cypher Query

executeCypher   Execute Cypher query on Neo4j database

Examples

Connect to Neo4j Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password)
```

```
neo4jconn =
  Neo4jConnect with properties:

         URL: 'http://localhost:7474/db/data/'
    UserName: 'neo4j'
     Message: []
```

`neo4j` returns a `Neo4jConnect` object with these properties:

- `URL` — The Neo4j database web location
- `UserName` — The user name used to connect to the database
- `Message` — Any database connection error messages

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful Neo4j database connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve all node labels using the Neo4j database connection `neo4jconn`. The cell array `nlabels` contains a character vector for the one node label in the Neo4j database.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels = 1×1 cell array
    {'Person'}
```

Close the database connection.

```
close(neo4jconn)
```

Version History

Introduced in R2016b

See Also

Topics

“Determine Dependencies of Services in Network” on page 10-22
“Find Shortest Path Between People in Social Neighborhood” on page 10-27
“Find Friends of Friends in Social Neighborhood” on page 10-32
“Explore Graph Database Structure” on page 10-2
“Graph Database Workflow for Neo4j Database Interfaces” on page 10-6
“Search Graph Database” on page 10-9

Neo4jNode

Neo4j database node

Description

After creating a Neo4j database connection using the MATLAB interface to Neo4j, explore nodes in the database. With a `Neo4jNode` object, you can explore the node degree and relationship types of the nodes in the database.

Creation

Create a `Neo4jNode` object using the `createNode`, `searchNodeByID`, and `searchNode` functions.

Properties

`NodeID` — Node identifier
double

This property is read-only.

Node identifier for the unique node in the Neo4j database, specified as a double.

Data Types: `double`

`NodeData` — Node data
structure

This property is read-only.

Node data consisting of property keys and values for the unique node in the Neo4j database, specified as a structure.

Data Types: `struct`

`NodeLabels` — Node labels
character vector | cell array of character vectors

This property is read-only.

Node labels of the unique Neo4j database node, specified as a character vector for one label or as a cell array of character vectors for multiple labels.

Data Types: `char` | `cell`

Object Functions

nodeDegree	In-degree and out-degree for each associated relationship type for Neo4j database node
nodeRelationTypes	Associated relationship types for Neo4j database node

Examples

Search Neo4j® Database by Node Identifier

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`.

```
neo4jconn.Message
```

```
ans =

     []
```

The blank `Message` property indicates a successful connection.

Search the database for the node with the node identifier `2` by using the Neo4j database connection `neo4jconn`.

```
nodeid = 2;

nodeinfo = searchNodeByID(neo4jconn,nodeid)
```

```
nodeinfo = 

  Neo4jNode with properties:

        NodeID: 2
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

`nodeinfo` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Access the property keys and values of the node using the property `NodeData`.

```
nodeinfo.NodeData
```

```
ans = 

  struct with fields:
```

```
name: 'User2'
```

Version History

Introduced in R2016b

See Also

Topics

“Explore Graph Database Structure” on page 10-2
“Graph Database Workflow for Neo4j Database Interfaces” on page 10-6
“Search Graph Database” on page 10-9

Neo4jRelation

Neo4j database relationship

Description

The `Neo4jRelation` object represents a single relationship in a Neo4j database. Use this object to find information about the relationship between two nodes in a Neo4j database.

Creation

Create a `Neo4jRelation` object using the `createRelation`, `searchRelation`, and `searchRelationByID` functions.

Properties

`RelationID` — Relationship identifier
numeric scalar

This property is read-only.

Relationship identifier, specified as a numeric scalar. The Neo4j database assigns this number automatically.

Example: 3

Data Types: `double`

`RelationData` — Relationship data
structure

This property is read-only.

Relationship data consisting of property keys and values for the unique relationship in the Neo4j database, specified as a structure. If the relationship has no properties, then this structure contains no fields.

Data Types: `struct`

`StartNodeID` — Start node identifier
numeric scalar

This property is read-only.

Start node identifier, specified as a numeric scalar. This number specifies the start node of the Neo4j database relationship.

Example: 3

Data Types: `double`

RelationType — Relationship type
character vector

This property is read-only.

Relationship type, specified as a character vector. This character vector specifies the type of the Neo4j database relationship.

Example: 'knows'

Data Types: char

EndNodeID — End node identifier
numeric scalar

This property is read-only.

End node identifier, specified as a numeric scalar. This number specifies the end node of the Neo4j database relationship.

Example: 7

Data Types: double

Examples

Search Neo4j Database by Relationship Identifier

Search for information about a Neo4jRelation object in a Neo4j® database and display the information.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key name with values User1 through User7. Each relationship has the type knows.

Create a Neo4j database connection using the URL http://localhost:7474/db/data, user name neo4j, and password matlab.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the Message property of the Neo4j connection object neo4jconn. The blank Message property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the database for the relationship with the identifier 3 by using the Neo4j database connection.

```
relationid = 3;

relinfo = searchRelationByID(neo4jconn,relationid)
```

```
relinfo = 

  Neo4jRelation with properties:

      RelationID: 3
    RelationData: [1×1 struct]
     StartNodeID: 1
    RelationType: 'knows'
       EndNodeID: 3
```

`relinfo` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Access the property keys and values of the relationship using the property `RelationData`. Here, the relationship does not contain properties, so the structure has no fields.

```
relinfo.RelationData
```

```
ans = 

  struct with no fields.
```

Version History

Introduced in R2018a

See Also

Topics

"Explore Graph Database Structure" on page 10-2
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

neo4j

Connect to Neo4j database

Syntax

```
neo4jconn = neo4j(url,username,password)
```

Description

The `neo4j` function creates connections to a Neo4j database. For relational database connections, see “Connect to Database” on page 2-129.

`neo4jconn = neo4j(url,username,password)` creates a `Neo4jConnect` object using the URL, user name, and password for the Neo4j database. Use the object to retrieve graph data from the Neo4j database.

Examples

Connect to Neo4j Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password)
```

```
neo4jconn = 
  Neo4jConnect with properties:

         URL: 'http://localhost:7474/db/data/'
    UserName: 'neo4j'
     Message: []
```

`neo4j` returns a `Neo4jConnect` object with these properties:

- `URL` — The Neo4j database web location
- `UserName` — The user name used to connect to the database
- `Message` — Any database connection error messages

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful Neo4j database connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve all node labels using the Neo4j database connection `neo4jconn`. The cell array `nlabels` contains a character vector for the one node label in the Neo4j database.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels = 1×1 cell array
    {'Person'}
```

Close the database connection.

```
close(neo4jconn)
```

Connect to Neo4j Database Using Bolt Protocol

Create a Neo4j® database connection using the Database Toolbox™ Interface for Neo4j Bolt Protocol. Use a Bolt protocol URL to connect to the Neo4j database.

Create a Neo4j database connection using the Bolt protocol URL `bolt://localhost:7687/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'bolt://localhost:7687/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password)
```

```
neo4jconn = 
  Neo4jConnect with properties:

         URL: 'bolt://localhost:7687/db/data'
    UserName: 'neo4j'
     Message: []
```

`neo4j` returns a `Neo4jConnect` object with these properties:

- `URL` — The Neo4j database web location
- `UserName` — The user name used to connect to the database
- `Message` — Any database connection error messages

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful Neo4j database connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve all node labels using the Neo4j database connection `neo4jconn`. The cell array `nlabels` contains a character vector for the one node label in the Neo4j database.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels = 1×1 cell array
    {'Person'}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`url` — Neo4j database connection URL
character vector | string scalar

Neo4j database connection URL that contains the server, port number, and web location of the Neo4j database, specified as a character vector or string scalar.

If you specify a URL that starts with the `http://` protocol identifier, then the `neo4j` function uses the REST API to connect to the Neo4j database.

If you specify a Bolt database connection URL that starts with the `bolt://` protocol identifier, that is, you use the Database Toolbox Interface for Neo4j Bolt Protocol, then the `neo4j` function creates a Bolt connection instead.

Note Ensure that you use the correct port number in the Neo4j database connection URL when you use the Bolt protocol. The default port number `7687` for the Bolt protocol is different from the default port numbers `7474` and `7473` for the HTTP and HTTPS protocols, respectively.

If you specify any other protocol identifier, then the `neo4j` function uses the REST API to create the database connection.

Example: `http://localhost:7474/db/data` specifies using the HTTP protocol where `localhost` is the server, `7474` is the port number, and `/db/data` is the web location of the database.

Example: `bolt://localhost:7687/db/data` specifies using the Bolt protocol where `localhost` is the server, `7687` is the port number, and `/db/data` is the web location of the database.

Data Types: `char` | `string`

`username` — User name
character vector | string scalar

User name for accessing the Neo4j database, specified as a character vector or string scalar. If no database authentication is required, specify an empty character vector.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password for accessing the Neo4j database, specified as a character vector or string scalar. If no database authentication is required, specify an empty character vector or string scalar.

Data Types: `char` | `string`

Output Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, returned as a `Neo4jConnect` object.

Limitations

- The REST API and Database Toolbox Interface for Neo4j Bolt Protocol do not support Neo4j database versions 4.0 and later.

Version History

Introduced in R2016b

See Also

`nodeLabels` | `relationTypes` | `propertyKeys` | `close` | `searchGraph`

Topics

“Determine Dependencies of Services in Network” on page 10-22
“Find Shortest Path Between People in Social Neighborhood” on page 10-27
“Find Friends of Friends in Social Neighborhood” on page 10-32
“Explore Graph Database Structure” on page 10-2
“Search Graph Database” on page 10-9
“Graph Database Workflow for Neo4j Database Interfaces” on page 10-6
“Error Messages for Neo4j Database Interfaces” on page 10-20

close

Namespace: `database.neo4j.http`

Close Neo4j database connection

Syntax

`close(neo4jconn)`

Description

`close(neo4jconn)` closes the Neo4j database connection.

Examples

Connect to Neo4j Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password)
```

```
neo4jconn =
  Neo4jConnect with properties:

         URL: 'http://localhost:7474/db/data/'
    UserName: 'neo4j'
     Message: []
```

`neo4j` returns a `Neo4jConnect` object with these properties:

- `URL` — The Neo4j database web location
- `UserName` — The user name used to connect to the database
- `Message` — Any database connection error messages

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful Neo4j database connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve all node labels using the Neo4j database connection `neo4jconn`. The cell array `nlabels` contains a character vector for the one node label in the Neo4j database.

```
nlabels = nodeLabels(neo4jconn)

nlabels = 1×1 cell array
    {'Person'}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

Version History

Introduced in R2019a

See Also

`neo4j`

Topics

"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Search Graph Database" on page 10-9
"Determine Dependencies of Services in Network" on page 10-22
"Find Shortest Path Between People in Social Neighborhood" on page 10-27
"Find Friends of Friends in Social Neighborhood" on page 10-32
"Explore Graph Database Structure" on page 10-2
"Error Messages for Neo4j Database Interfaces" on page 10-20

nodeLabels

Namespace: `database.neo4j.http`

All node labels in Neo4j database

Syntax

`nlabels = nodeLabels(neo4jconn)`

Description

`nlabels = nodeLabels(neo4jconn)` returns all node labels in the Neo4j database using the Neo4j database connection `neo4jconn`. You can retrieve the entire graph or search for a subgraph using the node labels. To search the graph database for relationship types instead, see `relationTypes`.

Examples

Retrieve All Node Labels

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve all node labels using the Neo4j database connection `neo4jconn`. The cell array `nlabels` contains a character vector for the one node label in the Neo4j database.

```
nlabels = nodeLabels(neo4jconn)
```

```
nlabels = 1×1 cell array
    {'Person'}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

Output Arguments

nlabels — Node labels
cell array of character vectors

Node labels in the Neo4j database, returned as a cell array of character vectors. Each character vector denotes a node label.

Version History

Introduced in R2016b

See Also

`neo4j` | `relationTypes` | `propertyKeys` | `close`

Topics

"Explore Graph Database Structure" on page 10-2
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Search Graph Database" on page 10-9
"Error Messages for Neo4j Database Interfaces" on page 10-20

relationTypes

Namespace: `database.neo4j.http`

All relationship types in Neo4j database

Syntax

```
rtypes = relationTypes(neo4jconn)
```

Description

`rtypes = relationTypes(neo4jconn)` returns all relationship types in the Neo4j database using the Neo4j database connection `neo4jconn`. You can retrieve the entire graph or search for a subgraph using the relationship types. To search the graph database for node labels instead, see `nodeLabels`.

Examples

Retrieve All Relationship Types

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve all relationship types using the Neo4j database connection `neo4jconn`. The cell array `rtypes` contains a character vector for the one relationship type in the Neo4j database.

```
rtypes = relationTypes(neo4jconn)
```

```
rtypes = 1×1 cell array
    {'knows'}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a Neo4jConnect object created with the function neo4j.

Output Arguments

rtypes — Relationship types
cell array of character vectors

Relationship types in the Neo4j database, returned as a cell array of character vectors. Each character vector denotes a relationship type.

Version History

Introduced in R2016b

See Also

neo4j | nodeLabels | propertyKeys | close

Topics

"Explore Graph Database Structure" on page 10-2
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Search Graph Database" on page 10-9
"Error Messages for Neo4j Database Interfaces" on page 10-20

propertyKeys

Namespace: `database.neo4j.http`

All property keys in Neo4j database

Syntax

```
propkeys = propertyKeys(neo4jconn)
```

Description

`propkeys = propertyKeys(neo4jconn)` returns all property keys in the Neo4j database using the Neo4j database connection `neo4jconn`.

Examples

Retrieve All Property Keys

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve all property keys using the Neo4j database connection `neo4jconn`. The cell array `propkeys` contains a character vector for the one property key in the Neo4j database.

```
propkeys = propertyKeys(neo4jconn)
```

```
propkeys = 15×1 cell array
    {'Weight'     }
    {'EndNodes'   }
    {'Address'    }
    {'Department' }
    {'title'      }
    {'name'       }
    {'Name'       }
    {'EndDate'    }
    {'Description'}
```

```
    {'StartDate'  }
    {'property'   }
    {'Date'       }
    {'Project'    }
    {'Location'   }
    {'Title'      }
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

Output Arguments

`propkeys` — Property keys
cell array of character vectors

Property keys in the Neo4j database, returned as a cell array of character vectors. Each character vector denotes a property key.

Version History

Introduced in R2016b

See Also

`neo4j` | `nodeLabels` | `relationTypes` | `close`

Topics

"Explore Graph Database Structure" on page 10-2
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Error Messages for Neo4j Database Interfaces" on page 10-20

searchNodeByID

Namespace: `database.neo4j.http`

Search Neo4j database nodes by node identifier

Syntax

`nodeinfo = searchNodeByID(neo4jconn,nodeid)`

Description

`nodeinfo = searchNodeByID(neo4jconn,nodeid)` creates the `Neo4jNode` object using the Neo4j database connection `neo4jconn` and the node identifier `nodeid`.

Examples

Search Neo4j Database by Node Identifier

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the database for the node with the node identifier `2` by using the Neo4j database connection `neo4jconn`.

```
nodeid = 2;

nodeinfo = searchNodeByID(neo4jconn,nodeid)
```

```
nodeinfo = 
  Neo4jNode with properties:

        NodeID: 2
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

`nodeinfo` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Access the property keys and values of the node using the property `NodeData`.

```
nodeinfo.NodeData
```

```
ans = struct with fields:
    name: 'User2'
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

neo4jconn — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

nodeid — Node identifier
numeric scalar | numeric vector

Node identifier of a Neo4j database node, specified as a numeric scalar for one node in the Neo4j database, or a numeric vector for multiple nodes. If a node identifier is unknown, search for nodes using `searchNode` and search for relationships using `searchRelation`.

Data Types: `double`

Output Arguments

nodeinfo — Node information
`Neo4jNode` object

Node information for one node in the Neo4j database, returned as a `Neo4jNode` object. You can use this node as the origin node for searching the Neo4j database.

Version History

Introduced in R2016b

See Also

`neo4j` | `nodeRelationTypes` | `nodeDegree` | `close`

Topics

"Explore Graph Database Structure" on page 10-2
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Search Graph Database" on page 10-9

searchNode

Namespace: `database.neo4j.http`

Search Neo4j database nodes by label or by property key and value

Syntax

```
nodeinfo = searchNode(neo4jconn,nlabel)
nodeinfo = searchNode(neo4jconn,nlabel,Name,Value)
```

Description

`nodeinfo = searchNode(neo4jconn,nlabel)` returns node information for nodes with a specific node label using the Neo4j database connection `neo4jconn`.

`nodeinfo = searchNode(neo4jconn,nlabel,Name,Value)` narrows the search for nodes with additional options specified by the `Name,Value` pair arguments.

Examples

Search Nodes by Node Label

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the database for nodes that have node label `Person` using the Neo4j database connection `neo4jconn`.

```
nlabel = 'Person';

nodeinfo = searchNode(neo4jconn,nlabel)
```

```
nodeinfo=7×3 table
         NodeLabels      NodeData                     NodeObject
         __________    ____________    ____________________________________
```

```
    0     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    4     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    5     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    9     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

`nodeinfo` is a table that contains information for each database node:

- Each row name is a node identifier.
- Variable `NodeLabels` is the node label.
- Variable `NodeData` is the node information.
- Variable `NodeObject` is the `Neo4jNode` object.

Access the node information for the first node in the table. The structure contains one property key and value.

```
node = nodeinfo.NodeData(1);
node{1}
```

```
ans = struct with fields:
    name: 'User1'
```

Access the node information using the row name as an index. The structure contains one property key and value.

```
nodeinfo.NodeData{'0'}
```

```
ans = struct with fields:
    name: 'User1'
```

Find the node degree for the first database node in the table. Specify outgoing relationships. There are two outgoing relationships from the first node in the table with relationship type `knows`.

```
degree = nodeDegree(nodeinfo.NodeObject(1),'out')
```

```
degree = struct with fields:
    knows: 2
```

Close the database connection.

```
close(neo4jconn)
```

Search Nodes by Property Key and Value

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
```

```
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the database for nodes that have node label `Person` using the Neo4j database connection `neo4jconn`. Filter the results further by the property key and value for a specific person named `User2`. The `nodeinfo` output argument is a `Neo4jNode` object that contains node information.

```
nlabel = 'Person';

nodeinfo = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User2')
```

```
nodeinfo =
  Neo4jNode with properties:

        NodeID: 2
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

Access the node information. The structure contains a property key and value for `User2`.

```
nodeinfo.NodeData
```

```
ans = struct with fields:
    name: 'User2'
```

Find the node degree of the outgoing relationships. There is one outgoing relationship type `knows` for `User2`.

```
degree = nodeDegree(nodeinfo,'out')
```

```
degree = struct with fields:
    knows: 1
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

neo4jconn — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`nlabel` — Neo4j database node label
character vector | string scalar

Neo4j database node label, specified as a character vector or string scalar.

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `nodeinfo = searchNode(neo4jconn,'Person','PropertyKey','name','PropertyValue','User2');`

`PropertyKey` — Property key
character vector | string scalar

Property key, specified as a comma-separated pair consisting of `'PropertyKey'` and a character vector or string scalar. A property key must have a corresponding property value. To specify the property value, use the name-value pair argument `'PropertyValue'`.

Example: `'PropertyKey','name'`

Data Types: `char` | `string`

`PropertyValue` — Property value
character vector | string scalar

Property value, specified as a comma-separated pair consisting of `'PropertyValue'` and a character vector or string scalar. A property value must have a corresponding property key. To specify the property key, use the name-value pair argument `'PropertyKey'`.

Example: `'PropertyValue','User1'`

Data Types: `char` | `string`

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or as a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node
- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

Version History

Introduced in R2016b

See Also

`neo4j` | `searchNodeByID` | `searchRelation` | `nodeRelationTypes` | `nodeDegree` | `searchGraph` | `close`

Topics

"Explore Graph Database Structure" on page 10-2
"Search Graph Database" on page 10-9
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Error Messages for Neo4j Database Interfaces" on page 10-20

searchRelation

Namespace: database.neo4j.http

Search relationships for Neo4j database node

Syntax

```
relinfo = searchRelation(neo4jconn,nodeinfo,direction)
relinfo = searchRelation(neo4jconn,nodeinfo,direction,Name,Value)
```

Description

`relinfo = searchRelation(neo4jconn,nodeinfo,direction)` returns relationship information for the origin node `nodeinfo` and relationship direction using a Neo4j database connection. The search starts from the origin node. To find an origin node, use `searchNode` or `searchNodeByID`.

`relinfo = searchRelation(neo4jconn,nodeinfo,direction,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'RelationTypes',{'works with'}` returns information for relationships that have the type `works with`.

Examples

Search for Incoming Relationship

Search for information about a relationship in a Neo4j® database and display the information.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the origin node `nodeinfo` using the Neo4j database connection and the node identifier `3`.

```
nodeid = 3;

nodeinfo = searchNodeByID(neo4jconn,nodeid);
```

Search for incoming relationships using the Neo4j database connection and the origin node `nodeinfo`.

```
direction = 'in';

relinfo = searchRelation(neo4jconn,nodeinfo,direction)
```

```
relinfo = struct with fields:
       Origin: 3
        Nodes: [2×3 table]
    Relations: [1×5 table]
```

`relinfo` is a structure that contains the results of the search:

- `Origin` — The node identifier for the specified origin node
- `Nodes` — A table containing all start and end nodes for each matched relationship
- `Relations` — A table containing all matched relationships

Access the table of nodes.

```
relinfo.Nodes
```

```
ans=2×3 table
         NodeLabels      NodeData                    NodeObject
         __________    ____________    ___________________________________

    1     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

Access the table of relationships.

```
relinfo.Relations
```

```
ans=1×5 table
         StartNodeID    RelationType    EndNodeID    RelationData              RelationObject
         ___________    ____________    _________    ____________    ______________________________

    3         1           'knows'           3        [1×1 struct]    [1x1 database.neo4j.http.Neo
```

Close the database connection.

```
close(neo4jconn)
```

Search Relationships by Type and Distance

Search for information about relationships in a Neo4j® database and display the information. Specify the relationship type and distance to search.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the origin node `nodeinfo` using the Neo4j database connection and the node identifier `3`.

```
nodeid = 3;

nodeinfo = searchNodeByID(neo4jconn,nodeid);
```

Search for incoming relationships using the Neo4j database connection and the origin node `nodeinfo`. Refine the search by filtering for the relationship type `knows` and for nodes at a distance of two or fewer.

```
direction = 'in';
reltypes = {'knows'};

relinfo = searchRelation(neo4jconn,nodeinfo,direction, ...
    'RelationTypes',reltypes,'Distance',2)
```

```
relinfo = struct with fields:
       Origin: 3
        Nodes: [4×3 table]
    Relations: [3×5 table]
```

`relinfo` is a structure that contains the results of the search:

- `Origin` — The node identifier for the specified origin node
- `Nodes` — A table containing all start and end nodes for each matched relationship
- `Relations` — A table containing all matched relationships

Access the table of nodes.

```
relinfo.Nodes
```

```
ans=4×3 table
         NodeLabels      NodeData                    NodeObject
         __________    ____________    ___________________________________
```

```
    0     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

Access the table of relationships.

```
relinfo.Relations
```

```
ans=3×5 table
         StartNodeID    RelationType    EndNodeID    RelationData              RelationObject
         ___________    ____________    _________    ____________    ______________________________

    3         1           'knows'           3        [1×1 struct]    [1x1 database.neo4j.http.Neo
    2         2           'knows'           1        [1×1 struct]    [1x1 database.neo4j.http.Neo
    1         0           'knows'           1        [1×1 struct]    [1x1 database.neo4j.http.Neo
```

Close the database connection.

```
close(neo4jconn)
```

Return Relationship Information as Directed Graph

Search for information about outgoing relationships in a Neo4j® database. Return the information as a directed graph and display the edges and nodes of the graph.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the origin node `nodeinfo` using the Neo4j database connection and the node identifier `3`.

```
nodeid = 3;
nodeinfo = searchNodeByID(neo4jconn,nodeid);
```

Search for outgoing relationships using the Neo4j database connection and the origin node `nodeinfo`. Return relationship information as a directed graph by using the `'DataReturnFormat'` name-value pair argument with the value `'digraph'`.

```
direction = 'out';
relinfo = searchRelation(neo4jconn,nodeinfo,direction, ...
    'DataReturnFormat','digraph')
```

```
relinfo = 
  digraph with properties:

    Edges: [2×3 table]
    Nodes: [3×3 table]
```

Display the edges of the directed graph.

```
relinfo.Edges
```

```
ans=2×3 table
       EndNodes        RelationType    RelationData
    ______________     ____________    ____________

    {'3'}    {'4'}      {'knows'}      {1×1 struct}
    {'3'}    {'5'}      {'knows'}      {1×1 struct}
```

Display the nodes of the directed graph.

```
relinfo.Nodes
```

```
ans=3×3 table
    Name     NodeLabels       NodeData
    _____    __________    ____________

    {'3'}    {'Person'}    {1×1 struct}
    {'4'}    {'Person'}    {1×1 struct}
    {'5'}    {'Person'}    {1×1 struct}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection

`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`nodeinfo` — Origin node information

`Neo4jNode` object | numeric scalar

Origin node information, specified as a `Neo4jNode` object or numeric scalar that denotes a node identifier.

Data Types: `double`

`direction` — Relationship direction
`'in'` | `'out'`

Relationship direction, specified as either `'in'` for an incoming relationship or `'out'` for an outgoing relationship. The relationships are associated with the specified origin node.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `relinfo = searchRelation(neo4jconn,nodeinfo,'in','RelationTypes',{'knows'},'Distance',2)` returns the relationship information for the incoming relationships, which have the relationship type `knows` and are two or fewer nodes away from the origin node.

`RelationTypes` — Relationship types
character vector | string scalar | cell array of character vectors | string array

Relationship types, specified as a comma-separated pair consisting of `'RelationTypes'` and a character vector, string scalar, cell array of character vectors, or string array. To search for relationships using only one relationship type, use a character vector or string scalar. To search for relationships using numerous relationship types, use a cell array of character vectors or string array.

Example: `'RelationTypes',{'knows'}`

Data Types: `char` | `cell` | `string`

`Distance` — Node distance
numeric scalar

Node distance, specified as a comma-separated pair consisting of `'Distance'` and a positive numeric scalar. For example, if the node distance is three, `searchRelation` returns information for nodes that are three or fewer nodes away from the origin node `nodeinfo`.

Example: `'Distance',3`

Data Types: `double`

`DataReturnFormat` — Data return format
`'struct'` (default) | `'digraph'`

Data return format, specified as the comma-separated pair consisting of `'DataReturnFormat'` and the value `'struct'` for a structure or `'digraph'` for a `digraph` object. Specify this argument to return relationship information as a `digraph` object.

Output Arguments

`relinfo` — Relationship information
structure

Relationship information in the Neo4j database that matches the search criteria from the origin node `nodeinfo`, returned as a structure with these fields.

Field	Description
Origin	Node identifier of the origin node nodeinfo.
Nodes	Table that contains node information for each node in the Relations table. The Nodes tab • NodeLabels — Character vector that denotes the node label for each matched database • NodeData — Structure array that contains node information such as property keys for e • NodeObject — Neo4jNode object that represents each matched database node The row names in the table are Neo4j node identifiers of the matched database nodes.
Relations	Table that contains relationship information for the nodes in the Nodes table. The Relatio • StartNodeID — Node identifier for the start node for each matched relationship • RelationType — Character vector that denotes the relationship type for each matched • EndNodeID — Node identifier for the end node for each matched relationship • RelationData — Structure array that contains property keys associated with each mat • RelationObject — Neo4jRelation object that represents each matched relationship The row names in the table are Neo4j relationship identifiers.

Note When you use the 'DataReturnFormat' name-value pair argument with the value 'digraph', the searchRelation function returns relationship information in a digraph object. The resulting digraph object contains the same data as the digraph object created when you execute the neo4jStruct2Digraph function using the relinfo output argument.

Version History

Introduced in R2016b

See Also

Neo4jRelation | neo4j | searchNode | searchNodeByID | searchGraph | searchRelationByID | close

Topics

"Explore Graph Database Structure" on page 10-2
"Search Graph Database" on page 10-9
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Error Messages for Neo4j Database Interfaces" on page 10-20

searchGraph

Namespace: database.neo4j.http

Search for subgraph or entire graph in Neo4j database

Syntax

```
graphinfo = searchGraph(neo4jconn,criteria)
graphinfo = searchGraph(neo4jconn,criteria,'DataReturnFormat','digraph')
```

Description

graphinfo = searchGraph(neo4jconn,criteria) returns graph information based on the search criteria using a Neo4j database connection. You can search for a subgraph or the entire graph.

graphinfo = searchGraph(neo4jconn,criteria,'DataReturnFormat','digraph') returns graph information as a digraph object.

Examples

Search Graph by Node Labels

Search for graph information in a Neo4j® database by using node labels and display the information.

Create a Neo4j database connection using the URL http://localhost:7474/db/data, user name neo4j, and password matlab.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the Message property of the Neo4j connection object neo4jconn. The blank Message property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the graph for all nodes with the label 'Person' using the Neo4j database connection.

```
nlabel = {'Person'};

graphinfo = searchGraph(neo4jconn,nlabel)
```

```
graphinfo = struct with fields:
        Nodes: [7×3 table]
    Relations: [8×5 table]
```

`graphinfo` is a structure that contains the results of the search:

- All start and end nodes that denote each matched relationship
- All matched relationships

Access the table of nodes.

```
graphinfo.Nodes
```

```
ans=7×3 table
         NodeLabels      NodeData                   NodeObject
         __________    ____________    ___________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    4     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    5     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    9     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

Access property keys for the first node.

```
graphinfo.Nodes.NodeData{1}
```

```
ans = struct with fields:
    name: 'User1'
```

Access the table of relationships.

```
graphinfo.Relations
```

```
ans=8×5 table
         StartNodeID    RelationType    EndNodeID    RelationData              RelationObject
         ___________    ____________    _________    ____________    ___________________________

    1         0           'knows'           1        [1×1 struct]    [1x1 database.neo4j.http.Neo
    0         0           'knows'           2        [1×1 struct]    [1x1 database.neo4j.http.Neo
    3         1           'knows'           3        [1×1 struct]    [1x1 database.neo4j.http.Neo
    2         2           'knows'           1        [1×1 struct]    [1x1 database.neo4j.http.Neo
    5         3           'knows'           4        [1×1 struct]    [1x1 database.neo4j.http.Neo
    4         3           'knows'           5        [1×1 struct]    [1x1 database.neo4j.http.Neo
    6         5           'knows'           4        [1×1 struct]    [1x1 database.neo4j.http.Neo
    8         5           'knows'           9        [1×1 struct]    [1x1 database.neo4j.http.Neo
```

Access property keys for the first relationship. The first relationship has no property keys.

```
graphinfo.Relations.RelationData{1}
```

```
ans = struct with no fields.
```

Search the graph for all node labels in the database.

```
allnodes = nodeLabels(neo4jconn);

graphinfo = searchGraph(neo4jconn,allnodes);
```

Close the database connection.

```
close(neo4jconn)
```

Search Graph by Relationships

Search for graph information in a Neo4j® database by using the relationship type and display the information.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the graph for the relationship type `'knows'` using the Neo4j database connection.

```
reltype = {'knows'};

graphinfo = searchGraph(neo4jconn,reltype)
```

```
graphinfo = struct with fields:
        Nodes: [7×3 table]
    Relations: [8×5 table]
```

`graphinfo` is a structure that contains the results of the search:

- All start and end nodes that denote each matched relationship
- All matched relationships

Access the table of nodes.

```
graphinfo.Nodes
```

```
ans=7×3 table
         NodeLabels      NodeData                    NodeObject
         __________    ____________    ___________________________________

    0     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

```
    2     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    5     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    4     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    9     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

Access the table of relationships.

```
graphinfo.Relations
```

```
ans=8×5 table
         StartNodeID    RelationType    EndNodeID    RelationData                  RelationObject
         ___________    ____________    _________    ____________    ________________________________

    0         0           'knows'           2        [1×1 struct]    [1x1 database.neo4j.http.Neo
    1         0           'knows'           1        [1×1 struct]    [1x1 database.neo4j.http.Neo
    2         2           'knows'           1        [1×1 struct]    [1x1 database.neo4j.http.Neo
    3         1           'knows'           3        [1×1 struct]    [1x1 database.neo4j.http.Neo
    4         3           'knows'           5        [1×1 struct]    [1x1 database.neo4j.http.Neo
    5         3           'knows'           4        [1×1 struct]    [1x1 database.neo4j.http.Neo
    6         5           'knows'           4        [1×1 struct]    [1x1 database.neo4j.http.Neo
    8         5           'knows'           9        [1×1 struct]    [1x1 database.neo4j.http.Neo
```

Search the graph for all relationship types in the database.

```
allreltypes = relationTypes(neo4jconn);
```

```
graphinfo = searchGraph(neo4jconn,allreltypes);
```

Close the database connection.

```
close(neo4jconn)
```

Return Graph Information as Directed Graph

Search for graph information in a Neo4j® database by using node labels. Return the information as a directed graph and display the edges and nodes of the graph.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the graph for all nodes with the node label `Person` using the Neo4j database connection. Return graph information as a directed graph by using the `'DataReturnFormat'` name-value pair argument with the value `'digraph'`.

```
nlabel = "Person";
graphinfo = searchGraph(neo4jconn,nlabel, ...
    'DataReturnFormat','digraph');
```

Display the edges of the directed graph.

```
graphinfo.Edges
```

```
ans=8×3 table
       EndNodes        RelationType    RelationData
    ______________    ____________    ____________

    {'0'}    {'1'}     {'knows'}      {1×1 struct}
    {'0'}    {'2'}     {'knows'}      {1×1 struct}
    {'1'}    {'3'}     {'knows'}      {1×1 struct}
    {'2'}    {'1'}     {'knows'}      {1×1 struct}
    {'3'}    {'4'}     {'knows'}      {1×1 struct}
    {'3'}    {'5'}     {'knows'}      {1×1 struct}
    {'5'}    {'4'}     {'knows'}      {1×1 struct}
    {'5'}    {'9'}     {'knows'}      {1×1 struct}
```

Display the nodes of the directed graph.

```
graphinfo.Nodes
```

```
ans=7×3 table
    Name     NodeLabels       NodeData
    _____    __________    ____________

    {'0'}    {'Person'}    {1×1 struct}
    {'1'}    {'Person'}    {1×1 struct}
    {'2'}    {'Person'}    {1×1 struct}
    {'3'}    {'Person'}    {1×1 struct}
    {'4'}    {'Person'}    {1×1 struct}
    {'5'}    {'Person'}    {1×1 struct}
    {'9'}    {'Person'}    {1×1 struct}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`criteria` — Search criteria
cell array of character vectors | string array

Search criteria, specified as a cell array of character vectors or string array. To search by nodes, specify one or more node labels as character vectors in the cell array. To search by relationships, specify one or more relationship types as character vectors in the cell array. Or, specify a string array for multiple node labels or relationship types.

Data Types: `cell` | `string`

Output Arguments

`graphinfo` — Graph information
structure

Graph information in the Neo4j database that matches the search criteria, returned as a structure with these fields.

Field	Description
`Nodes`	Table that contains node information for each node in the `Relations` table. The `Nodes` tabl • `NodeLabels` — Character vector that denotes the node label for each matched database • `NodeData` — Structure array that contains node information such as property keys for e • `NodeObject` — `Neo4jNode` object for each matched database node The row names in the table are Neo4j node identifiers of the matched database nodes. If `criteria` contains node labels, the output is automatically sorted by `StartNodeID` and
`Relations`	Table that contains relationship information for the nodes in the `Nodes` table. The `Relatio` • `StartNodeID` — Node identifier for the start node for each matched relationship • `RelationType` — Character vector that denotes the relationship type for each matched • `EndNodeID` — Node identifier for the end node for each matched relationship • `RelationData` — Structure array that contains property keys associated with each mat • `RelationObject` — `Neo4jRelation` object that represents each matched relationship The row names in the table are Neo4j relationship identifiers. If `criteria` contains relationship types, the output is automatically sorted by `RelationID`

Note When you use the `'DataReturnFormat'` name-value pair argument with the value `'digraph'`, the `searchGraph` function returns graph information in a `digraph` object. The resulting `digraph` object contains the same data as the `digraph` object created when you execute the `neo4jStruct2Digraph` function using the `graphinfo` output argument.

Version History

Introduced in R2016b

See Also

`neo4j` | `searchNode` | `searchNodeByID` | `searchRelation` | `relationTypes` | `nodeLabels` | `close`

Topics

"Determine Dependencies of Services in Network" on page 10-22
"Find Shortest Path Between People in Social Neighborhood" on page 10-27
"Find Friends of Friends in Social Neighborhood" on page 10-32
"Search Graph Database" on page 10-9
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

executeCypher

Namespace: `database.neo4j.http`

Execute Cypher query on Neo4j database

Syntax

`results = executeCypher(neo4jconn,query)`

Description

`results = executeCypher(neo4jconn,query)` returns data from the Neo4j database using the Neo4j database connection `neo4jconn` and a Cypher query. You can execute a Cypher query on the Neo4j database using the Cypher Query Language.

Examples

Execute Cypher Query in Neo4j Database

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create the Cypher® query that searches for the names of all nodes with the node label `Person`.

```
query = 'MATCH (node:Person) RETURN node.name';
```

Execute the query and display the results using the Neo4j database connection `neo4jconn`.

```
results = executeCypher(neo4jconn,query)
```

```
results=7×1 table
    node_name
    _________

     'User1'
     'User3'
     'User2'
```

```
    'User4'
    'User5'
    'User6'
    'User7'
```

`results` is a table that contains the column `node_name`. This column has the names of each node in the Neo4j database.

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`query` — Cypher query
character vector | string scalar

Cypher query, specified as a character vector or string scalar.

Example: `'MATCH (movie: Movie {title: ''The Matrix''}) RETURN movie.title, movie.studio'`

Data Types: `char` | `string`

Output Arguments

`results` — Cypher query results
table

Cypher query results, returned as a table. The columns in the table match the RETURN statement in the Cypher query.

Version History

Introduced in R2016b

See Also

`neo4j` | `searchGraph` | `searchNode` | `searchNodeByID` | `searchRelation` | `close`

Topics

"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Search Graph Database" on page 10-9
"Error Messages for Neo4j Database Interfaces" on page 10-20

nodeRelationTypes

Namespace: `database.neo4j.http`

Associated relationship types for Neo4j database node

Syntax

`nodereltypes = nodeRelationTypes(node,direction)`

Description

`nodereltypes = nodeRelationTypes(node,direction)` returns the relationship types for the specified `Neo4jNode` object and direction.

Examples

Search Relationship Types for Node

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the database for the node with node identifier `2` using the Neo4j database connection `neo4jconn`.

```
nodeid = 2;

node = searchNodeByID(neo4jconn,nodeid);
```

Search for all incoming relationships for the node. `nodereltypes` returns a list of the relationship types.

```
nodereltypes = nodeRelationTypes(node,'in')
```

```
nodereltypes = 1×1 cell array
    {'knows'}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

node — Neo4j database node
Neo4jNode object

Neo4j database node, specified as a `Neo4jNode` object created using `searchNode` or `searchNodeByID`.

`direction` — Relationship direction
'in' | 'out'

Relationship direction, specified as either `'in'` for an incoming relationship or `'out'` for an outgoing relationship. The relationships are associated with the specified origin node.

Output Arguments

`nodereltypes` — Relationship types
cell array of character vectors

Relationship types, returned as a cell array of character vectors. The cell array contains one character vector for one relationship or multiple character vectors for multiple relationships.

Version History

Introduced in R2016b

See Also

`nodeDegree` | `searchNodeByID` | `searchNode` | `close`

Topics

“Explore Graph Database Structure” on page 10-2
“Graph Database Workflow for Neo4j Database Interfaces” on page 10-6
“Search Graph Database” on page 10-9

nodeDegree

Namespace: `database.neo4j.http`

In-degree and out-degree for each associated relationship type for Neo4j database node

Syntax

`degree = nodeDegree(node,direction)`

Description

`degree = nodeDegree(node,direction)` returns the in- or out-degree for each relationship for the specified `Neo4jNode` object. `direction` specifies the relationship direction.

Examples

Search Node Degree for Node

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search the database for the node with node identifier `2` using the Neo4j® database connection `neo4jconn`.

```
nodeid = 2;
node = searchNodeByID(neo4jconn,nodeid);
```

Search for the degree of all incoming relationships for the node. `degree` returns a structure with the in-degree for each relationship type.

```
degree = nodeDegree(node,'in')
```

```
degree = struct with fields:
    knows: 1
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

node — Neo4j database node
`Neo4jNode` object

Neo4j database node, specified as a `Neo4jNode` object created using `searchNode` or `searchNodeByID`.

`direction` — Relationship direction
`'in'` | `'out'`

Relationship direction, specified as either `'in'` for an incoming relationship or `'out'` for an outgoing relationship. The relationships are associated with the specified origin node.

Output Arguments

degree — In- or out-degree
structure

In- or out-degree, returned as a structure. Each field in the structure represents either incoming or outgoing relationship types. If there are no incoming or outgoing relationship types, the structure is empty.

Version History

Introduced in R2016b

See Also

`searchNodeByID` | `searchNode` | `nodeRelationTypes` | `close`

Topics

"Explore Graph Database Structure" on page 10-2
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6
"Search Graph Database" on page 10-9

neo4jStruct2Digraph

Convert graph or relationship structure from Neo4j database to directed graph

Syntax

```
G = neo4jStruct2Digraph(s)
G = neo4jStruct2Digraph(s,'NodeNames',nodenames)
```

Description

`G = neo4jStruct2Digraph(s)` creates a directed graph from the structure `s`. With the directed graph, run graph network analytics using MATLAB. For example, to visualize the graph, see "Graph Plotting and Customization".

`G = neo4jStruct2Digraph(s,'NodeNames',nodenames)` specifies names of the Neo4j database nodes in the directed graph.

Examples

Create Directed Graph Using Relationships

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for incoming relationships using the Neo4j database connection `neo4jconn` and origin node identifier `nodeid`.

```
nodeid = 1;
direction = 'in';

relinfo = searchRelation(neo4jconn,nodeid,direction);
```

Convert the relationship information into a directed graph. `G` is a `digraph` object that contains two tables for edges and nodes.

```
G = neo4jStruct2Digraph(relinfo)
```

```
G = 
  digraph with properties:

    Edges: [2×3 table]
    Nodes: [3×3 table]
```

Access the table of edges.

```
G.Edges
```

```
ans=2×3 table
     EndNodes     RelationType    RelationData
    __________    ____________    ____________

    '0'    '1'      'knows'       [1×1 struct]
    '2'    '1'      'knows'       [1×1 struct]
```

Access the table of nodes.

```
G.Nodes
```

```
ans=3×3 table
    Name    NodeLabels      NodeData   
    ____    __________    ____________

    '0'      'Person'     [1×1 struct]
    '1'      'Person'     [1×1 struct]
    '2'      'Person'     [1×1 struct]
```

Find the shortest path between all nodes in G.

```
d = distances(G)
```

```
d = 3×3

     0     1   Inf
   Inf     0   Inf
   Inf     1     0
```

Close the database connection.

```
close(neo4jconn)
```

Create Directed Graph Using a Subgraph

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for a subgraph using the Neo4j database connection `neo4jconn` and node label `nlabel`.

```
nlabel = {'Person'};

graphinfo = searchGraph(neo4jconn,nlabel);
```

Convert the graph information into a directed graph. `G` is a `digraph` object that contains two tables for edges and nodes.

```
G = neo4jStruct2Digraph(graphinfo)
```

```
G =
  digraph with properties:

    Edges: [8×3 table]
    Nodes: [7×3 table]
```

Access the table of edges.

```
G.Edges
```

```
ans=8×3 table
     EndNodes      RelationType    RelationData
    ___________    ____________    ____________

    '0'    '1'       'knows'       [1×1 struct]
    '0'    '2'       'knows'       [1×1 struct]
    '1'    '3'       'knows'       [1×1 struct]
    '2'    '1'       'knows'       [1×1 struct]
    '3'    '4'       'knows'       [1×1 struct]
    '3'    '5'       'knows'       [1×1 struct]
    '5'    '4'       'knows'       [1×1 struct]
    '5'    '9'       'knows'       [1×1 struct]
```

Access the table of nodes.

```
G.Nodes
```

```
ans=7×3 table
    Name    NodeLabels      NodeData
    ____    __________    ____________

    '0'      'Person'     [1×1 struct]
    '1'      'Person'     [1×1 struct]
    '2'      'Person'     [1×1 struct]
    '3'      'Person'     [1×1 struct]
    '4'      'Person'     [1×1 struct]
    '5'      'Person'     [1×1 struct]
```

```
    '9'      'Person'     [1×1 struct]
```

Find the shortest path between all nodes in G.

```
d = distances(G)
```

```
d = 7×7

     0     1     1     2     3     3     4
   Inf     0   Inf     1     2     2     3
   Inf     1     0     2     3     3     4
   Inf   Inf   Inf     0     1     1     2
   Inf   Inf   Inf   Inf     0   Inf   Inf
   Inf   Inf   Inf   Inf     1     0     1
   Inf   Inf   Inf   Inf   Inf   Inf     0
```

Close the database connection.

```
close(neo4jconn)
```

Create Directed Graph Using Node Names

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for a subgraph using the Neo4j database connection `neo4jconn` and node label `nlabel`.

```
nlabel = {'Person'};

graphinfo = searchGraph(neo4jconn,nlabel);
```

Convert the graph information into a directed graph using the node names in the subgraph. Convert node names into a cell array of character vectors `nodenames`. `G` is a `digraph` object that contains two tables for edges and nodes.

```
names = [graphinfo.Nodes.NodeData{:}];
nodenames = {names(:).name};

G = neo4jStruct2Digraph(graphinfo,'NodeNames',nodenames)
```

```
G = 
  digraph with properties:

    Edges: [8×3 table]
    Nodes: [7×3 table]
```

Access the table of edges.

```
G.Edges
```

```
ans=8×3 table
          EndNodes          RelationType    RelationID
    ____________________    ____________    __________

    'User1'    'User3'        'knows'           1     
    'User1'    'User2'        'knows'           0     
    'User3'    'User4'        'knows'           3     
    'User2'    'User3'        'knows'           2     
    'User4'    'User5'        'knows'           5     
    'User4'    'User6'        'knows'           4     
    'User6'    'User5'        'knows'           6     
    'User6'    'User7'        'knows'           8     
```

Access the table of nodes.

```
G.Nodes
```

```
ans=7×3 table
      Name      NodeLabels      NodeData   
    _______    __________    ____________

    'User1'     'Person'     [1×1 struct]
    'User3'     'Person'     [1×1 struct]
    'User2'     'Person'     [1×1 struct]
    'User4'     'Person'     [1×1 struct]
    'User5'     'Person'     [1×1 struct]
    'User6'     'Person'     [1×1 struct]
    'User7'     'Person'     [1×1 struct]
```

Find the shortest path between all nodes in G.

```
d = distances(G)
```

```
d = 7×7

     0     1     1     2     3     3     4
   Inf     0   Inf     1     2     2     3
   Inf     1     0     2     3     3     4
   Inf   Inf   Inf     0     1     1     2
   Inf   Inf   Inf   Inf     0   Inf   Inf
   Inf   Inf   Inf   Inf     1     0     1
   Inf   Inf   Inf   Inf   Inf   Inf     0
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

s — Graph or relationship information
structure

Graph or relationship information, specified as a structure returned by `searchGraph` or `searchRelation`.

Data Types: `struct`

nodenames — Node names
cell array of character vectors | string array

Node names in a Neo4j database, specified as a cell array of character vectors or string array.

Example: `["User6","User7"]`

Data Types: `cell` | `string`

Output Arguments

G — Directed graph
`digraph` object

Directed graph, returned as a `digraph` object.

Version History

Introduced in R2016b

See Also

`neo4j` | `searchNode` | `searchGraph` | `searchRelation` | `distances` | `close`

Topics

"Determine Dependencies of Services in Network" on page 10-22
"Find Shortest Path Between People in Social Neighborhood" on page 10-27
"Find Friends of Friends in Social Neighborhood" on page 10-32
"Search Graph Database" on page 10-9
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

createNode

Namespace: `database.neo4j.http`

Create nodes in Neo4j database

Syntax

```
createNode(neo4jconn)
createNode(neo4jconn,Name,Value)
nodeinfo = createNode( ___ )
```

Description

`createNode(neo4jconn)` creates a single node without labels and properties by using a Neo4j database connection.

`createNode(neo4jconn,Name,Value)` creates a single node or multiple nodes and returns node information by specifying additional options using one or more name-value pair arguments. For example, `'Labels','Person'` creates a node with the label `Person`.

`nodeinfo = createNode( ___ )` returns node information as a `Neo4jNode` object for one node, or as a table for multiple nodes, using any of the input argument combinations in the previous syntaxes.

Examples

Create Single Node

Create a single node in a Neo4j® database and display the contents of the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the database using the Neo4j database connection.

```
createNode(neo4jconn)
```

When you execute the `createNode` function without any arguments except the Neo4j database connection, the function creates a single node without labels and properties.

Close the database connection.

```
close(neo4jconn)
```

Create Single Node with Label

Create a single node with a label in a Neo4j® database and access the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node with a label in the database by using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the label `Scientist`.

```
label = 'Scientist';
createNode(neo4jconn,'Labels',label)
```

Search for the new node using the label `Scientist`.

```
nodeinfo = searchNode(neo4jconn,label)
```

```
nodeinfo = 
  Neo4jNode with properties:

        NodeID: 6
      NodeData: [1×1 struct]
    NodeLabels: 'Scientist'
```

`nodeinfo` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Close the database connection.

```
close(neo4jconn)
```

Create Two Nodes with Labels

Create two nodes with labels in a Neo4j® database. Access data in the nodes.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes that represent two people in the database by using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the node labels. One node has the label `Person`, and the other node has two labels, `Person` and `Employee`.

```
labels = {{'Person'},{'Person','Employee'}};
nodeinfo = createNode(neo4jconn,'Labels',labels)
```

```
nodeinfo=2×3 table
          NodeLabels      NodeData                  NodeObject
          __________    ____________    ___________________________________

    35    'Person'      [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    36    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

`nodeinfo` is a table with two rows, one for each person. The table contains these variables:

- Node label
- Node data
- `Neo4jNode` object

Access the `Neo4jNode` object for the first node.

```
data = nodeinfo.NodeObject(1)
```

```
data = 
  Neo4jNode with properties:

        NodeID: 35
      NodeData: [1×1 struct]
```

```
    NodeLabels: 'Person'
```

`data` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node label

Access the node labels of both nodes.

```
nodeinfo.NodeObject(1).NodeLabels
```

```
ans = 
'Person'
```

```
nodeinfo.NodeObject(2).NodeLabels
```

```
ans = 2×1 cell array
    {'Person'  }
    {'Employee'}
```

Close the database connection.

```
close(neo4jconn)
```

Create Two Nodes with Labels and Properties

Create two nodes with labels and properties in a Neo4j® database. Access the data in the nodes.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a table with two rows that contain the names and job titles of two people (users).

```
props = table(["User8";"User9"],["Analyst";"Technician"], ...
    'VariableNames',{'Name','Title'});
```

Create two nodes that represent these two people in the database by using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the node labels `Person` and `Employee`. Then, use the `'Properties'` name-value pair argument to specify the node properties using the `props` table.

```
labels = ["Person","Employee"];
nodeinfo = createNode(neo4jconn,'Labels',labels,'Properties',props)
```

```
nodeinfo=2×3 table
          NodeLabels      NodeData                   NodeObject
          __________    ____________    ___________________________________

    28    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    21    {2×1 cell}    [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

`nodeinfo` is a table with two rows, one for each person. The table contains these variables:

- Node label
- Node data
- `Neo4jNode` object

Access the properties of the first node. This structure contains the properties of the node as fields and values.

```
nodeinfo.NodeData{1}
```

```
ans = struct with fields:
    Title: 'Analyst'
     Name: 'User8'
```

Access the `Neo4jNode` object for the first node.

```
data = nodeinfo.NodeObject(1)
```

```
data = 
  Neo4jNode with properties:

        NodeID: 28
      NodeData: [1×1 struct]
    NodeLabels: {2×1 cell}
```

`data` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node label

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `node = createNode(neo4jconn,'Labels','Person','Properties',table(["User8"],["Analyst"],'VariableNames',{'Name','Title'}))` creates a single node with the label `Person` and two properties, `Name` and `Title`, with their corresponding values, `User8` and `Analyst`.

`Labels` — Node labels
character vector | string scalar | cell array of character vectors | string array | cell array of cell arrays | cell array of string arrays

Node labels, specified as the comma-separated pair consisting of `'Labels'` and a character vector, string scalar, cell array of character vectors, string array, cell array of cell arrays, or cell array of string arrays. To specify one node label, use a character vector or string scalar. For multiple node labels, use a cell array of character vectors or a string array. To create multiple nodes with different labels, use a cell array of cell arrays or a cell array of string arrays.

Note If you do not specify any labels, then the created node has no labels by default.

Example: `'Labels','Person'`

Data Types: `char` | `string` | `cell`

`Properties` — Node properties
structure | structure array | table | cell array of structures

Node properties, specified as the comma-separated pair consisting of `'Properties'` and a structure, structure array, table, or cell array of structures.

When you specify a structure, the `createNode` function converts each field and its corresponding value to a property and its corresponding value in the database node. The function also sets the `NodeData` property of the `Neo4jNode` object to this structure.

When you specify a table that contains one row, the `createNode` function converts each variable and its corresponding value to a property and its corresponding value in the database node. The function also converts the variables and their corresponding values to fields and their corresponding values in a structure. The function sets this structure to the `NodeData` property of the `Neo4jNode` object.

To create multiple nodes, specify a structure array or table with multiple rows.

To create multiple nodes with different properties, specify a cell array of structures.

Note If a property is missing its corresponding value, then the created node does not contain this property.

Data Types: `struct` | `table` | `cell`

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or as a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node
- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

Version History

Introduced in R2018a

See Also

`deleteNode` | `neo4j` | `updateNode` | `addNodeLabel` | `removeNodeLabel` | `setNodeProperty` | `removeNodeProperty` | `close`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

createRelation

Namespace: `database.neo4j.http`

Create relationships between nodes in Neo4j database

Syntax

```
createRelation(neo4jconn,startnode,endnode,relationtype)
createRelation(neo4jconn,startnode,endnode,relationtype,'Properties',
properties)
relationinfo = createRelation( ___ )
```

Description

`createRelation(neo4jconn,startnode,endnode,relationtype)` creates a single relationship or multiple relationships between the start nodes and end nodes with specified relationship types by using the Neo4j database connection.

`createRelation(neo4jconn,startnode,endnode,relationtype,'Properties', properties)` specifies the properties of the new relationships.

`relationinfo = createRelation( ___ )` returns relationship information as a `Neo4jRelation` object or a table using any of the input argument combinations in the previous syntaxes.

Examples

Create Single Relationship Between Two Nodes

Create a single relationship between two nodes in a Neo4j® database and display the relationship.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the label `Person` for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. Specify the relationship type as `works with`.

```
relationtype = 'works with';
createRelation(neo4jconn,startnode,endnode,relationtype)
```

Search for the new relationship and display its relationship type.

```
direction = "out";
relinfo = searchRelation(neo4jconn,startnode,direction, ...
    'RelationTypes',relationtype,'Distance',2);
relinfo.Relations.RelationType
```

```
ans = 1×1 cell array
    {'works with'}
```

Close the database connection.

```
close(neo4jconn)
```

Create Single Relationship with Properties

Create a single relationship with properties between two nodes in a Neo4j® database and display the properties.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the label `Person` for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. The nodes represent two colleagues who started working together on a project named `Database` on September

1, 2017. Specify the relationship type as `works with`. Specify the project name and start date as properties of the relationship by using the `properties` structure.

```
relationtype = 'works with';
properties.Project = 'Database';
properties.StartDate = '09/01/2017';
createRelation(neo4jconn,startnode,endnode,relationtype, ...
    'Properties',properties)
```

Search for the new relationship and display its properties.

```
direction = "out";
relinfo = searchRelation(neo4jconn,startnode,direction, ...
    'RelationTypes',relationtype,'Distance',2);
relinfo.Relations.RelationData{1}
```

```
ans = struct with fields:
    StartDate: '09/01/2017'
      Project: 'Database'
```

Close the database connection.

```
close(neo4jconn)
```

Create Multiple Relationships

Create two relationships between nodes in a Neo4j® database and display the relationships.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for the node with the label `Person` and the property key `name` set to the value `User7` by using the Neo4j database connection.

```
nlabel = 'Person';
user7 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7');
```

Create two nodes in the database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the label `Person` for each node.

```
label = 'Person';
user8 = createNode(neo4jconn,'Labels',label);
user9 = createNode(neo4jconn,'Labels',label);
```

Create two relationships using the Neo4j database connection. Specify the relationship types as `works with` and `studies with`. The two relationships are:

- `User8` works with `User7`
- `User8` studies with `User9`

```
startnode = [user8,user8];
endnode = [user7,user9];
relationtype = {'works with','studies with'};
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype)
```

```
relationinfo=2×5 table
         StartNodeID     RelationType      EndNodeID     RelationData               RelationObjec
         ___________    ______________    _________    ____________    __________________________

    9         6         'works with'          9        [1×1 struct]    [1x1 database.neo4j.http.N
    7         6         'studies with'        7        [1×1 struct]    [1x1 database.neo4j.http.N
```

`relationinfo` is a table with these variables:

- Start node identifier
- Relationship type
- End node identifier
- Relationship data
- `Neo4jRelation` object

Display the `Neo4jRelation` object for the first relationship.

```
relation = relationinfo.RelationObject(1)
```

```
relation = 
  Neo4jRelation with properties:

      RelationID: 9
    RelationData: [1×1 struct]
     StartNodeID: 6
    RelationType: 'works with'
       EndNodeID: 9
```

`relation` is a `Neo4jRelation` object with these properties:

- Relationship identifier

- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

startnode — Start node
numeric scalar | numeric vector | Neo4jNode object | Neo4jNode object array

Start node, specified as a numeric scalar, numeric vector, `Neo4jNode` object, or `Neo4jNode` object array. To specify database nodes using node identifiers, use a numeric scalar for one node or a numeric vector for multiple nodes. To specify database nodes as `Neo4jNode` objects, use the object for one node or an array of the objects for multiple nodes.

The number of start nodes must match the number of end nodes in `endnode`.

The number of start nodes equals the number of relationships created by the `createRelation` function in the Neo4j database.

Example: 8

endnode — End node
numeric scalar | numeric vector | Neo4jNode object | Neo4jNode object array

End node, specified as a numeric scalar, numeric vector, `Neo4jNode` object, or `Neo4jNode` object array. To specify database nodes using node identifiers, use a numeric scalar for one node or a numeric vector for multiple nodes. To specify database nodes as `Neo4jNode` objects, use the object for one node or an array of the objects for multiple nodes.

The number of end nodes must match the number of start nodes in `startnode`.

The number of end nodes equals the number of relationships created by the `createRelation` function in the Neo4j database.

Example: 9

relationtype — Relationship type
character vector | string scalar | cell array of character vectors | string array

Relationship type, specified as a character vector, string scalar, cell array of character vectors, or string array. To specify one relationship type, use a character vector or string scalar. To specify multiple relationship types, use a cell array of character vectors or a string array.

If you specify only one relationship type, all relationships must have the same type. Otherwise, the number of relationship types in this input argument must match the number of nodes in `startnode` and `endnode`.

Example: `'knows'`

Data Types: `char` | `string` | `cell`

`properties` — Relationship properties
structure | structure array | table | cell array of structures

Relationship properties, specified as a structure, structure array, table, or cell array of structures.

When you specify a structure, the `createRelation` function converts each field and its corresponding value to a property and its corresponding value in the database relationship. When you specify a table with one row, the function converts each variable and its corresponding value to a property and its corresponding value in the database relationship.

The `createRelation` function also sets the `RelationObject` variable of the `relationinfo` output argument to the `Neo4jRelation` object, which contains the relationship information.

For multiple relationships, specify a structure array or table with multiple rows.

For multiple relationships with different properties, specify a cell array of structures.

Note If a property is missing its corresponding value, then the updated relationship does not contain this property.

Data Types: `struct` | `table` | `cell`

Output Arguments

`relationinfo` — Relationship information
`Neo4jRelation` object | table

Relationship information, returned as a `Neo4jRelation` object for one relationship or as a table for multiple relationships.

For multiple relationships, the table contains these variables:

- `StartNodeID` — Node identifier of the start node for each matched relationship
- `RelationType` — Character vector that denotes the relationship type for each matched relationship
- `EndNodeID` — Node identifier of the end node for each matched relationship
- `RelationData` — Structure array that contains property keys associated with each matched relationship
- `RelationObject` — `Neo4jRelation` object for each matched relationship

The row names in the table are Neo4j relationship identifiers.

Version History

Introduced in R2018a

See Also

`neo4j` | `updateRelation` | `deleteRelation` | `setRelationProperty` | `removeRelationProperty` | `close` | `createNode` | `searchNode` | `searchRelation`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

deleteNode

Namespace: `database.neo4j.http`

Delete nodes from Neo4j database

Syntax

```
deleteNode(neo4jconn,node)
deleteNode(neo4jconn,node,'DeleteRelations','true')
```

Description

`deleteNode(neo4jconn,node)` deletes a single node or multiple nodes using the Neo4j database connection. If a specified node has an associated relationship, this syntax throws an error.

`deleteNode(neo4jconn,node,'DeleteRelations','true')` deletes nodes and their associated relationships without throwing an error.

Examples

Delete Node

Create a single node in a Neo4j® database and delete the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the Neo4j database using the Neo4j database connection.

```
node = createNode(neo4jconn)
```

```
node = 
  Neo4jNode with properties:

        NodeID: 7
      NodeData: [1×1 struct]
    NodeLabels: []
```

`node` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node label

Delete the node using the Neo4j database connection.

```
deleteNode(neo4jconn,node)
```

Close the database connection.

```
close(neo4jconn)
```

Delete Node and Its Relationship

Create a single relationship between two nodes in a Neo4j® database. Then, delete one of the nodes and the relationship.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between two nodes using the Neo4j database connection. Specify the relationship type as `works with`.

```
relationtype = 'works with';
relation = createRelation(neo4jconn,startnode,endnode,relationtype)
```

```
relation = 
  Neo4jRelation with properties:

      RelationID: 19
    RelationData: [1×1 struct]
```

```
     StartNodeID: 14
    RelationType: 'works with'
       EndNodeID: 15
```

`relation` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Delete the first node and the associated relationship. Use this syntax to delete the node and relationship without throwing an error.

```
deleteNode(neo4jconn,startnode,'DeleteRelations',true)
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

node — Node
`Neo4jNode` object | `Neo4jNode` object array | numeric scalar | numeric vector

Node in a Neo4j database, specified as a `Neo4jNode` object, `Neo4jNode` object array, numeric scalar, or a numeric vector. For one node, specify a `Neo4jNode` object or a numeric scalar. For multiple nodes, specify a `Neo4jNode` object array or a numeric vector.

The numeric scalar or vector must contain Neo4j database node identifiers.

Example: 15

Example: `[2,3,4]`

Version History

Introduced in R2018a

See Also

`neo4j` | `createNode` | `createRelation` | `updateNode` | `close`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

deleteRelation

Namespace: `database.neo4j.http`

Delete relationships from Neo4j database

Syntax

`deleteRelation(neo4jconn,relation)`

Description

`deleteRelation(neo4jconn,relation)` deletes a single relationship or multiple relationships using the Neo4j database connection.

Examples

Delete Relationship from Neo4j Database

Create a single relationship between two nodes in a Neo4j® database. Then, delete the relationship and the corresponding nodes.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the Neo4j database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the `Person` node label for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. These nodes represent two colleagues who work together. Specify the relationship type as `works with`.

```
relationtype = 'works with';
relation = createRelation(neo4jconn,startnode,endnode,relationtype)
```

```
relation = 
  Neo4jRelation with properties:

      RelationID: 17
    RelationData: [1×1 struct]
     StartNodeID: 52
    RelationType: 'works with'
       EndNodeID: 6
```

`relation` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Delete the relationship.

```
deleteRelation(neo4jconn,relation)
```

Delete the two nodes by using a `Neo4jNode` object array.

```
nodes = [startnode,endnode];
deleteNode(neo4jconn,nodes)
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`relation` — Relationship
`Neo4jRelation` object | `Neo4jRelation` object array | numeric scalar | numeric vector

Relationship in a Neo4j database, specified as a `Neo4jRelation` object, `Neo4jRelation` object array, numeric scalar, or numeric vector. For a single relationship, use a `Neo4jRelation` object or a numeric scalar that contains the relationship identifier. For multiple relationships, use a `Neo4jRelation` object array or a numeric vector that contains an array of relationship identifiers.

Example: 15

Example: `[15,16,17]`

Version History

Introduced in R2018a

See Also

`neo4j` | `createRelation` | `createNode` | `updateRelation` | `close`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

updateNode

Namespace: `database.neo4j.http`

Update node labels and properties in Neo4j database

Syntax

```
updateNode(neo4jconn,node,'Labels',labels)
updateNode(neo4jconn,node,'Properties',properties)
updateNode(neo4jconn,node,'Labels',labels,'Properties',properties)
nodeinfo = updateNode( ___ )
```

Description

`updateNode(neo4jconn,node,'Labels',labels)` updates existing node labels with the specified node labels using a Neo4j database connection.

`updateNode(neo4jconn,node,'Properties',properties)` updates existing node properties with the specified node properties.

`updateNode(neo4jconn,node,'Labels',labels,'Properties',properties)` updates existing node labels and properties.

`nodeinfo = updateNode( ___ )` returns updated node information as a `Neo4jNode` object for one node, or as a table for multiple nodes, using any of the input argument combinations in the previous syntaxes.

Examples

Update Node Labels

Create a single node in a Neo4j® database and update its node labels.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the database using the Neo4j database connection.

```
node = createNode(neo4jconn)
```

```
node = 
  Neo4jNode with properties:

        NodeID: 47
      NodeData: [1×1 struct]
    NodeLabels: []
```

`node` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node label

Update the node by adding the labels `Person` and `Employee`.

```
labels = ["Person","Employee"];
updateNode(neo4jconn,node,'Labels',labels)
```

Display the updated node information. `nodeinfo` is a `Neo4jNode` object.

```
nodeid = node.NodeID;
nodeinfo = searchNodeByID(neo4jconn,nodeid);
nodeinfo.NodeLabels
```

```
ans = 2×1 cell array
    {'Person'  }
    {'Employee'}
```

Close the database connection.

```
close(neo4jconn)
```

Update Properties of Existing Node

Search for an existing node in a Neo4j® database, add a node property, and display the updated node properties.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for a node with the label `Person`. Then, using the Neo4j database connection, filter the results by the property key and value for the person named `User7`.

```
nlabel = 'Person';
node = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7')
```

```
node =
  Neo4jNode with properties:

        NodeID: 9
      NodeData: [1×1 struct]
    NodeLabels: 'Person'
```

`node` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Retrieve the existing properties of the node by using the `NodeData` property of the `Neo4jNode` object. `properties` is a structure.

```
properties = node.NodeData
```

```
properties = struct with fields:
    name: 'User7'
```

Update the properties of the node. Add another node property by setting a new field in the structure to specify the job title of the person.

```
properties.title = 'Analyst';
updateNode(neo4jconn,node,'Properties',properties)
```

Display the updated node properties. `nodeinfo` is a `Neo4jNode` object.

```
nodeid = node.NodeID;
nodeinfo = searchNodeByID(neo4jconn,nodeid);
nodeinfo.NodeData
```

```
ans = struct with fields:
     name: 'User7'
    title: 'Analyst'
```

Close the database connection.

```
close(neo4jconn)
```

Update Labels and Properties for One Node

Create a single node in a Neo4j® database, update its node labels and properties, and display them.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the database using the Neo4j database connection.

```
node = createNode(neo4jconn)
```

```
node = 
  Neo4jNode with properties:

        NodeID: 48
      NodeData: [1×1 struct]
    NodeLabels: []
```

`node` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Create a table with one row that contains data about a person. Specify the name and job title of the person.

```
properties = table("User8","Analyst",'VariableNames',{'Name','Title'});
```

Update the node by adding the labels `Person` and `Employee` and the node properties defined in the table.

```
labels = ["Person","Employee"];
updateNode(neo4jconn,node,'Labels',labels, ...
    'Properties',properties)
```

Display the updated node labels. `nodeinfo` is a `Neo4jNode` object.

```
nodeid = node.NodeID;
nodeinfo = searchNodeByID(neo4jconn,nodeid);
nodeinfo.NodeLabels
```

```
ans = 2×1 cell array
    {'Person'  }
    {'Employee'}
```

Display the updated node properties.

```
nodeinfo.NodeData
```

```
ans = struct with fields:
    Title: 'Analyst'
     Name: 'User8'
```

Close the database connection.

```
close(neo4jconn)
```

Update Labels and Properties for Two Nodes

Create two nodes in a Neo4j® database, update their node labels and properties, and display the labels and properties for the first node.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the database using the Neo4j database connection. These nodes represent two people.

```
user8 = createNode(neo4jconn);
user9 = createNode(neo4jconn);
```

Create a table with two rows. Each row contains data about a person. Specify the name and job title for each person.

```
properties = table(["User8";"User9"],["Analyst";"Technician"], ...
    'VariableNames',{'Name','Title'});
```

Update the nodes by adding the labels `Person` and `Employee` and the node properties defined in the table.

```
labels = ["Person","Employee"];
updateNode(neo4jconn,[user8;user9],'Labels',labels, ...
    'Properties',properties)
```

Display the node labels for the nodes.

```
nodeid = [user8.NodeID user9.NodeID];
nodeinfo = searchNodeByID(neo4jconn,nodeid);
nodeinfo.NodeLabels{:}
```

```
ans = 2×1 cell array
    {'Person'  }
    {'Employee'}


ans = 2×1 cell array
    {'Person'  }
    {'Employee'}
```

Display the node properties for the nodes.

```
nodeinfo.NodeData{:}
```

```
ans = struct with fields:
    Title: 'Analyst'
     Name: 'User8'


ans = struct with fields:
    Title: 'Technician'
     Name: 'User9'
```

Close the database connection.

```
close(neo4jconn)
```

Update Node Properties and Return Output

Create a single node in a Neo4j® database, update its properties, and display them. Access the updated node information using an output argument.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a single node in the database using the Neo4j database connection.

```
node = createNode(neo4jconn)
```

```
node =
  Neo4jNode with properties:

        NodeID: 49
      NodeData: [1×1 struct]
    NodeLabels: []
```

`node` is a `Neo4jNode` object with these properties:

- Node identifier
- Node data
- Node labels

Update the properties of a node that represents a person. Create a table with one row that contains the name and job title for this person. The `nodeinfo` output argument is a `Neo4jNode` object.

```
properties = table("User8","Analyst",'VariableNames',{'Name','Title'});
nodeinfo = updateNode(neo4jconn,node,'Properties',properties);
```

Display the node properties.

```
nodeinfo.NodeData
```

```
ans = struct with fields:
    Title: 'Analyst'
     Name: 'User8'
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`node` — Node
`Neo4jNode` object | `Neo4jNode` object array | numeric scalar | numeric vector

Node in a Neo4j database, specified as a `Neo4jNode` object, `Neo4jNode` object array, numeric scalar, or a numeric vector. For one node, specify a `Neo4jNode` object or a numeric scalar. For multiple nodes, specify a `Neo4jNode` object array or a numeric vector.

The numeric scalar or vector must contain Neo4j database node identifiers.

Example: `15`

Example: `[2,3,4]`

`labels` — Node labels
character vector | cell array of character vectors | string scalar | string array | cell array of cell arrays | cell array of string arrays

Node labels, specified as a character vector, cell array of character vectors, string scalar, string array, cell array of cell arrays, or cell array of string arrays. To specify one node label, use a character vector or string scalar. For multiple node labels, use a cell array of character vectors or a string array. To update multiple nodes with different node labels, use a cell array of cell arrays or a cell array of string arrays.

Example: `'Person'`

Data Types: `char` | `string` | `cell`

`properties` — Node properties
structure | structure array | table | cell array of structures

Node properties, specified as a structure, structure array, table, or cell array of structures.

When you specify a structure, the `updateNode` function converts each field and its corresponding value to a property and its corresponding value in the database node. The function also sets the `NodeData` property of the `Neo4jNode` object to this structure.

When you specify a table that contains one row, the `updateNode` function converts each variable and its corresponding value to a property and its corresponding value in the database node. The function also converts the variables and their corresponding values to fields and their corresponding values in a structure. The function sets this structure to the `NodeData` property of the `Neo4jNode` object.

To update multiple nodes, specify a structure array or table with multiple rows.

To update multiple nodes with different properties, specify a cell array of structures.

Note If a property is missing its corresponding value, then the updated node does not contain this property.

Data Types: `struct` | `table` | `cell`

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or as a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node
- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

Version History

Introduced in R2018a

See Also

`neo4j` | `createNode` | `searchNode` | `searchNodeByID` | `deleteNode` | `addNodeLabel` | `removeNodeLabel` | `removeNodeProperty` | `setNodeProperty` | `close`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

updateRelation

Namespace: `database.neo4j.http`

Update relationship properties in Neo4j database

Syntax

```
updateRelation(neo4jconn,relation,properties)
relationinfo = updateRelation(neo4jconn,relation,properties)
```

Description

`updateRelation(neo4jconn,relation,properties)` updates the properties for one or more relationships in a Neo4j database using a Neo4j database connection.

`relationinfo = updateRelation(neo4jconn,relation,properties)` returns updated relationship information as a `Neo4jRelation` object for one relationship, or as a table for multiple relationships.

Examples

Update Relationship Between Two Nodes

Create a single relationship between two nodes in a Neo4j® database and update the properties of the relationship.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the label `Person` for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. Specify the relationship type as `works with`. The output `relationinfo` is a `Neo4jRelation` object.

```
relationtype = 'works with';
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype);
```

Update the relationship to include two more properties. The nodes represent two colleagues who started working together on a project named `Database` on September 1, 2017. Specify the project name and start date as properties of the relationship by using the `properties` structure.

```
properties.Project = 'Database';
properties.StartDate = '09/01/2017';
updateRelation(neo4jconn,relationinfo,properties)
```

Display the updated relationship information.

```
relationid = relationinfo.RelationID;
relationinfo = searchRelationByID(neo4jconn,relationid);
relationinfo.RelationType
```

```
ans =
'works with'
```

```
relationinfo.RelationData
```

```
ans = struct with fields:
    StartDate: '09/01/2017'
      Project: 'Database'
```

Close the database connection.

```
close(neo4jconn)
```

Update Relationship Between Two Nodes and Return Output

Create a single relationship between two nodes in a Neo4j® database, update the properties of the relationship, and display the properties. Access the updated relationship information using an output argument.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create two nodes in the database using the Neo4j database connection. Use the `'Labels'` name-value pair argument to specify the label `Person` for each node.

```
label = 'Person';
startnode = createNode(neo4jconn,'Labels',label);
endnode = createNode(neo4jconn,'Labels',label);
```

Create a relationship between the two nodes using the Neo4j database connection. Specify the relationship type as `works with`. The output `relationinfo` is a `Neo4jRelation` object.

```
relationtype = 'works with';
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype);
```

Update the relationship to include two more properties. The nodes represent two colleagues who started working together on a project named `Database` on September 1, 2017. Specify the project name and start date as properties of the relationship by using the `properties` structure.

```
properties.Project = 'Database';
properties.StartDate = '09/01/2017';
relationinfo = updateRelation(neo4jconn,relationinfo,properties)
```

```
relationinfo =
  Neo4jRelation with properties:

      RelationID: 18
    RelationData: [1×1 struct]
     StartNodeID: 50
    RelationType: 'works with'
       EndNodeID: 51
```

`relationinfo` is a `Neo4jRelation` object that contains these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Display the updated relationship properties.

```
relationinfo.RelationData
```

```
ans = struct with fields:
    StartDate: '09/01/2017'
      Project: 'Database'
```

Close the database connection.

```
close(neo4jconn)
```

Update Multiple Relationships

Create two relationships between nodes in a Neo4j® database, update the properties of the relationships, and display the properties.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key name with a value ranging from User1 through User7. Each relationship has the type knows.

Create a Neo4j database connection using the URL http://localhost:7474/db/data, user name neo4j, and password matlab.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the Message property of the Neo4j connection object neo4jconn. The blank Message property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for the node with the label Person and the property key name set to the value User7 by using the Neo4j database connection.

```
nlabel = 'Person';
user7 = searchNode(neo4jconn,nlabel,'PropertyKey','name', ...
    'PropertyValue','User7');
```

Create two nodes in the database using the Neo4j database connection. Use the 'Labels' name-value pair argument to specify the label Person for each node.

```
label = 'Person';
user8 = createNode(neo4jconn,'Labels',label);
user9 = createNode(neo4jconn,'Labels',label);
```

Create two relationships using the Neo4j database connection. Specify the relationship types as works with and studies with. The two relationships are:

- User8 works with User7
- User8 studies with User9

relationinfo is a table that contains the relationship and node information.

```
startnode = [user8,user8];
endnode = [user7,user9];
relationtype = {'works with','studies with'};
relationinfo = createRelation(neo4jconn,startnode,endnode,relationtype);
```

Create a table that defines the properties. Here, `User8` works with `User7` in the workplace, and `User8` studies with `User9` in the library. Also, `User8` started working with `User7` on January 2, 2017, and `User8` started studying with `User9` on March 6, 2017.

```
properties = table(["Workplace";"Library"],["01/02/2017";"03/06/2017"], ...
    'VariableNames',{'Location','Date'});
```

Update both relationships with these properties.

```
relations = relationinfo.RelationObject;
relationinfo = updateRelation(neo4jconn,relations,properties)
```

```
relationinfo=2×5 table
          StartNodeID     RelationType      EndNodeID     RelationData              RelationObje
          ___________    ______________     _________    ____________    _________________________

    12        17         'works with'           9        [1×1 struct]    [1x1 database.neo4j.http
    11        17         'studies with'        18        [1×1 struct]    [1x1 database.neo4j.http
```

`relationinfo` is a table with these variables:

- Start node identifier
- Relationship type
- End node identifier
- Relationship data
- `Neo4jRelation` object

Display the updated properties of the relationships.

```
relationinfo.RelationData{1}
```

```
ans = struct with fields:
        Date: '01/02/2017'
    Location: 'Workplace'
```

```
relationinfo.RelationData{2}
```

```
ans = struct with fields:
        Date: '03/06/2017'
    Location: 'Library'
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

relation — Relationship
Neo4jRelation object | Neo4jRelation object array | numeric scalar | numeric vector

Relationship in a Neo4j database, specified as a Neo4jRelation object, Neo4jRelation object array, numeric scalar, or numeric vector. For a single relationship, use a Neo4jRelation object or a numeric scalar that contains the relationship identifier. For multiple relationships, use a Neo4jRelation object array or a numeric vector that contains an array of relationship identifiers.

Example: 15

Example: [15,16,17]

properties — Relationship properties
structure | structure array | table | cell array of structures

Relationship properties, specified as a structure, structure array, table, or cell array of structures.

When you specify a structure, the updateRelation function converts each field and its corresponding value to a property and its corresponding value in the database relationship. When you specify a table with one row, the function converts each variable and its corresponding value to a property and its corresponding value in the database relationship.

The updateRelation function also sets the RelationObject variable of the relationinfo output argument to the Neo4jRelation object, which contains the relationship information.

For multiple relationships, specify a structure array or table with multiple rows.

For multiple relationships with different properties, specify a cell array of structures.

Note If a property is missing its corresponding value, then the updated relationship does not contain this property.

Data Types: struct | table | cell

Output Arguments

relationinfo — Relationship information
Neo4jRelation object | table

Relationship information, returned as a Neo4jRelation object for one relationship or as a table for multiple relationships.

For multiple relationships, the table contains these variables:

- StartNodeID — Node identifier of the start node for each matched relationship
- RelationType — Character vector that denotes the relationship type for each matched relationship
- EndNodeID — Node identifier of the end node for each matched relationship
- RelationData — Structure array that contains property keys associated with each matched relationship
- RelationObject — Neo4jRelation object for each matched relationship

The row names in the table are Neo4j relationship identifiers.

Version History

Introduced in R2018a

See Also

`neo4j` | `createRelation` | `deleteRelation` | `setRelationProperty` | `removeRelationProperty` | `close` | `createNode` | `searchNode` | `searchRelationByID`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

searchRelationByID

Namespace: `database.neo4j.http`

Search Neo4j relationship by relationship identifier

Syntax

`relationinfo = searchRelationByID(neo4jconn,relationid)`

Description

`relationinfo = searchRelationByID(neo4jconn,relationid)` returns the Neo4j relationship specified by the relationship identifier using the Neo4j database connection.

Examples

Search for Relationships

Search for a single relationship or multiple relationships by using relationship identifiers in the Neo4j® database.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Search for the relationship with the identifier `8` by using the Neo4j database connection.

```
relationid = 8;
relationinfo = searchRelationByID(neo4jconn,relationid)
```

```
relationinfo =
  Neo4jRelation with properties:
```

```
      RelationID: 8
    RelationData: [1×1 struct]
     StartNodeID: 5
    RelationType: 'knows'
       EndNodeID: 9
```

`relationinfo` is a `Neo4jRelation` object with these properties:

- Relationship identifier
- Relationship data
- Start node identifier
- Relationship type
- End node identifier

Display the relationship type.

```
relationinfo.RelationType
```

```
ans = 
'knows'
```

Search for multiple relationships with the identifiers `4`, `5`, and `6` by using the Neo4j database connection.

```
relationid = [4,5,6];
relationinfo = searchRelationByID(neo4jconn,relationid)
```

```
relationinfo=3×5 table
         StartNodeID    RelationType    EndNodeID    RelationData              RelationObject
         ___________    ____________    _________    ____________    ______________________________

    5         3           'knows'           4        [1×1 struct]    [1x1 database.neo4j.http.Neo
    4         3           'knows'           5        [1×1 struct]    [1x1 database.neo4j.http.Neo
    6         5           'knows'           4        [1×1 struct]    [1x1 database.neo4j.http.Neo
```

`relationinfo` is a table with these variables:

- Start node identifier
- Relationship type
- End node identifier
- Relationship data
- `Neo4jRelation` object

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`relationid` — Relationship identifier
numeric scalar | numeric vector

Relationship identifier, specified as a numeric scalar for a single relationship or numeric vector for multiple relationships.

Example: `[15,16]`

Data Types: `double`

Output Arguments

`relationinfo` — Relationship information
`Neo4jRelation` object | table

Relationship information, returned as a `Neo4jRelation` object for one relationship or as a table for multiple relationships.

For multiple relationships, the table contains these variables:

- `StartNodeID` — Node identifier of the start node for each matched relationship
- `RelationType` — Character vector that denotes the relationship type for each matched relationship
- `EndNodeID` — Node identifier of the end node for each matched relationship
- `RelationData` — Structure array that contains property keys associated with each matched relationship
- `RelationObject` — `Neo4jRelation` object for each matched relationship

The row names in the table are Neo4j relationship identifiers.

Version History
Introduced in R2018a

See Also
`neo4j` | `searchNodeByID` | `searchRelation` | `close`

Topics
“Explore Graph Database Structure” on page 10-2
“Graph Database Workflow for Neo4j Database Interfaces” on page 10-6

storeDigraph

Namespace: `database.neo4j.http`

Store directed graph in Neo4j database

Syntax

```
storeDigraph(neo4jconn,G)
storeDigraph(neo4jconn,G,Name,Value)
graphinfo = storeDigraph( ___ )
```

Description

`storeDigraph(neo4jconn,G)` converts a directed graph to a Neo4j graph and stores it in a Neo4j database using a Neo4j database connection. The variables in the node and edge tables of the `digraph` object (except the `EndNodes` variable) become the properties of the nodes and relationships in the Neo4j graph.

`storeDigraph(neo4jconn,G,Name,Value)` specifies additional options using one or more name-value pair arguments. For example, `'GlobalNodeLabel','Person'` stores all nodes in the directed graph by using the `Person` node label.

`graphinfo = storeDigraph( ___ )` returns graph information as a structure using any of the input argument combinations in the previous syntaxes.

Examples

Store Directed Graph in Neo4j Database

Create a `digraph` object and store its contents in a Neo4j® database. Display the contents of the resulting Neo4j graph.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a `digraph` object with three nodes, which represents a new Neo4j graph. The nodes represent three additional people: `User8`, `User9`, and `User10`.

```
G = digraph([1 1 3],[2 3 2],[1 2 3],{'User8','User9','User10'});
```

Store the data as a Neo4j graph in the Neo4j database.

```
storeDigraph(neo4jconn,G)
```

By default, the `storeDigraph` function stores the directed graph without node labels. Also, the function stores the relationships with the default relationship type `Edge`.

Display information about the Neo4j graph nodes. `graphinfo` is a structure that contains node and relationship information.

```
criteria = ["Edge"];
graphinfo = searchGraph(neo4jconn,criteria);
graphinfo.Nodes
```

```
ans=3×3 table
          NodeLabels      NodeData                  NodeObject
          __________    ____________    ___________________________________

    7         []        [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    52        []        [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    47        []        [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

`Nodes` is a table that contains these variables:

- Node label
- Node data
- `Neo4jNode` object

Display information about the Neo4j graph relationships.

```
graphinfo.Relations
```

```
ans=3×5 table
          StartNodeID    RelationType    EndNodeID    RelationData                RelationObject
          ___________    ____________    _________    ____________    ___________________________________

    17         7            'Edge'          52        [1×1 struct]    [1x1 database.neo4j.http.Ne
    18        47            'Edge'          52        [1×1 struct]    [1x1 database.neo4j.http.Ne
    35         7            'Edge'          47        [1×1 struct]    [1x1 database.neo4j.http.Ne
```

`Relations` is a table that contains these variables:

- Start node identifier
- Relationship type
- End node identifier

- Relationship data
- `Neo4jRelation` object

Close the database connection.

```
close(neo4jconn)
```

Store Directed Graph with Global Node Labels and Relationship Types

Create a `digraph` object and store its contents in a Neo4j® database. Specify a node label to apply to all nodes in the resulting Neo4j graph. Specify a relationship type to apply to all relationships in the resulting Neo4j graph. Display the contents of the graph.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a `digraph` object with three nodes, which represents a new Neo4j graph. The nodes represent three additional people: `User8`, `User9`, and `User10`.

```
G = digraph([1 1 3],[2 3 2],[1 2 3],["User8" "User9" "User10"]);
```

Store the data as a Neo4j graph in the Neo4j database. Specify the node label `Person` for each node in the resulting Neo4j graph by using the `'GlobalNodeLabel'` name-value pair argument. Specify the relationship type `knows` for each relationship in the graph by using the `'GlobalRelationType'` name-value pair argument.

```
storeDigraph(neo4jconn,G,'GlobalNodeLabel','Person', ...
    'GlobalRelationType','knows')
```

Display information about the Neo4j graph nodes. `graphinfo` is a structure that contains node and relationship information.

```
criteria = {'Person'};
graphinfo = searchGraph(neo4jconn,criteria);
graphinfo.Nodes
```

```
ans=10×3 table
          NodeLabels      NodeData                  NodeObject
          __________    ____________    ___________________________________

    0      'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    48     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    1      'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    2      'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    3      'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    4      'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    5      'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    9      'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    49     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
    50     'Person'     [1×1 struct]    [1x1 database.neo4j.http.Neo4jNode]
```

`Nodes` is a table that contains these variables:

- Node label
- Node data
- `Neo4jNode` object

`graphinfo` contains the three additional nodes.

Display information about the Neo4j graph relationships.

```
graphinfo.Relations
```

```
ans=11×5 table
          StartNodeID    RelationType    EndNodeID    RelationData              RelationObject
          ___________    ____________    _________    ____________    __________________________

    1          0           'knows'           1        [1×1 struct]    [1x1 database.neo4j.http.Ne
    0          0           'knows'           2        [1×1 struct]    [1x1 database.neo4j.http.Ne
    3          1           'knows'           3        [1×1 struct]    [1x1 database.neo4j.http.Ne
    2          2           'knows'           1        [1×1 struct]    [1x1 database.neo4j.http.Ne
    5          3           'knows'           4        [1×1 struct]    [1x1 database.neo4j.http.Ne
    4          3           'knows'           5        [1×1 struct]    [1x1 database.neo4j.http.Ne
    6          5           'knows'           4        [1×1 struct]    [1x1 database.neo4j.http.Ne
    8          5           'knows'           9        [1×1 struct]    [1x1 database.neo4j.http.Ne
    19        48           'knows'          49        [1×1 struct]    [1x1 database.neo4j.http.Ne
    7         48           'knows'          50        [1×1 struct]    [1x1 database.neo4j.http.Ne
    9         50           'knows'          49        [1×1 struct]    [1x1 database.neo4j.http.Ne
```

`Relations` is a table that contains these variables:

- Start node identifier
- Relationship type
- End node identifier
- Relationship data
- `Neo4jRelation` object

`graphinfo` contains the three additional relationships.

Close the database connection.

```
close(neo4jconn)
```

Store Directed Graph with Node Labels and Relationship Types and Return Output

Create a `digraph` object by specifying nodes and edges. Then, store the directed graph in a Neo4j® database by specifying node labels and relationship types. Display the contents of the resulting Neo4j graph. Access the graph information using an output argument.

Assume that you have graph data stored in a Neo4j database that represents a social neighborhood. This database has seven nodes and eight relationships. Each node has only one unique property key `name` with a value ranging from `User1` through `User7`. Each relationship has the type `knows`.

Create a Neo4j® database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';

neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j® connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Create a table for nodes. Define the `names` variable, which contains the names of three additional people: `User8`, `User9`, and `User10`. Then, define the `classification` variable to classify each person as `Person`. Also, define the `titles` variable, which contains the job title of each person. The first two people are analysts and the third is a technician.

```
names = {'User8';'User9';'User10'};
classification = {'Person';'Person';'Person'};
titles = {'Analyst';'Analyst';'Technician'};
nodetable = table(names,classification,titles,'VariableNames', ...
    {'Name','Classification','Title'});
```

Create a table with two edges. One edge specifies that two people know each other. The other edge specifies that two people work with each other.

```
edge1 = [1 2];
edge2 = [3 3];
description = {'knows','works with'};
edgetable = table([edge1',edge2'],description', ...
    'VariableNames',{'EndNodes','Description'});
```

Create a `digraph` object using the edge and node tables.

```
G = digraph(edgetable,nodetable);
```

Store the data in the `digraph` object as a Neo4j graph in the Neo4j database. Specify the node labels for each node in the resulting Neo4j graph by using the `'NodeLabel'` name-value pair argument.

The graph uses the `Classification` and `Title` variables of the node table for the node labels. Also, the graph uses the `Description` variable of the edge table for the relationship types.

```
labels = {'Classification';'Title'};
relation = 'Description';
graphinfo = storeDigraph(neo4jconn,G,'NodeLabel',labels, ...
    'RelationType',relation)
```

```
graphinfo = struct with fields:
        Nodes: [3×3 table]
    Relations: [2×5 table]
```

Display information about the Neo4j graph nodes.

```
graphinfo.Nodes
```

```
ans=3×3 table
          NodeLabels      NodeData                   NodeObject
          ___________    _____________    ___________________________________

    6     {2×1 cell}     [1×1 struct]     [1x1 database.neo4j.http.Neo4jNode]
    52    {2×1 cell}     [1×1 struct]     [1x1 database.neo4j.http.Neo4jNode]
    7     {2×1 cell}     [1×1 struct]     [1x1 database.neo4j.http.Neo4jNode]
```

`Nodes` is a table that contains these variables:

- Node label
- Node data
- `Neo4jNode` object

Display information about the Neo4j graph relationships.

```
graphinfo.Relations
```

```
ans=2×5 table
          StartNodeID    RelationType    EndNodeID    RelationData                RelationObject
          ___________    ____________    _________    ____________    ___________________________________

    17         6         'knows'             7        [1×1 struct]    [1x1 database.neo4j.http.Ne
    35        52         'works with'        7        [1×1 struct]    [1x1 database.neo4j.http.Ne
```

`Relations` is a table that contains these variables:

- Start node identifier
- Relationship type
- End node identifier
- Relationship data
- `Neo4jRelation` object

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`G` — Directed graph
`digraph` object

Directed graph, specified as a `digraph` object.

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `graphinfo = storeDigraph(neo4jconn,G,'GlobalNodeLabel','Person','GlobalRelationType','knows')` stores a directed graph and specifies that all nodes in the resulting graph have the `Person` node label and all relationships have the `knows` type.

Note If you do not specify `'GlobalNodeLabel'` or `'NodeLabel'`, the resulting Neo4j graph contains nodes without labels.

`GlobalNodeLabel` — Global node label
character vector | cell array of character vectors | string scalar | string array

Global node label, specified as the comma-separated pair consisting of `'GlobalNodeLabel'` and a character vector, cell array of character vectors, string scalar, or string array. To specify one node label, use a character vector or string scalar. To specify multiple node labels, use a cell array of character vectors or a string array.

After you execute the `storeDigraph` function, each node in the resulting Neo4j graph contains node labels that you specify using this name-value pair argument.

Example: `"Person"`

Example: `{'Person','Employee'}`

Data Types: `char` | `string` | `cell`

`NodeLabel` — Node label
character vector | cell array of character vectors | string scalar | string array

Node label, specified as the comma-separated pair consisting of `'NodeLabel'` and a character vector, cell array of character vectors, string scalar, or string array. To specify one node label, use a character vector or string scalar. To specify multiple node labels, specify a cell array of character vectors or a string array.

To specify different labels for nodes in the resulting Neo4j graph, use this name-value pair argument. The specified node labels must match the variable names in the table of node information in the `digraph` object.

Example: `"Person"`

Example: `{'Name','Title'}`

Data Types: `char` | `string` | `cell`

`GlobalRelationType` — Global relationship type
`'Edge'` (default) | character vector | string scalar

Global relationship type, specified as the comma-separated pair consisting of `'GlobalRelationType'` and a character vector or string scalar. To specify the same type of relationship for all relationships between nodes in the resulting Neo4j graph, use this name-value pair argument.

Note When specifying the type of relationship, use either the `'GlobalRelationType'` or `'RelationType'` name-value pair argument. You cannot specify both of these arguments at the same time.

Example: `"knows"`

Data Types: `char` | `string`

`RelationType` — Relationship type
`'Edge'` (default) | character vector | string scalar

Relationship type, specified as the comma-separated pair consisting of `'RelationType'` and a character vector or string scalar. To specify different types of relationships between nodes in the resulting Neo4j graph, use this name-value pair argument. The specified types must match the variable names in the table of edge information in the `digraph` object.

Note When specifying the type of relationship, use either the `'RelationType'` or `'GlobalRelationType'` name-value pair argument. You cannot specify both of these arguments at the same time.

Example: `'Description'`

Data Types: `char` | `string`

Output Arguments

`graphinfo` — Graph information
structure

Graph information in the Neo4j database, returned as a structure with these fields.

Field	Description
`Nodes`	Table that contains node information for each node in the `Relations` table. The `Nodes` tabl • `NodeLabels` — Character vector that denotes the node label • `NodeData` — Structure array that contains node information such as property keys • `NodeObject` — `Neo4jNode` object that represents each node The row names in the table are Neo4j node identifiers.
`Relations`	Table that contains relationship information for the nodes in the `Nodes` table. The `Relatio` • `StartNodeID` — Node identifier for the start node of each relationship • `RelationType` — Character vector that denotes the type of each relationship • `EndNodeID` — Node identifier for the end node of each relationship • `RelationData` — Structure array that contains property keys associated with each rela • `RelationObject` — `Neo4jRelation` object that represents each relationship The row names in the table are Neo4j relationship identifiers.

Tips

- The `storeDigraph` function stores all MATLAB objects as JSON `string` equivalents in the Neo4j graph. For example, the function stores the date `datetime('Jan/01/2017')` as `"Jan/01/2017"` in the Neo4j graph.

Version History

Introduced in R2018a

See Also

`deleteNode` | `neo4j` | `deleteRelation` | `createNode` | `createRelation` | `addNodeLabel` | `removeNodeLabel` | `removeNodeProperty` | `removeRelationProperty` | `setNodeProperty` | `setRelationProperty` | `close`

Topics

"Add and Query Group of Colleagues in Social Neighborhood" on page 10-14
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

addNodeLabel

Namespace: `database.neo4j.http`

Add labels to nodes in Neo4j database

Syntax

```
addNodeLabel(neo4jconn,node,labels)
nodeinfo = addNodeLabel(neo4jconn,node,labels)
```

Description

`addNodeLabel(neo4jconn,node,labels)` adds node labels to one or more nodes in a Neo4j database using a Neo4j database connection.

`nodeinfo = addNodeLabel(neo4jconn,node,labels)` returns updated node information as a `Neo4jNode` object for one node, or as a table for multiple nodes.

Examples

Add One Node Label

Add one node label to a single node in a Neo4j® database and access the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the first node in the table of node information. This node has the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(1);
```

Add one node label to a single node in the database using the Neo4j database connection.

```
labels = "Analyst";
addNodeLabel(neo4jconn,node,labels)
```

Display the node labels for the updated node. The `NodeLabels` property contains two labels.

```
nodeinfo = searchNode(neo4jconn,labels);
nodeinfo.NodeLabels
```

```
ans = 2×1 cell array
    {'Person' }
    {'Analyst'}
```

Close the database connection.

```
close(neo4jconn)
```

Add Multiple Node Labels and Return Output

Add node labels to multiple nodes in a Neo4j® database. Access the updated node information using an output argument.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Find nodes with the label `Person`, and display the node labels.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
nodeinfo.NodeLabels
```

```
ans = 7×1 cell array
    {'Person'}
    {'Person'}
    {'Person'}
    {'Person'}
    {'Person'}
    {'Person'}
    {'Person'}
```

Add multiple node labels to the nodes in the database using the Neo4j database connection. The `nodeinfo` output argument is a `Neo4jNode` object.

```
node = nodeinfo.NodeObject;
labels = ["Analyst" "Scientist"];
nodeinfo = addNodeLabel(neo4jconn,node,labels);
```

Display the node information for the updated nodes. Each node has three node labels (`Person`, `Analyst`, and `Scientist`).

```
nodeinfo.NodeLabels
```

```
ans = 7×1 cell array
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection

`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`node` — Node

`Neo4jNode` object | `Neo4jNode` object array | numeric scalar | numeric vector

Node in a Neo4j database, specified as a `Neo4jNode` object, `Neo4jNode` object array, numeric scalar, or a numeric vector. For one node, specify a `Neo4jNode` object or a numeric scalar. For multiple nodes, specify a `Neo4jNode` object array or a numeric vector.

The numeric scalar or vector must contain Neo4j database node identifiers.

Example: `15`

Example: `[2,3,4]`

`labels` — Node labels

character vector | cell array of character vectors | string scalar | string array

Node labels, specified as a character vector, cell array of character vectors, string scalar, or string array. To specify one node label, use a character vector or string scalar. For multiple node labels, use a cell array of character vectors or a string array.

Example: `"Person"`

Data Types: `char` | `string` | `cell`

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or as a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node
- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

Version History

Introduced in R2019a

See Also

`neo4j` | `searchNode` | `removeNodeLabel` | `setNodeProperty` | `removeNodeProperty` | `close`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

removeNodeLabel

Namespace: `database.neo4j.http`

Remove labels from nodes in Neo4j database

Syntax

```
removeNodeLabel(neo4jconn,node,labels)
nodeinfo = removeNodeLabel(neo4jconn,node,labels)
```

Description

`removeNodeLabel(neo4jconn,node,labels)` removes node labels from one or more nodes in a Neo4j database using a Neo4j database connection.

`nodeinfo = removeNodeLabel(neo4jconn,node,labels)` returns updated node information as a `Neo4jNode` object for one node, or as a table for multiple nodes.

Examples

Remove One Node Label

Add one node label to a single node in a Neo4j® database, access the node, and then remove the new node label.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the first node in the table of node information. This node has the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(1);
```

Add one node label to a single node in the database using the Neo4j database connection.

```
labels = "Analyst";
addNodeLabel(neo4jconn,node,labels)
```

Display the node information for the updated node.

```
nodeinfo = searchNode(neo4jconn,labels);
node.NodeLabels
```

```
ans = 2×1 cell array
    {'Person' }
    {'Analyst'}
```

Remove the label `Analyst` from the updated node.

```
removeNodeLabel(neo4jconn,node,labels)
```

Find the first node again and display its node labels. The node now has only the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
nodeinfo.NodeLabels(1)
```

```
ans = 1×1 cell array
    {'Person'}
```

Close the database connection.

```
close(neo4jconn)
```

Remove Multiple Node Labels and Return Output

Add node labels to multiple nodes in a Neo4j® database, remove the new node labels, and access the updated node information using an output argument.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Find nodes with the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
```

Add multiple node labels to the nodes in the database using the Neo4j database connection.

```
labels = ["Analyst" "Scientist"];
node = nodeinfo.NodeObject;
addNodeLabel(neo4jconn,node,labels)
```

Display the node information for the updated nodes. Each node has three node labels (`Person`, `Analyst`, and `Scientist`).

```
nlabel = "Analyst";
nodeinfo = searchNode(neo4jconn,nlabel);
nodeinfo.NodeLabels
```

```
ans = 7×1 cell array
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
    {3×1 cell}
```

Remove the labels `Analyst` and `Scientist` from the updated nodes and display updated node information. Each node now has only the label `Person`. The `nodeinfo` output argument is a `Neo4jNode` object.

```
nodeinfo = removeNodeLabel(neo4jconn,node,labels);
nodeinfo.NodeLabels
```

```
ans = 7×1 cell array
    {'Person'}
    {'Person'}
    {'Person'}
    {'Person'}
    {'Person'}
    {'Person'}
    {'Person'}
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection

`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

node — Node

`Neo4jNode` object | `Neo4jNode` object array | numeric scalar | numeric vector

Node in a Neo4j database, specified as a `Neo4jNode` object, `Neo4jNode` object array, numeric scalar, or a numeric vector. For one node, specify a `Neo4jNode` object or a numeric scalar. For multiple nodes, specify a `Neo4jNode` object array or a numeric vector.

The numeric scalar or vector must contain Neo4j database node identifiers.

Example: 15

Example: [2,3,4]

labels — Node labels
character vector | cell array of character vectors | string scalar | string array

Node labels, specified as a character vector, cell array of character vectors, string scalar, or string array. To specify one node label, use a character vector or string scalar. For multiple node labels, use a cell array of character vectors or a string array.

Example: "Person"

Data Types: char | string | cell

Output Arguments

nodeinfo — Node information
Neo4jNode object | table

Node information in the Neo4j database, returned as a Neo4jNode object for one node or as a table for multiple nodes.

For multiple nodes, the table contains these variables:

- NodeLabels — Cell array of character vectors that contains the node labels for each database node
- NodeData — Cell array of structures that contains node information such as property keys
- NodeObject — Neo4jNode object for each database node

The row names of the table are Neo4j node identifiers of each database node.

Version History

Introduced in R2019a

See Also

neo4j | searchNode | addNodeLabel | setNodeProperty | removeNodeProperty | close

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

setNodeProperty

Namespace: `database.neo4j.http`

Set properties for nodes in Neo4j database

Syntax

```
setNodeProperty(neo4jconn,node,properties)
nodeinfo = setNodeProperty(neo4jconn,node,properties)
```

Description

`setNodeProperty(neo4jconn,node,properties)` sets properties for one or more nodes in a Neo4j database using a Neo4j database connection.

`nodeinfo = setNodeProperty(neo4jconn,node,properties)` returns updated node information as a `Neo4jNode` object for one node, or as a table for multiple nodes.

Examples

Set One Node Property

Set one node property for a single node in a Neo4j® database and access the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the first node in the table of node information. This node has the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(1);
```

Set the `Title` node property for a single node in the database using the Neo4j database connection.

```
properties.Title = "Analyst";
setNodeProperty(neo4jconn,node,properties)
```

Display the node information for the updated node.

```
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(1);
node.NodeData
```

```
ans = struct with fields:
     name: 'User1'
    Title: 'Analyst'
```

Close the database connection.

```
close(neo4jconn)
```

Set Multiple Node Properties and Return Output

Set node properties for multiple nodes in a Neo4j® database. Access the updated node information using an output argument.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Find nodes with the label `Person`, and select the first two nodes.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
nodes = nodeinfo.NodeObject;
firstnodes = nodes(1:2);
```

Set the `Title` node property for multiple nodes to different values using the Neo4j database connection. Create a structure array to store the properties. Display the updated node information for the first two nodes. The `nodeinfo` output argument is a `Neo4jNode` object.

```
properties(1).Title = "Analyst";
properties(2).Title = "Engineer";
nodeinfo = setNodeProperty(neo4jconn,firstnodes,properties);
nodeinfo.NodeData{1:2}
```

```
ans = struct with fields:
     name: 'User1'
```

```
    Title: 'Analyst'


ans = struct with fields:
     name: 'User3'
    Title: 'Engineer'
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a Neo4jConnect object created with the function neo4j.

node — Node
Neo4jNode object | Neo4jNode object array | numeric scalar | numeric vector

Node in a Neo4j database, specified as a Neo4jNode object, Neo4jNode object array, numeric scalar, or a numeric vector. For one node, specify a Neo4jNode object or a numeric scalar. For multiple nodes, specify a Neo4jNode object array or a numeric vector.

The numeric scalar or vector must contain Neo4j database node identifiers.

Example: 15

Example: [2,3,4]

properties — Node properties
structure | structure array | table

Node properties, specified as a structure, structure array, or table.

If a property does not exist, then the setNodeProperty function adds a new property. If the property exists, then the function sets a new value for the existing property.

When you specify a structure, the setNodeProperty function converts each field and its corresponding value to a property and its corresponding value in the database node. When you specify a table that contains one row, the function converts each variable and its corresponding value to a property and its corresponding value in the database node.

Specify a structure array or a table with multiple rows to update multiple nodes in the database.

The dimensions of the data in the structure array or table must be the same as the number of the specified nodes in the database to update. However, you can use a scalar structure to set the same values for multiple nodes in the database simultaneously.

Data Types: struct | table

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or as a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node
- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

Version History

Introduced in R2019a

See Also

`neo4j` | `searchNode` | `removeNodeProperty` | `addNodeLabel` | `removeNodeLabel` | `close`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

removeNodeProperty

Namespace: `database.neo4j.http`

Remove properties from nodes in Neo4j database

Syntax

```
removeNodeProperty(neo4jconn,node,propertyNames)
nodeinfo = removeNodeProperty(neo4jconn,node,propertyNames)
```

Description

`removeNodeProperty(neo4jconn,node,propertyNames)` removes properties from one or more nodes in a Neo4j database using a Neo4j database connection.

`nodeinfo = removeNodeProperty(neo4jconn,node,propertyNames)` returns updated node information as a `Neo4jNode` object for one node, or as a table for multiple nodes.

Examples

Remove One Node Property

Remove one node property from a single node in a Neo4j® database and access the node.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the first node in the table of node information. This node has the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(1);
```

Set the `Title` node property for a single node in the database using the Neo4j database connection.

```
properties.Title = "Analyst";
setNodeProperty(neo4jconn,node,properties)
```

Display the node information for the updated node.

```
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(1);
node.NodeData
```

```
ans = struct with fields:
     name: 'User1'
    Title: 'Analyst'
```

Remove the node property.

```
propertyNames = "Title";
removeNodeProperty(neo4jconn,node,propertyNames)
```

Display the node information for the updated node.

```
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(1);
node.NodeData
```

```
ans = struct with fields:
    name: 'User1'
```

Close the database connection.

```
close(neo4jconn)
```

Remove Multiple Node Properties and Return Output

Remove node properties from multiple nodes in a Neo4j® database. Access the updated node information using an output argument.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Find nodes with the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
nodes = nodeinfo.NodeObject;
```

Set the `Title` and `Department` node properties for multiple nodes using the Neo4j database connection. Display the updated node information for the first three nodes.

```
properties.Title = "Analyst";
properties.Department = "Sales";
nodeinfo = setNodeProperty(neo4jconn,nodes,properties);
nodeinfo.NodeData{1:3}
```

```
ans = struct with fields:
    Department: 'Sales'
          name: 'User1'
         Title: 'Analyst'


ans = struct with fields:
    Department: 'Sales'
          name: 'User3'
         Title: 'Analyst'


ans = struct with fields:
    Department: 'Sales'
          name: 'User2'
         Title: 'Analyst'
```

Remove the node properties using the property names. Display the updated node information for the first three nodes. The `nodeinfo` output argument is a `Neo4jNode` object.

```
propertyNames = ["Title" "Department"];
nodeinfo = removeNodeProperty(neo4jconn,nodes,propertyNames);
nodeinfo.NodeData{1:3}
```

```
ans = struct with fields:
    name: 'User1'


ans = struct with fields:
    name: 'User3'


ans = struct with fields:
    name: 'User2'
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

node — Node
`Neo4jNode` object | `Neo4jNode` object array | numeric scalar | numeric vector

Node in a Neo4j database, specified as a `Neo4jNode` object, `Neo4jNode` object array, numeric scalar, or a numeric vector. For one node, specify a `Neo4jNode` object or a numeric scalar. For multiple nodes, specify a `Neo4jNode` object array or a numeric vector.

The numeric scalar or vector must contain Neo4j database node identifiers.

Example: `15`

Example: `[2,3,4]`

`propertyNames` — Property names
character vector | cell array of character vectors | string scalar | string array

Property names, specified as a character vector, cell array of character vectors, string scalar, or string array. For one property, use a character vector or string scalar. For multiple properties, use a cell array of character vectors or a string array.

Example: `"Analyst"`

Example: `["Analyst" "Clerk"]`

Data Types: `char` | `string`

Output Arguments

`nodeinfo` — Node information
`Neo4jNode` object | table

Node information in the Neo4j database, returned as a `Neo4jNode` object for one node or as a table for multiple nodes.

For multiple nodes, the table contains these variables:

- `NodeLabels` — Cell array of character vectors that contains the node labels for each database node
- `NodeData` — Cell array of structures that contains node information such as property keys
- `NodeObject` — `Neo4jNode` object for each database node

The row names of the table are Neo4j node identifiers of each database node.

Version History

Introduced in R2019a

See Also

`neo4j` | `searchNode` | `setNodeProperty` | `addNodeLabel` | `removeNodeLabel` | `close`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

setRelationProperty

Namespace: `database.neo4j.http`

Set properties for relationships in Neo4j database

Syntax

```
setRelationProperty(neo4jconn,relation,properties)
relationinfo = setRelationProperty(neo4jconn,relation,properties)
```

Description

`setRelationProperty(neo4jconn,relation,properties)` sets properties for one or more relationships in a Neo4j database using a Neo4j database connection.

`relationinfo = setRelationProperty(neo4jconn,relation,properties)` returns updated relationship information as a `Neo4jRelation` object for one relationship, or as a table for multiple relationships.

Examples

Set One Relationship Property

Set one property for a single relationship in a Neo4j® database and access the relationship.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the second node in the table of node information. This node has the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(2);
```

Find the outgoing relationship from the origin node.

```
direction = "out";
relinfo = searchRelation(neo4jconn,node,direction);
relation = relinfo.Relations.RelationObject;
```

Set the `StartDate` property for a single relationship in the database using the Neo4j database connection.

```
properties.StartDate = "01/01/2018";
setRelationProperty(neo4jconn,relation,properties)
```

Display the relationship information for the updated relationship.

```
relinfo = searchRelation(neo4jconn,node,direction);
relinfo.Relations.RelationData{1}
```

```
ans = struct with fields:
    StartDate: '01/01/2018'
```

Close the database connection.

```
close(neo4jconn)
```

Set Multiple Relationship Properties and Return Output

Set relationship properties for multiple relationships in a Neo4j® database. Access the updated relationship information using an output argument.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Find the origin node with the node identifier `3` and retrieve its node information.

```
nodeid = 3;
nodeinfo = searchNodeByID(neo4jconn,nodeid);
```

Find the outgoing relationships from the origin node.

```
direction = "out";
relinfo = searchRelation(neo4jconn,nodeinfo,direction);
relation = relinfo.Relations.RelationObject;
```

Set the `MeetLocation` property for two outgoing relationships to different values using the Neo4j database connection. Create a structure array to store the properties. The `relationinfo` output argument is a `Neo4jRelation` object.

```
properties(1).MeetLocation = "Chicago";
properties(2).MeetLocation = "Miami";
relationinfo = setRelationProperty(neo4jconn,relation,properties);
```

Display the relationship information for the two updated relationships.

```
relationinfo.RelationData{1:2}
```

```
ans = struct with fields:
    MeetLocation: 'Chicago'


ans = struct with fields:
    MeetLocation: 'Miami'
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

`neo4jconn` — Neo4j database connection
`Neo4jConnect` object

Neo4j database connection, specified as a `Neo4jConnect` object created with the function `neo4j`.

`relation` — Relationship
`Neo4jRelation` object | `Neo4jRelation` object array | numeric scalar | numeric vector

Relationship in a Neo4j database, specified as a `Neo4jRelation` object, `Neo4jRelation` object array, numeric scalar, or numeric vector. For a single relationship, use a `Neo4jRelation` object or a numeric scalar that contains the relationship identifier. For multiple relationships, use a `Neo4jRelation` object array or a numeric vector that contains an array of relationship identifiers.

Example: 15

Example: `[15,16,17]`

`properties` — Relationship properties
structure | structure array | table

Relationship properties, specified as a structure, structure array, or table.

If a property does not exist, then the `setRelationProperty` function adds a new property. If the property exists, then the function sets a new value for the existing property.

When you specify a structure, the `setRelationProperty` function converts each field and its corresponding value to a property and its corresponding value in the database relationship. When you specify a table that contains one row, the function converts each variable and its corresponding value to a property and its corresponding value in the database relationship.

Specify a structure array or a table with multiple rows to update multiple relationships in the database.

The dimensions of the data in the structure array or table must be the same as the number of the specified relationships in the database to update. However, you can use a scalar structure to set the same values for multiple relationships in the database simultaneously.

Data Types: `struct` | `table`

Output Arguments

`relationinfo` — Relationship information
`Neo4jRelation` object | table

Relationship information, returned as a `Neo4jRelation` object for one relationship or as a table for multiple relationships.

For multiple relationships, the table contains these variables:

- `StartNodeID` — Node identifier of the start node for each matched relationship
- `RelationType` — Character vector that denotes the relationship type for each matched relationship
- `EndNodeID` — Node identifier of the end node for each matched relationship
- `RelationData` — Structure array that contains property keys associated with each matched relationship
- `RelationObject` — `Neo4jRelation` object for each matched relationship

The row names in the table are Neo4j relationship identifiers.

Version History

Introduced in R2019a

See Also

`neo4j` | `removeRelationProperty` | `setNodeProperty` | `removeNodeProperty` | `close` | `searchNode` | `searchNodeByID` | `searchRelation`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

removeRelationProperty

Namespace: `database.neo4j.http`

Remove properties from relationships in Neo4j database

Syntax

```
removeRelationProperty(neo4jconn,relation,propertyNames)
relationinfo = removeRelationProperty(neo4jconn,relation,propertyNames)
```

Description

`removeRelationProperty(neo4jconn,relation,propertyNames)` removes properties from one or more relationships in a Neo4j database using a Neo4j database connection.

`relationinfo = removeRelationProperty(neo4jconn,relation,propertyNames)` returns updated relationship information as a `Neo4jRelation` object for one relationship or as a table for multiple relationships.

Examples

Remove One Relationship Property

Remove one property from a single relationship in a Neo4j® database and access the relationship.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Retrieve the second node in the table of node information. This node has the label `Person`.

```
nlabel = "Person";
nodeinfo = searchNode(neo4jconn,nlabel);
node = nodeinfo.NodeObject(2);
```

Find the outgoing relationship from the origin node.

```
direction = "out";
relinfo = searchRelation(neo4jconn,node,direction);
relation = relinfo.Relations.RelationObject;
```

Set the `StartDate` property for a single relationship in the database using the Neo4j database connection.

```
properties.StartDate = "01/01/2018";
setRelationProperty(neo4jconn,relation,properties)
```

Display the relationship information for the updated relationship.

```
relinfo = searchRelation(neo4jconn,node,direction);
relinfo.Relations.RelationData{1}
```

```
ans = struct with fields:
    StartDate: '01/01/2018'
```

Remove the relationship property.

```
propertyNames = "StartDate";
removeRelationProperty(neo4jconn,relation,propertyNames)
```

Display the relationship information for the updated relationship.

```
relinfo = searchRelation(neo4jconn,node,direction);
relinfo.Relations.RelationData{1}
```

```
ans = struct with no fields.
```

Close the database connection.

```
close(neo4jconn)
```

Remove Multiple Relationship Properties and Return Output

Remove relationship properties from multiple relationships in a Neo4j® database. Access the updated relationship information using an output argument.

Create a Neo4j database connection using the URL `http://localhost:7474/db/data`, user name `neo4j`, and password `matlab`.

```
url = 'http://localhost:7474/db/data';
username = 'neo4j';
password = 'matlab';
neo4jconn = neo4j(url,username,password);
```

Check the `Message` property of the Neo4j connection object `neo4jconn`. The blank `Message` property indicates a successful connection.

```
neo4jconn.Message
```

```
ans =

     []
```

Find the origin node with the node identifier 3 and retrieve its node information.

```
nodeid = 3;
nodeinfo = searchNodeByID(neo4jconn,nodeid);
```

Find the outgoing relationships from the origin node.

```
direction = "out";
relinfo = searchRelation(neo4jconn,nodeinfo,direction);
relation = relinfo.Relations.RelationObject;
```

Set the `StartDate` and `EndDate` properties for the outgoing relationships using the Neo4j database connection.

```
properties.StartDate = "01/01/2018";
properties.EndDate = "12/31/2018";
relationinfo = setRelationProperty(neo4jconn,relation,properties);
```

Display the relationship information for the two updated relationships.

```
relationinfo.RelationData{1:2}
```

```
ans = struct with fields:
    StartDate: '01/01/2018'
      EndDate: '12/31/2018'


ans = struct with fields:
    StartDate: '01/01/2018'
      EndDate: '12/31/2018'
```

Remove the relationship properties using the property names. The `relationinfo` output argument is a `Neo4jRelation` object.

```
propertyNames = ["StartDate" "EndDate"];
relationinfo = removeRelationProperty(neo4jconn,relation,propertyNames);
```

Display the relationship information for the two updated relationships.

```
relationinfo.RelationData{1:2}
```

```
ans = struct with no fields.


ans = struct with no fields.
```

Close the database connection.

```
close(neo4jconn)
```

Input Arguments

neo4jconn — Neo4j database connection
Neo4jConnect object

Neo4j database connection, specified as a Neo4jConnect object created with the function neo4j.

relation — Relationship
Neo4jRelation object | Neo4jRelation object array | numeric scalar | numeric vector

Relationship in a Neo4j database, specified as a Neo4jRelation object, Neo4jRelation object array, numeric scalar, or numeric vector. For a single relationship, use a Neo4jRelation object or a numeric scalar that contains the relationship identifier. For multiple relationships, use a Neo4jRelation object array or a numeric vector that contains an array of relationship identifiers.

Example: 15

Example: [15,16,17]

propertyNames — Property names
character vector | cell array of character vectors | string scalar | string array

Property names, specified as a character vector, cell array of character vectors, string scalar, or string array. For one property, use a character vector or string scalar. For multiple properties, use a cell array of character vectors or a string array.

Example: "Analyst"

Example: ["Analyst" "Clerk"]

Data Types: char | string

Output Arguments

relationinfo — Relationship information
Neo4jRelation object | table

Relationship information, returned as a Neo4jRelation object for one relationship or as a table for multiple relationships.

For multiple relationships, the table contains these variables:

- StartNodeID — Node identifier of the start node for each matched relationship
- RelationType — Character vector that denotes the relationship type for each matched relationship
- EndNodeID — Node identifier of the end node for each matched relationship
- RelationData — Structure array that contains property keys associated with each matched relationship
- RelationObject — Neo4jRelation object for each matched relationship

The row names in the table are Neo4j relationship identifiers.

Version History

Introduced in R2019a

See Also

`neo4j` | `setRelationProperty` | `setNodeProperty` | `removeNodeProperty` | `close` | `searchNode` | `searchNodeByID` | `searchRelation`

Topics

"Update Friend Information in Social Neighborhood" on page 10-11
"Graph Database Workflow for Neo4j Database Interfaces" on page 10-6

connection

MongoDB C++ interface connection

Description

The `connection` object enables you to connect to MongoDB stored on one or more database servers. Using the `connection` object, you can manage document collections in the database. You can also query documents stored in a collection and import them into the MATLAB workspace. From MATLAB, you can export MATLAB tables, structures, and objects into MongoDB. For details about MongoDB, see the MongoDB Manual.

Creation

Create the `connection` object using the `mongoc` function.

Properties

`Database` — Database name
character vector

Database name, specified as a character vector.

The `dbname` input argument of the `mongoc` function sets this property.

To change the name of the database, use dot notation to set this property; for example:

```
conn.Database = "otherDatabase";
```

Example: `"databasename"`

Data Types: `char`

`UserName` — User name
character vector

This property is read-only.

User name, specified as a character vector.

The `UserName` name-value argument of the `mongoc` function sets this property.

Example: `"username"`

Data Types: `char`

`Server` — Server name
string scalar

This property is read-only.

Server name, specified as a string scalar.

The `server` input argument of the `mongoc` function sets this property.

Example: `"server1"`

Data Types: `string`

`Port` — Port number
numeric scalar | numeric vector

This property is read-only.

Port number, specified as a numeric scalar for one port or a numeric vector for multiple ports.

The `port` input argument of the `mongoc` function sets this property.

Example: `27017`

Data Types: `double`

`CollectionNames` — Collection names
string scalar | string array

This property is read-only.

Collection names of all collections defined in MongoDB, specified as a string scalar for one collection or string array for multiple collections.

Example: `[13×1 string]`

Data Types: `string`

Object Functions

MongoDB Connection

isopen	Determine if MongoDB C++ interface connection is open
close	Close MongoDB C++ interface connection

Import Document Collections into MATLAB

count	Count total number of documents in MongoDB collection
find	Retrieve documents in MongoDB collection

Export and Manage Document Collections in MongoDB

createCollection	Create MongoDB collection
dropCollection	Drop MongoDB collection
insert	Insert one or multiple documents into MongoDB collection
remove	Remove one or multiple documents from MongoDB collection
update	Update one or multiple documents in MongoDB collection

Examples

Create MongoDB C++ Interface Connection

Connect to MongoDB® using the MongoDB C++ interface and count the total number of documents in a collection.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Determine the number of documents in the `employees` collection. The collection contains seven documents.

```
collection = "employees";
n = count(conn,collection)
```

```
n = int64
    7
```

Close the MongoDB connection.

```
close(conn)
```

Version History

Introduced in R2021b

See Also

Topics

“Import and Analyze Data from MongoDB Using MongoDB C++ Interface” on page 11-2
“Import Filtered Data from MongoDB Using MongoDB C++ Interface” on page 11-4
“Import Large Data from MongoDB Using MongoDB C++ Interface” on page 11-6
“Export MATLAB Data into MongoDB Using MongoDB C++ Interface” on page 11-8
“Import and Export MATLAB Objects Using MongoDB and MongoDB C++ Interface” on page 11-10

External Websites

MongoDB Manual

mongoc

Create MongoDB C++ interface connection

Syntax

```
conn = mongoc(server,port,dbname)
conn = mongoc(server,port,dbname,Name=Value)
```

Description

`conn = mongoc(server,port,dbname)` creates a MongoDB connection using the MongoDB C++ interface with the database server, port number, and database name.

`conn = mongoc(server,port,dbname,Name=Value)` specifies additional options using one or more name-value arguments. For example, `UserName="adminuser"` specifies the user name for the connection.

Examples

Create MongoDB C++ Interface Connection

Connect to MongoDB® using the MongoDB C++ interface and count the total number of documents in a collection.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Determine the number of documents in the `employees` collection. The collection contains seven documents.

```
collection = "employees";
n = count(conn,collection)
```

```
n = int64
    7
```

Close the MongoDB connection.

```
close(conn)
```

Create MongoDB Connection Using User Name and Password

Connect to MongoDB using the MongoDB C++ interface and count the total number of documents in a collection. Specify a user name and password to connect to the database.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`. Specify the user name `adminuser` and password `matlab` by setting the `UserName` and `Password` name-value arguments, respectively.

```
conn = mongoc("dbtb01",27017,"mongotest",UserName="adminuser",Password="matlab")
```

```
conn = 

  connection with properties:

               Database: "mongotest"
               UserName: "adminuser"
                 Server: "dbtb01"
                   Port: 27017
        CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB C++ interface connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is `adminuser`.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Check the MongoDB C++ interface connection.

```
isopen(conn)

ans =

  logical

   1
```

The database connection is successful because the `isopen` function returns `1`. Otherwise, the database connection is closed.

Determine the number of documents in the `employees` collection. The collection contains seven documents.

```
collection = "employees";
n = count(conn,collection)

n =

     7
```

Close the MongoDB C++ interface connection.

```
close(conn)
```

Input Arguments

`server` — Server name
string scalar | string array

Server name, specified as a string scalar for one database server name or a string array for multiple database server names.

Example: `"localhost"`

Data Types: `string`

`port` — Port number
numeric scalar | numeric vector

Port number, specified as a numeric scalar for one port or a numeric vector for multiple ports.

Example: `27017`

Data Types: `double`

`dbname` — Database name
string scalar

Database name, specified as a string scalar.

Example: `"employeesdb"`

Data Types: `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Example: `conn = mongoc(server,port,dbname,UserName="username",Password="pwd")` creates a MongoDB C++ interface connection using the specified user name and password.

`UserName` — User name
string scalar

User name, specified as a string scalar. Contact your MongoDB administrator for access credentials.

If you specify the `UserName` name-value argument, then you must also specify the `Password` name-value argument.

Example: `"username"`

Data Types: `string`

`Password` — Password
string scalar

Password, specified as a string scalar. Contact your MongoDB administrator for access credentials.

If you specify the `Password` name-value argument, then you must also specify the `UserName` name-value argument.

Example: `"pwd"`

Data Types: `string`

Output Arguments

`conn` — MongoDB C++ connection
`connection` object

MongoDB C++ connection, returned as a `connection` object.

Version History

Introduced in R2021b

See Also

Objects
`connection`

Functions
`isopen` | `count` | `find` | `close`

Topics
"Import and Analyze Data from MongoDB Using MongoDB C++ Interface" on page 11-2
"Import Filtered Data from MongoDB Using MongoDB C++ Interface" on page 11-4

"Import Large Data from MongoDB Using MongoDB C++ Interface" on page 11-6
"Export MATLAB Data into MongoDB Using MongoDB C++ Interface" on page 11-8
"Import and Export MATLAB Objects Using MongoDB and MongoDB C++ Interface" on page 11-10

External Websites

MongoDB Manual

close

Namespace: `database.mongo`

Close MongoDB C++ interface connection

Syntax

`close(conn)`

Description

`close(conn)` closes the MongoDB C++ interface connection.

Examples

Create MongoDB C++ Interface Connection

Connect to MongoDB® using the MongoDB C++ interface and count the total number of documents in a collection.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Determine the number of documents in the `employees` collection. The collection contains seven documents.

```
collection = "employees";
n = count(conn,collection)
```

```
n = int64
    7
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB C++ interface connection
`connection` object

MongoDB C++ interface connection, specified as a `connection` object.

Version History

Introduced in R2021b

See Also

Objects
`connection`

Functions
`mongoc` | `isopen` | `count` | `find`

Topics
"Import and Analyze Data from MongoDB Using MongoDB C++ Interface" on page 11-2
"Import Filtered Data from MongoDB Using MongoDB C++ Interface" on page 11-4
"Import Large Data from MongoDB Using MongoDB C++ Interface" on page 11-6

External Websites
MongoDB Manual

count

Namespace: `database.mongo`

Count total number of documents in MongoDB collection

Syntax

```
n = count(conn,collection)
n = count(conn,collection,Query=mongoquery)
```

Description

`n = count(conn,collection)` returns the total number of documents in a collection by using the MongoDB C++ interface connection.

`n = count(conn,collection,Query=mongoquery)` returns the total number of documents in an executed MongoDB query on a collection.

Examples

Count Documents in Collection

Connect to MongoDB® using the MongoDB C++ interface and count the total number of documents in a collection.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
          Database: "mongotest"
          UserName: ""
            Server: "dbtb01"
              Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.

- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Determine the number of documents in the `employees` collection. The collection contains seven documents.

```
collection = "employees";
n = count(conn,collection)
```

```
n = int64
    7
```

Close the MongoDB connection.

```
close(conn)
```

Count Documents in MongoDB Query

Connect to MongoDB® using the MongoDB C++ interface and count the total number of documents in a MongoDB query on a collection in the database. Here, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.

- The port number is 27017.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Create a JSON-style query as a string scalar that contains a JSON-style string. This query sets the department identifier field equal to 80.

```
mongoquery = "{""department_id"":80}";
```

Use the MongoDB query on the employees collection to count the total number of employees who work in the specified department. A total of four employees work in the department.

```
collection = "employees";
n = count(conn,collection,Query=mongoquery)
```

```
n = int64
    4
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB C++ interface connection
connection object

MongoDB C++ interface connection, specified as a connection object.

collection — Collection name
string scalar

Collection name, specified as a string scalar.

Example: "taxidata"

Data Types: string

mongoquery — MongoDB query
string scalar | character vector

MongoDB query, specified as a string scalar or character vector. Specify a JSON-style string to query the database.

Example: "{""department"":""Sales""}" queries the database for documents where the department field is equal to Sales.

Example: `"{""salary"": {""$gt"": 90000}}"` queries the database for documents where the value of the `salary` field is greater than `90000`.

Data Types: `string` | `char`

Output Arguments

n — Total number of documents
`int64` scalar

Total number of documents in a MongoDB collection or query, returned as an `int64` scalar.

Version History

Introduced in R2021b

See Also

`mongoc` | `isopen` | `find` | `close`

Topics

"Import and Analyze Data from MongoDB Using MongoDB C++ Interface" on page 11-2
"Import Filtered Data from MongoDB Using MongoDB C++ Interface" on page 11-4
"Import Large Data from MongoDB Using MongoDB C++ Interface" on page 11-6

External Websites

MongoDB Manual

createCollection

Namespace: `database.mongo`

Create MongoDB collection

Syntax

`createCollection(conn,collection)`

Description

`createCollection(conn,collection)` creates a collection in MongoDB by using the MongoDB C++ interface connection.

Examples

Create Collection in MongoDB

Connect to MongoDB® using the MongoDB C++ interface and create a collection.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
          Database: "mongotest"
          UserName: ""
            Server: "dbtb01"
              Port: 27017
   CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Create a collection in the database using the MongoDB connection. Specify the collection name `taxidata`.

```
collection = "taxidata";
createCollection(conn,collection)
```

Display the collections in the database by using the `CollectionNames` property. The database contains the new collection `taxidata`.

```
conn.CollectionNames
```

```
ans = 14×1 string
    "dateissue"
    "product"
    "timestamps"
    "restaurants"
    "employees"
    "bsontest"
    "taxidata"
    "airlinesmall"
    "largedata"
    "patients"
    "genderMeanAge"
    "escalation"
    "nyctaxi"
    "tsunamis"
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB C++ interface connection

`connection` object

MongoDB C++ interface connection, specified as a `connection` object.

`collection` — Collection name

string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

Version History

Introduced in R2021b

See Also

`mongoc` | `isopen` | `find` | `dropCollection` | `close`

Topics

"Import and Analyze Data from MongoDB Using MongoDB C++ Interface" on page 11-2
"Import Filtered Data from MongoDB Using MongoDB C++ Interface" on page 11-4
"Import Large Data from MongoDB Using MongoDB C++ Interface" on page 11-6

External Websites

MongoDB Manual

dropCollection

Namespace: `database.mongo`

Drop MongoDB collection

Syntax

```
dropCollection(conn,collection)
```

Description

`dropCollection(conn,collection)` drops an existing collection from MongoDB by using the MongoDB C++ interface connection.

Examples

Drop Collection in MongoDB

Connect to MongoDB® using the MongoDB C++ interface and drop an existing collection.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
          Database: "mongotest"
          UserName: ""
            Server: "dbtb01"
              Port: 27017
   CollectionNames: [14×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 14 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Display the collections in the database before dropping a collection by using the `CollectionNames` property.

```
conn.CollectionNames
```

```
ans = 14×1 string
    "dateissue"
    "product"
    "timestamps"
    "restaurants"
    "employees"
    "bsontest"
    "taxidata"
    "airlinesmall"
    "largedata"
    "patients"
    "genderMeanAge"
    "escalation"
    "nyctaxi"
    "tsunamis"
```

Drop an existing collection from the database by using the MongoDB connection. Specify the collection name `taxidata`.

```
collection = "taxidata";
dropCollection(conn,collection)
```

Display the collections in the database again by using the `CollectionNames` property. The database no longer contains the collection `taxidata`.

```
conn.CollectionNames
```

```
ans = 13×1 string
    "dateissue"
    "product"
    "timestamps"
    "restaurants"
    "employees"
    "bsontest"
    "airlinesmall"
    "largedata"
    "patients"
    "genderMeanAge"
    "escalation"
    "nyctaxi"
    "tsunamis"
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

`conn` — MongoDB C++ interface connection
`connection` object

MongoDB C++ interface connection, specified as a `connection` object.

`collection` — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

Version History

Introduced in R2021b

See Also

`mongoc` | `isopen` | `find` | `createCollection` | `close`

Topics

“Import and Analyze Data from MongoDB Using MongoDB C++ Interface” on page 11-2
“Import Filtered Data from MongoDB Using MongoDB C++ Interface” on page 11-4
“Import Large Data from MongoDB Using MongoDB C++ Interface” on page 11-6

External Websites

MongoDB Manual

find

Namespace: `database.mongo`

Retrieve documents in MongoDB collection

Syntax

```
documents = find(conn,collection)
documents = find(conn,collection,Name=Value)
```

Description

`documents = find(conn,collection)` returns all documents in a collection by using the MongoDB C++ interface connection.

`documents = find(conn,collection,Name=Value)` specifies additional options using one or more name-value arguments. For example, `Limit=10` limits the number of documents returned to 10.

Examples

Retrieve All Documents in Collection

Connect to MongoDB® using the MongoDB C++ interface, retrieve all documents in a collection, and import them into MATLAB®. In this example, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.

- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Specify the `employees` collection for document retrieval. Retrieve all documents in the collection by using the MongoDB connection. `documents` is a cell array of structures.

```
collection = "employees";
documents = find(conn,collection);
```

Display the first document in the collection. Each document is a structure.

```
documents{1}
```

```
ans = struct with fields:
              _id: '5d8ccb9c961c96252819ea63'
      employee_id: 100
       first_name: 'Steven'
        last_name: 'King'
            email: 'SKING'
     phone_number: '515.123.4567'
        hire_date: '2003-06-17 00:00:00.0'
           job_id: 'AD_PRES'
           salary: 24000
    department_id: 90
        temporary: 0
```

The structure fields are:

- Unique identifier
- Employee identifier
- First name
- Last name
- Email
- Phone number
- Hire date
- Job name
- Employee salary
- Department identifier
- Temporary flag

Close the MongoDB connection.

```
close(conn)
```

Retrieve All Documents in MongoDB Query

Connect to MongoDB® using the MongoDB C++ interface, retrieve all documents in a MongoDB query on a collection in the database, and import them into MATLAB®. In this example, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Specify the `employees` collection for document retrieval. Create the MongoDB query as a string scalar that contains a JSON-style string. This query retrieves all employees in the department that has the department identifier `80`.

```
collection = "employees";
mongoquery = "{""department_id"":80}";
```

Retrieve all documents in the MongoDB query on the `employees` collection by using the MongoDB connection. `documents` is a cell array that contains a structure for each document returned by the query.

```
documents = find(conn,collection,Query=mongoquery);
```

Close the MongoDB connection.

```
close(conn)
```

Sort Retrieved Documents in Collection

Connect to MongoDB® using the MongoDB C++ interface and retrieve documents in a MongoDB query on a collection in the database. Then, sort the results by a field in the documents. In this example, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Specify the `employees` collection for document retrieval. Create the MongoDB query as a string scalar that contains a JSON-style string. This query retrieves all employees in the department that has the department identifier `80`.

```
collection = "employees";
mongoquery = "{""department_id"":80}";
```

Create the sort query as a string scalar that contains a JSON-style string. Sort the documents by the salary field.

```
sortquery = "{""salary"":1.0}";
```

Retrieve all documents in the MongoDB query on the `employees` collection by using the MongoDB connection, and sort the documents. `documents` is a cell array that contains a structure for each document returned by the query. The documents are sorted by salary in increasing order.

```
documents = find(conn,collection,Query=mongoquery,Sort=sortquery);
```

Display the data for the first two employees sorted by salary. The salary for the second employee is higher than the first employee.

```
documents{1:2}
```

```
ans = struct with fields:
              _id: '5d8ccc16961c96252819ea68'
      employee_id: 148
       first_name: 'Gerald'
        last_name: 'Cambrault'
            email: 'GCAMBRAU'
     phone_number: '011.44.1344.619268'
        hire_date: '2007-10-15 00:00:00.0'
           job_id: 'SA_MAN'
           salary: 11000
   commission_pct: 0.3000
       manager_id: 100
    department_id: 80
        temporary: 0


ans = struct with fields:
              _id: '5d8ccc12961c96252819ea67'
      employee_id: 147
       first_name: 'Alberto'
        last_name: 'Errazuriz'
            email: 'AERRAZUR'
     phone_number: '011.44.1344.429278'
        hire_date: '2005-03-10 00:00:00.0'
           job_id: 'SA_MAN'
           salary: 12000
   commission_pct: 0.3000
       manager_id: 100
    department_id: 80
        temporary: 0
```

Close the MongoDB connection.

```
close(conn)
```

Retrieve Specific Fields in Collection

Connect to MongoDB® using the MongoDB C++ interface and retrieve all documents in a collection. Specify the fields to retrieve for each document. Import the documents into MATLAB®. In this example, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Specify the `employees` collection for document retrieval. Specify the fields to retrieve for each document by using a string scalar that contains a JSON-style string. For this example, return the `department_id` and `salary` fields.

```
collection = "employees";
fields = "{""department_id"":1.0,""salary"":1.0}";
```

Retrieve all documents in the collection. Use the name-value argument `Projection` to retrieve the specified fields for each document. `documents` is a cell array.

```
documents = find(conn,collection,Projection=fields);
```

Display the first document in the results. In addition to the unique identifier for the document, the document contains only the specified fields.

```
documents{1}
```

```
ans = struct with fields:
            _id: '5d8ccb9c961c96252819ea63'
         salary: 24000
    department_id: 90
```

Close the MongoDB connection.

```
close(conn)
```

Retrieve Specific Number of Documents Using Offset

Connect to MongoDB® using the MongoDB C++ interface and retrieve a specific number of documents in a collection in the database. Return documents from a specific position in the results using an offset value. Import the documents into MATLAB®. In this example, each document in the collection represents an employee.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Specify the `employees` collection for document retrieval.

```
collection = "employees";
```

Use the name-value argument `Skip` to skip the first five documents in the collection. Then, use the name-value argument `Limit` to return the next 10 documents in the collection. `documents` is a cell array that contains 10 documents.

```
documents = find(conn,collection,Skip=5,Limit=10);
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB C++ interface connection
`connection` object

MongoDB C++ interface connection, specified as a `connection` object.

collection — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Example: `Skip=5,Limit=10` skips the first five documents in a collection and returns the next 10 documents.

Query — MongoDB query
string scalar | character vector

MongoDB query, specified as a string scalar or character vector. Specify a JSON-style string to query the database.

Example: `Query="{""department"":""Sales""}"` queries the database for documents where the `department` field is equal to `Sales`.

Example: `Query="{""salary"": {""$gt"": 90000}}"` queries the database for documents where the value of the `salary` field is greater than `90000`.

Example: `Query="{""_id"":{""$oid"":""593fec95b78dc311e01e9204""}}"` queries the database for the document that has the identifier `593fec95b78dc311e01e9204`.

Data Types: `char` | `string`

Projection — Fields
string scalar | character vector

Fields to retrieve in each document, specified as a string scalar or character vector. Specify a JSON-style string to describe the fields.

Example: `Projection="{""department"":1.0,""salary"":1.0}"` returns the `department` and `salary` fields.

Data Types: `char` | `string`

`Sort` — Sort field
string scalar | character vector

Sort field for documents, specified as a string scalar or character vector. Specify a JSON-style string to describe the sort field.

Example: `Sort="{""department"":1.0}"` sorts the returned documents by the `department` field.

Data Types: `char` | `string`

`Skip` — Offset
numeric scalar

Offset from the beginning of the returned documents, specified as a numeric scalar.

Example: `Skip=5` skips the first five returned documents.

Data Types: `double`

`Limit` — Number of documents to return
numeric scalar

Number of documents to return, specified as a numeric scalar.

Example: `Limit=10` returns 10 documents.

Data Types: `double`

Output Arguments

`documents` — Documents
structure | structure array | cell array of structures

Documents in a MongoDB collection or query on a collection, returned as a structure, structure array, or cell array of structures.

Each JSON-style document is represented as a structure. The `find` function returns a:

- Structure for one document
- Structure array for multiple documents containing the same fields
- Cell array of structures for multiple documents containing different fields

Version History

Introduced in R2021b

See Also

`mongoc` | `isopen` | `insert` | `remove` | `update` | `close`

Topics

"Import and Analyze Data from MongoDB Using MongoDB C++ Interface" on page 11-2
"Import Filtered Data from MongoDB Using MongoDB C++ Interface" on page 11-4
"Import Large Data from MongoDB Using MongoDB C++ Interface" on page 11-6

External Websites

MongoDB Manual

insert

Namespace: `database.mongo`

Insert one or multiple documents into MongoDB collection

Syntax

`n = insert(conn,collection,documents)`

Description

`n = insert(conn,collection,documents)` returns the number of documents inserted into a collection using the MongoDB C++ interface connection. Specify one or multiple documents to insert.

Examples

Insert One Document into Collection as Structure

Connect to MongoDB® using the MongoDB C++ interface and export one document from MATLAB® and insert it into a collection. Specify the document to insert as a structure. In this example, the collection represents employee data.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Create one document as the `document` structure with three fields. Set the `employee_id` field to 28, `department_id` field to 80, and `salary` field to 200,000.

```
document.employee_id = 28;
document.department_id = 80;
document.salary = 200000;
```

Specify the `employees` collection. Insert the document into the collection by using the MongoDB C++ interface connection. The `insert` function inserts one document into the collection.

```
collection = "employees";
n = insert(conn,collection,document)
```

```
n = int64
    1
```

Close the MongoDB connection.

```
close(conn)
```

Insert Multiple Documents into Collection as Structure Array

Connect to MongoDB® using the MongoDB C++ interface and export multiple documents from MATLAB® and insert them into a collection. Specify documents to insert as a structure array. In this example, the collection represents employee data.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.

- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the isopen function returns 1. Otherwise, the database connection is closed.

Create two documents as structures with these fields: employee_id, department_id, and salary. For the employee1 structure, set the employee_id field to 26, department_id field to 80, and salary field to 100,000. For the employee2 structure, set the same fields to the values 27, 90, and 150,000 respectively. Create the documents structure array from these documents.

```
employee1.employee_id = 26;
employee1.department_id = 80;
employee1.salary = 100000;

employee2.employee_id = 27;
employee2.department_id = 90;
employee2.salary = 150000;

documents = [employee1 employee2];
```

Specify the employees collection. Insert documents into the collection using the MongoDB connection. The insert function inserts two documents into the collection.

```
collection = "employees";
n = insert(conn,collection,documents)
```

```
n = int64
    2
```

Close the MongoDB connection.

```
close(conn)
```

Insert Multiple Documents into Collection as Table

Connect to MongoDB® using the MongoDB C++ interface and export documents from MATLAB® and insert them into a collection. Specify documents to insert as a table. In this example, the collection represents employee data.

Create a MongoDB connection to the database mongotest using the MongoDB C++ interface. Here, the database server dbtb01 hosts this database using port number 27017.

```
server = "dbtb01";
port = 27017;
```

```
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Create two documents using these workspace variables:

- `department_ids` — Double array
- `employee_ids` — Double array
- `salaries` — Double array

Create the `documents` table from these workspace variables.

```
department_ids = [80;90];
employee_ids = [24;25];
salaries = [100000;150000];
documents = table(department_ids,employee_ids,salaries);
```

Specify the `employees` collection. Insert documents into the collection using the MongoDB connection. The `insert` function inserts two documents into the collection.

```
collection = "employees";
n = insert(conn,collection,documents)
```

```
n = int64
    2
```

Close the MongoDB connection.

```
close(conn)
```

Insert Multiple Documents into Collection as Cell Array of Structures

Connect to MongoDB® using the MongoDB C++ interface and export documents from MATLAB® and insert them into a collection. Specify documents to insert as a cell array of structures. In this example, the collection represents employee data.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Create two documents as the structures `employee1` and `employee2`. Create the `documents` cell array using these structures.

```
employee1.department_id = 90;
employee1.employee_id = 22;
employee1.salary = 100000;

employee2.department_id = 80;
employee2.employee_id = 23;
employee2.salary = 150000;

documents = {employee1;employee2};
```

Specify the `employees` collection. Insert documents into the collection using the MongoDB C++ interface connection. The `insert` function inserts two documents into the collection.

```
collection = "employees";
n = insert(conn,collection,documents)
```

```
n = int64
    2
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB C++ interface connection
`connection` object

MongoDB C++ interface connection, specified as a `connection` object.

`collection` — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

`documents` — Documents to insert
string scalar | character vector | structure | ...

Documents to insert into a MongoDB collection, specified as one of these types:

- String scalar
- Character vector
- Structure
- Structure array
- Cell array of structures
- Table
- Handle or value classes

When working with string scalars and character vectors, you specify key-value pairs as shown in these examples.

- String scalar — `"{""department"":""Sales"",""employeename"":""George Mason""}"`
- Character vector — `'{''department'':''Sales'',''employeename'':''George Mason''}'`

For handle and value classes, you can define your own class. After you instantiate a class, you can insert the resulting object into MongoDB. However, the resulting object properties must contain data types that can be converted to MATLAB data types. For example, if one of the object properties is a

Java object, then you cannot insert the object into MongoDB. For details about these classes, see "Handle Classes".

Output Arguments

n — Number of documents inserted
int64 scalar

Number of documents inserted into a collection in the database, returned as an `int64` scalar.

Note The `insert` function does not return the `containers.Map` data type.

Version History

Introduced in R2021b

See Also

`mongoc` | `isopen` | `remove` | `update` | `close`

Topics

"Export MATLAB Data into MongoDB Using MongoDB C++ Interface" on page 11-8
"Import and Export MATLAB Objects Using MongoDB and MongoDB C++ Interface" on page 11-10

External Websites

MongoDB Manual

isopen

Namespace: `database.mongo`

Determine if MongoDB C++ interface connection is open

Syntax

```
i = isopen(conn)
```

Description

`i = isopen(conn)` returns `1` if the MongoDB connection is open and `0` if it is closed.

Examples

Verify MongoDB C++ Interface Connection

Connect to MongoDB® using the MongoDB C++ interface and count the total number of documents in a collection. Then, verify the connection is closed.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Determine the number of documents in the `employees` collection. The collection contains seven documents.

```
collection = "employees";
n = count(conn,collection)
```

```
n = int64
    7
```

Close the MongoDB connection.

```
close(conn)
```

Verify the MongoDB connection is closed.

```
isopen(conn)
```

```
ans = logical
   0
```

Input Arguments

conn — MongoDB C++ interface connection
`connection` object

MongoDB C++ interface connection, specified as a `connection` object.

Version History

Introduced in R2021b

See Also

Objects
`connection`

Functions
`mongoc` | `count` | `find` | `close`

Topics
“Import and Analyze Data from MongoDB Using MongoDB C++ Interface” on page 11-2
“Import Filtered Data from MongoDB Using MongoDB C++ Interface” on page 11-4
“Import Large Data from MongoDB Using MongoDB C++ Interface” on page 11-6

External Websites

MongoDB Manual

remove

Namespace: database.mongo

Remove one or multiple documents from MongoDB collection

Syntax

n = remove(conn,collection,mongoquery)

Description

n = remove(conn,collection,mongoquery) returns the number of documents removed from a collection using the MongoDB C++ interface connection. Use a MongoDB query to specify removing one or multiple documents.

Examples

Remove Documents Using MongoDB Query

Connect to MongoDB® using the MongoDB C++ interface and remove documents from a collection. Specify a MongoDB query to determine which documents to remove. In this example, the collection represents employee data.

Create a MongoDB connection to the database mongotest using the MongoDB C++ interface. Here, the database server dbtb01 hosts this database using port number 27017.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [14×1 string]
```

conn is the connection object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is mongotest.
- The user name is blank.
- The database server is dbtb01.
- The port number is 27017.
- This database contains 14 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Create a MongoDB query to identify documents to remove. For this example, specify the `employeedata` collection. Create the MongoDB query to identify documents in the department that has the department identifier set to `80`.

```
collection = "employeedata";
mongoquery = "{""department_id"":80}";
```

Remove documents using the MongoDB query. The `remove` function removes three documents from the collection.

```
n = remove(conn,collection,mongoquery)
```

```
n = int64
    3
```

Close the MongoDB connection.

```
close(conn)
```

Remove All Documents from Collection

Connect to MongoDB® using the MongoDB C++ interface and remove all documents from a collection. In this example, the collection represents employee data.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [14×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.

- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 14 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Remove all documents from the `employeedata` collection. Use an empty MongoDB query to specify removing all documents. The `remove` function removes three documents from the collection.

```
collection = "employeedata";
n = remove(conn,collection,"{}")
```

```
n = int64
    3
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

conn — MongoDB C++ interface connection
`connection` object

MongoDB C++ interface connection, specified as a `connection` object.

`collection` — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

`mongoquery` — MongoDB query
string scalar | character vector

MongoDB query, specified as a string scalar or character vector. Specify a JSON-style string to query the database.

Example: `"{""department"":""Sales""}"` queries the database for documents where the `department` field is equal to `Sales`.

Example: `"{""salary"": {""$gt"": 90000}}"` queries the database for documents where the value of the `salary` field is greater than `90000`.

Data Types: `string` | `char`

Output Arguments

n — Number of documents removed
numeric scalar

Number of documents removed from a collection in the database, returned as a numeric scalar.

Version History

Introduced in R2021b

See Also

`mongoc` | `isopen` | `insert` | `update` | `close`

Topics

"Export MATLAB Data into MongoDB Using MongoDB C++ Interface" on page 11-8
"Import and Export MATLAB Objects Using MongoDB and MongoDB C++ Interface" on page 11-10

External Websites

MongoDB Manual

update

Namespace: `database.mongo`

Update one or multiple documents in MongoDB collection

Syntax

`n = update(conn,collection,findquery,updatequery)`

Description

`n = update(conn,collection,findquery,updatequery)` returns the number of documents updated in a collection using the MongoDB C++ interface connection. Use MongoDB queries to find and update documents.

Examples

Update Documents in Collection

Connect to MongoDB® using the MongoDB C++ interface and update documents in a collection. Find documents to update by using a MongoDB query. Specify the criteria for the update by using a MongoDB query. In this example, the collection represents employee data.

Create a MongoDB connection to the database `mongotest` using the MongoDB C++ interface. Here, the database server `dbtb01` hosts this database using port number `27017`.

```
server = "dbtb01";
port = 27017;
dbname = "mongotest";
conn = mongoc(server,port,dbname)
```

```
conn = connection with properties:
           Database: "mongotest"
           UserName: ""
             Server: "dbtb01"
               Port: 27017
    CollectionNames: [13×1 string]
```

`conn` is the `connection` object that contains the MongoDB connection. The object properties contain information about the connection and the database.

- The database name is `mongotest`.
- The user name is blank.
- The database server is `dbtb01`.
- The port number is `27017`.
- This database contains 13 document collections.

Verify the MongoDB connection.

```
isopen(conn)
```

```
ans = logical
   1
```

The database connection is successful because the `isopen` function returns 1. Otherwise, the database connection is closed.

Specify the `employees` collection. Create a MongoDB query to find employees in the department where the department identifier is set to `90`. Then, create a MongoDB query to increase the value in the salary field by `5000`.

```
collection = "employees";
findquery = "{""department_id"":90}";
updatequery = "{""$inc"":{""salary"":5000}}";
```

Increase the salaries for all employees in the department using the MongoDB connection. The `update` function updates four documents in the collection.

```
n = update(conn,collection,findquery,updatequery)
```

```
n = int64
    4
```

Close the MongoDB connection.

```
close(conn)
```

Input Arguments

`conn` — MongoDB C++ interface connection
`connection` object

MongoDB C++ interface connection, specified as a `connection` object.

`collection` — Collection name
string scalar

Collection name, specified as a string scalar.

Example: `"taxidata"`

Data Types: `string`

`findquery` — MongoDB find query
string scalar | character vector

MongoDB find query, specified as a string scalar or character vector. Specify a JSON-style string to find documents in the database.

Example: `"{""department"":""Sales""}"` finds all documents where the `department` field is equal to `Sales`.

Example: `"{""_id"":{""$oid"":""593fec95b78dc311e01e9204""}}"` finds the document that has the identifier `593fec95b78dc311e01e9204`.

Data Types: `char` | `string`

`updatequery` — MongoDB update query
string scalar | character vector

MongoDB update query, specified as a string scalar or character vector. Use a JSON-style string to specify the criteria for the update.

Example: `"{""$inc"":{""salary"":5000}}"` increases the values in the `salary` field by `5000`.

Data Types: `char` | `string`

Output Arguments

`n` — Number of documents updated
numeric scalar

Number of documents updated in a collection in the database, returned as a numeric scalar.

Version History

Introduced in R2021b

See Also

`mongoc` | `isopen` | `insert` | `remove` | `close`

Topics

"Export MATLAB Data into MongoDB Using MongoDB C++ Interface" on page 11-8
"Import and Export MATLAB Objects Using MongoDB and MongoDB C++ Interface" on page 11-10

External Websites

MongoDB Manual

CassandraConnectionOptions

Apache Cassandra database connection options

Description

Create connection options for an Apache Cassandra database connection.

After you create an `CassandraConnectionOptions` object, set the connection options, test the connection, and save the data source, you can create an Apache Cassandra database connection using the saved data source. The connection options include the options required to make a Cassandra database connection.

Creation

To create a `CassandraConnectionOptions` object, use the `databaseConnectionOptions` function.

Properties

`DataSourceName` — Data source name
string scalar

Data source name, specified as a string scalar. You can use the data source name in the `apacheCassandra` function to create a Cassandra database connection.

Example: `"ApacheCassandra"`

Data Types: `string`

`Vendor` — Database vendor
string scalar

This property is read-only.

Database vendor, specified as a string scalar. Set this property using the `vendor` input argument in the `databaseConnectionOptions` function.

Example: `"Cassandra"`

Data Types: `string`

`ContactPoints` — Contact points
`"localhost"` (default) | string scalar | string array

Contact points that are host addresses for one node or for multiple nodes in the Cassandra cluster, specified as a string scalar or string array. Specify a string scalar for one node. Or, specify a string array for multiple nodes.

You can specify a local host or the IP address of a different machine in the Cassandra cluster.

When you specify multiple nodes, if the connection to one host fails, then the `apacheCassandra` function connects to the other nodes in the cell array or string array until a connection succeeds. If a connection attempt fails for all specified nodes, the function displays an error message. If one or more nodes are not available, enter multiple nodes in the string array to increase the likelihood of a successful connection.

Data Types: `string`

`PortNumber` — Port number
`9042` (default) | positive numeric scalar

Port number for connection to the host, specified as a positive numeric scalar.

Data Types: `double`

`SSLEnabled` — SSL-enabled connection
`false` (default) | `true`

SSL-enabled connection, specified as the value `false` or `true`. Setting this argument to `true` creates an SSL-enabled connection to the Cassandra database.

Data Types: `logical`

`LoginTimeout` — Login timeout
`5` (default) | positive numeric scalar

Login timeout, specified as a positive numeric scalar. The login timeout specifies the number of seconds that the C++ driver waits while trying to connect to the Cassandra database before throwing an error.

Data Types: `double`

`RequestTimeout` — Request timeout
`12` (default) | positive numeric scalar

This property is read-only.

Request timeout, specified as a positive numeric scalar. The request timeout indicates the number of seconds the database waits to return a CQL query before throwing an error.

Data Types: `double`

Object Functions

setoptions	Set Apache Cassandra database connection options
testConnection	Test Apache Cassandra database connection
reset	Reset Apache Cassandra database connection options to defaults
saveAsDataSource	Save Apache Cassandra data source

Examples

Create Cassandra Data Source and Set Connection Options

Configure an Apache™ Cassandra® database connection by creating a Cassandra data source, setting the Cassandra connection options, and saving the data source.

Create a Cassandra data source for a Cassandra database connection.

```
vendor = "Cassandra";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  CassandraConnectionOptions with properties:

             DataSourceName: ""
                     Vendor: "Cassandra"

              ContactPoints: "localhost"
                 PortNumber: 9042
                 SSLEnabled: false
               LoginTimeout: 5
             RequestTimeout: 12
```

`opts` is an `CassandraConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `ContactPoints` — Contact points
- `PortNumber` — Port number
- `SSLEnabled` — SSL-enabled connection
- `LoginTimeout` — Login timeout
- `RequestTimeout` — Request timeout

Configure the data source by setting the Cassandra connection options for the data source `CassandraDataSource`, local host address for one node in the cluster, port number `9042`, SSL encryption that is disabled, login timeout of 5 seconds, and request timeout of 12 seconds.

```
opts = setoptions(opts, ...
    "DataSourceName","CassandraDataSource", ...
    "ContactPoints","localhost","PortNumber",9042, ...
    "SSLEnabled",false,"LoginTimeout",5, ...
    "RequestTimeout",12)
```

```
opts = 
  CassandraConnectionOptions with properties:

             DataSourceName: "CassandraDataSource"
                     Vendor: "Cassandra"

              ContactPoints: "localhost"
                 PortNumber: 9042
                 SSLEnabled: false
               LoginTimeout: 5
             RequestTimeout: 12
```

The `setoptions` function sets the `DataSourceName`, `ContactPoints`, `PortNumber`, `SSLEnabled`, `LoginTimeout`, and `RequestTimeout` properties in the `CassandraConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)

status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

Version History

Introduced in R2021a

See Also

`apacheCassandra` | `databaseConnectionOptions` | `deleteDataSource`

External Websites

Apache Cassandra
Apache Cassandra Documentation

setoptions

Namespace: `database.options.native.cassandra`

Set Apache Cassandra database connection options

Syntax

`opts = setoptions(opts,Option1,OptionValue1,...,OptionN,OptionValueN)`

Description

`opts = setoptions(opts,Option1,OptionValue1,...,OptionN,OptionValueN)` sets Apache Cassandra database connection options using the `CassandraConnectionOptions` object `opts`.

Examples

Create Cassandra Data Source and Set Connection Options

Configure an Apache™ Cassandra® database connection by creating a Cassandra data source, setting the Cassandra connection options, and saving the data source.

Create a Cassandra data source for a Cassandra database connection.

```
vendor = "Cassandra";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  CassandraConnectionOptions with properties:

             DataSourceName: ""
                     Vendor: "Cassandra"

              ContactPoints: "localhost"
                 PortNumber: 9042
                 SSLEnabled: false
               LoginTimeout: 5
             RequestTimeout: 12
```

`opts` is an `CassandraConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `ContactPoints` — Contact points
- `PortNumber` — Port number
- `SSLEnabled` — SSL-enabled connection
- `LoginTimeout` — Login timeout

- `RequestTimeout` — Request timeout

Configure the data source by setting the Cassandra connection options for the data source `CassandraDataSource`, local host address for one node in the cluster, port number `9042`, SSL encryption that is disabled, login timeout of 5 seconds, and request timeout of 12 seconds.

```
opts = setoptions(opts, ...
    "DataSourceName","CassandraDataSource", ...
    "ContactPoints","localhost","PortNumber",9042, ...
    "SSLEnabled",false,"LoginTimeout",5, ...
    "RequestTimeout",12)
```

```
opts = 
  CassandraConnectionOptions with properties:

              DataSourceName: "CassandraDataSource"
                      Vendor: "Cassandra"

               ContactPoints: "localhost"
                  PortNumber: 9042
                  SSLEnabled: false
                LoginTimeout: 5
              RequestTimeout: 12
```

The `setoptions` function sets the `DataSourceName`, `ContactPoints`, `PortNumber`, `SSLEnabled`, `LoginTimeout`, and `RequestTimeout` properties in the `CassandraConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

Input Arguments

opts — Database connection options

`CassandraConnectionOptions` object

Database connection options, specified as a `CassandraConnectionOptions` object.

Option1,OptionValue1,...,OptionN,OptionValueN — Cassandra database connection options to set

name-value pair arguments

Cassandra database connection options to set, specified as one or more name-value pair arguments. `Option` is a character vector or string scalar that specifies the name of a Cassandra database

connection option. `OptionValue` specifies the value of the Cassandra database connection option. `OptionValue` can be a character vector, string scalar, logical scalar, or numeric scalar. You can specify any Cassandra database connection option that is a property of the `CassandraConnectionOptions` object.

Example:
`"DataSourceName","myDataSource","ContactPoints","localhost","PortNumber",9042` configures a Cassandra data source named `myDataSource` that is located on the local host address with the port number `9042`.

Output Arguments

`opts` — Database connection options
`CassandraConnectionOptions` object

Database connection options, returned as a `CassandraConnectionOptions` object.

Version History

Introduced in R2021a

See Also

Objects
`CassandraConnectionOptions` | `connection`

Functions
`reset` | `testConnection` | `saveAsDataSource` | `databaseConnectionOptions` | `deleteDataSource`

Topics
"Modify and Delete Data Sources" on page 4-17

testConnection

Namespace: `database.options.native.cassandra`

Test Apache Cassandra database connection

Syntax

```
status = testConnection(opts,username,password)
[status,message] = testConnection(opts,username,password)
```

Description

`status = testConnection(opts,username,password)` tests the Apache Cassandra database connection specified by the `CassandraConnectionOptions` object `opts`, a user name, and a password.

`[status,message] = testConnection(opts,username,password)` also returns the error message associated with testing the database connection.

Examples

Create Cassandra Data Source and Set Connection Options

Configure an Apache™ Cassandra® database connection by creating a Cassandra data source, setting the Cassandra connection options, and saving the data source.

Create a Cassandra data source for a Cassandra database connection.

```
vendor = "Cassandra";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  CassandraConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "Cassandra"

               ContactPoints: "localhost"
                  PortNumber: 9042
                  SSLEnabled: false
                LoginTimeout: 5
              RequestTimeout: 12
```

`opts` is an `CassandraConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `ContactPoints` — Contact points

- `PortNumber` — Port number
- `SSLEnabled` — SSL-enabled connection
- `LoginTimeout` — Login timeout
- `RequestTimeout` — Request timeout

Configure the data source by setting the Cassandra connection options for the data source `CassandraDataSource`, local host address for one node in the cluster, port number `9042`, SSL encryption that is disabled, login timeout of 5 seconds, and request timeout of 12 seconds.

```
opts = setoptions(opts, ...
    "DataSourceName","CassandraDataSource", ...
    "ContactPoints","localhost","PortNumber",9042, ...
    "SSLEnabled",false,"LoginTimeout",5, ...
    "RequestTimeout",12)
```

```
opts = 
  CassandraConnectionOptions with properties:

             DataSourceName: "CassandraDataSource"
                     Vendor: "Cassandra"

              ContactPoints: "localhost"
                 PortNumber: 9042
                 SSLEnabled: false
               LoginTimeout: 5
             RequestTimeout: 12
```

The `setoptions` function sets the `DataSourceName`, `ContactPoints`, `PortNumber`, `SSLEnabled`, `LoginTimeout`, and `RequestTimeout` properties in the `CassandraConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

Retrieve Message for Apache Cassandra Database Connection Test

Create and configure a Cassandra data source to a Cassandra database. Test the database connection to the Cassandra data source and retrieve the error message.

Create a Cassandra data source for a Cassandra database connection.

```
vendor = "Cassandra";
opts = databaseConnectionOptions("native",vendor)

opts = 
  CassandraConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Cassandra"

             ContactPoints: "localhost"
                PortNumber: 9042
                SSLEnabled: false
              LoginTimeout: 5
            RequestTimeout: 12
```

`opts` is a `CassandraConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `ContactPoints` — Contact points
- `PortNumber` — Port number
- `SSLEnabled` — SSL-enabled connection
- `LoginTimeout` — Login timeout
- `RequestTimeout` — Request timeout

Configure the data source by setting the Cassandra connection options for the data source `CassandraDataSource`, local host address for one node in the cluster, port number `1500`, SSL encryption that is disabled, login timeout of 5 seconds, and request timeout of 12 seconds. In this case, the port number is invalid.

```
opts = setoptions(opts, ...
    "DataSourceName","CassandraDataSource", ...
    "ContactPoints","localhost","PortNumber",1500, ...
    "SSLEnabled",false,"LoginTimeout",5, ...
    "RequestTimeout",12)

opts = 
  CassandraConnectionOptions with properties:

            DataSourceName: "CassandraDataSource"
                    Vendor: "Cassandra"

             ContactPoints: "localhost"
                PortNumber: 1500
                SSLEnabled: false
              LoginTimeout: 5
            RequestTimeout: 12
```

The `setoptions` function sets the `DataSourceName`, `ContactPoints`, `PortNumber`, `SSLEnabled`, `LoginTimeout`, and `RequestTimeout` properties in the `CassandraConnectionOptions` object.

Test the database connection using a blank user name and password. The `testConnection` function returns the logical `0`, which indicates the database connection fails because the port number is invalid. Retrieve and display the error message for the failed connection.

```
username = "";
password = "";
[status,message] = testConnection(opts,username,password)
```

```
status =

  logical

   0


message =

    'Cassandra exception: Underlying connection error: Connect error 'connection refused''
```

Input Arguments

`opts` — Database connection options
`CassandraConnectionOptions` object

Database connection options, specified as a `CassandraConnectionOptions` object.

`username` — User name
character vector | string scalar

User name required to access the database, specified as a character vector or string scalar. If no user name is required, specify an empty value `""`.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password required to access the database, specified as a character vector or string scalar. If no password is required, specify an empty value `""`.

Data Types: `char` | `string`

Output Arguments

`status` — Connection status
logical

Connection status, returned as a logical `true` if the connection test passes or `false` if the connection test fails.

`message` — Error message
character vector

Error message, returned as a character vector. If the connection test passes, then the error message is an empty character vector. Otherwise, the error message contains text from the failed database connection.

Version History

Introduced in R2021a

See Also

Objects
`CassandraConnectionOptions` | `connection`

Functions
`setoptions` | `reset` | `saveAsDataSource` | `databaseConnectionOptions` | `deleteDataSource`

Topics
"Modify and Delete Data Sources" on page 4-17

reset

Namespace: `database.options.native.cassandra`

Reset Apache Cassandra database connection options to defaults

Syntax

`opts = reset(opts)`

Description

`opts = reset(opts)` resets all Apache Cassandra database connection options to their default values for all properties of the `CassandraConnectionOptions` object.

Examples

Reset Cassandra Connection Options to Default Values

Create, configure, and test an Apache™ Cassandra® data source for a Cassandra database. Reset the Cassandra connection options to their default values. Then configure, test, and save the data source with different Cassandra connection options.

Create a Cassandra data source for a Cassandra database connection.

```
vendor = "Cassandra";
opts = databaseConnectionOptions("native",vendor)
```

```
opts =
  CassandraConnectionOptions with properties:

            DataSourceName: ""
                    Vendor: "Cassandra"

             ContactPoints: "localhost"
                PortNumber: 9042
                SSLEnabled: false
              LoginTimeout: 5
            RequestTimeout: 12
```

`opts` is an `CassandraConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `ContactPoints` — Contact points
- `PortNumber` — Port number
- `SSLEnabled` — SSL-enabled connection
- `LoginTimeout` — Login timeout

- `RequestTimeout` — Request timeout

Configure the data source by setting the Cassandra connection options for the data source `CassandraDataSource`, local host address for one node in the cluster, port number `9042`, SSL encryption that is disabled, login timeout of 5 seconds, and request timeout of 12 seconds.

```
opts = setoptions(opts, ...
    "DataSourceName","CassandraDataSource", ...
    "ContactPoints","localhost","PortNumber",9042, ...
    "SSLEnabled",false,"LoginTimeout",5, ...
    "RequestTimeout",12)
```

```
opts = 
  CassandraConnectionOptions with properties:

             DataSourceName: "CassandraDataSource"
                     Vendor: "Cassandra"

              ContactPoints: "localhost"
                 PortNumber: 9042
                 SSLEnabled: false
               LoginTimeout: 5
             RequestTimeout: 12
```

The `setoptions` function sets the `DataSourceName`, `ContactPoints`, `PortNumber`, `SSLEnabled`, `LoginTimeout`, and `RequestTimeout` properties in the `CassandraConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Reset the Cassandra connection options to their default values. The properties of the `CassandraConnectionOptions` object contain the default values.

```
opts = reset(opts)
```

```
opts = 
  CassandraConnectionOptions with properties:

             DataSourceName: ""
                     Vendor: "Cassandra"

              ContactPoints: "localhost"
                 PortNumber: 9042
                 SSLEnabled: false
               LoginTimeout: 5
             RequestTimeout: 12
```

Configure the data source by setting the Cassandra connection options for the data source `CassandraDataSource`, local host address for one node in the cluster, port number `9042`, SSL encryption that is disabled, login timeout of 5 seconds, and request timeout of 20 seconds.

```
opts = setoptions(opts, ...
    "DataSourceName","CassandraDataSource", ...
    "ContactPoints","localhost","PortNumber",9042, ...
    "SSLEnabled",false,"LoginTimeout",5, ...
    "RequestTimeout",20)
```

```
opts =
  CassandraConnectionOptions with properties:

              DataSourceName: "CassandraDataSource"
                      Vendor: "Cassandra"

               ContactPoints: "localhost"
                  PortNumber: 9042
                  SSLEnabled: false
                LoginTimeout: 5
              RequestTimeout: 20
```

The `setoptions` function sets the `DataSourceName`, `ContactPoints`, `PortNumber`, `SSLEnabled`, `LoginTimeout`, and `RequestTimeout` properties in the `CassandraConnectionOptions` object.

Test the database connection again.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

Input Arguments

opts — Database connection options
`CassandraConnectionOptions` object

Database connection options, specified as a `CassandraConnectionOptions` object.

Output Arguments

opts — Database connection options
`CassandraConnectionOptions` object

Database connection options, returned as a `CassandraConnectionOptions` object.

Version History

Introduced in R2021a

See Also

Objects

`CassandraConnectionOptions` | `connection`

Functions

`setoptions` | `testConnection` | `saveAsDataSource` | `databaseConnectionOptions` | `deleteDataSource`

Topics

"Modify and Delete Data Sources" on page 4-17

saveAsDataSource

Namespace: `database.options.native.cassandra`

Save Apache Cassandra data source

Syntax

`saveAsDataSource(opts)`

Description

`saveAsDataSource(opts)` saves the Apache Cassandra data source specified by the `CassandraConnectionOptions` object `opts`.

Examples

Create Cassandra Data Source and Set Connection Options

Configure an Apache™ Cassandra® database connection by creating a Cassandra data source, setting the Cassandra connection options, and saving the data source.

Create a Cassandra data source for a Cassandra database connection.

```
vendor = "Cassandra";
opts = databaseConnectionOptions("native",vendor)
```

```
opts = 
  CassandraConnectionOptions with properties:

              DataSourceName: ""
                      Vendor: "Cassandra"

               ContactPoints: "localhost"
                  PortNumber: 9042
                  SSLEnabled: false
                LoginTimeout: 5
              RequestTimeout: 12
```

`opts` is an `CassandraConnectionOptions` object with these properties:

- `DataSourceName` — Name of the data source
- `Vendor` — Database vendor name
- `ContactPoints` — Contact points
- `PortNumber` — Port number
- `SSLEnabled` — SSL-enabled connection
- `LoginTimeout` — Login timeout
- `RequestTimeout` — Request timeout

Configure the data source by setting the Cassandra connection options for the data source `CassandraDataSource`, local host address for one node in the cluster, port number `9042`, SSL encryption that is disabled, login timeout of 5 seconds, and request timeout of 12 seconds.

```
opts = setoptions(opts, ...
    "DataSourceName","CassandraDataSource", ...
    "ContactPoints","localhost","PortNumber",9042, ...
    "SSLEnabled",false,"LoginTimeout",5, ...
    "RequestTimeout",12)
```

```
opts = 
  CassandraConnectionOptions with properties:

            DataSourceName: "CassandraDataSource"
                    Vendor: "Cassandra"

             ContactPoints: "localhost"
                PortNumber: 9042
                SSLEnabled: false
              LoginTimeout: 5
            RequestTimeout: 12
```

The `setoptions` function sets the `DataSourceName`, `ContactPoints`, `PortNumber`, `SSLEnabled`, `LoginTimeout`, and `RequestTimeout` properties in the `CassandraConnectionOptions` object.

Test the database connection with a blank user name and password. The `testConnection` function returns the logical `1`, which indicates the database connection is successful.

```
username = "";
password = "";
status = testConnection(opts,username,password)
```

```
status = logical
   1
```

Save the configured data source.

```
saveAsDataSource(opts)
```

Input Arguments

`opts` — Database connection options

`CassandraConnectionOptions` object

Database connection options, specified as a `CassandraConnectionOptions` object.

Version History

Introduced in R2021a

See Also

Objects
CassandraConnectionOptions | connection

Functions
setoptions | testConnection | reset | databaseConnectionOptions | deleteDataSource

Topics
"Modify and Delete Data Sources" on page 4-17

connection

Apache Cassandra database connection

Description

The `connection` object represents an Apache Cassandra database connection created using the Apache Cassandra database C++ interface.

After you create a `connection` object, you can use the object functions to import data from the Cassandra database into MATLAB. Or, you can export data from MATLAB to the Cassandra database. You can also explore the database structure and execute Cassandra Query Language (CQL) queries.

For details about the Cassandra database, see the Apache Cassandra Documentation.

Creation

To create a `connection` object, use the `apacheCassandra` function.

Properties

`Cluster` — Cassandra cluster name
string scalar

This property is read-only.

Cassandra cluster name, specified as a string scalar.

Example: `"Test Cluster"`

Data Types: `string`

`HostAddresses` — Host address
string scalar | string array

This property is read-only.

Host address for one node or host addresses for multiple nodes in the Cassandra cluster, specified as a string scalar for one node or string array for multiple nodes. These addresses include the addresses specified in the `'ContactPoints'` name-value argument of the `apacheCassandra` function.

Example: `"localhost/127.0.0.1"`

Data Types: `string`

`LocalDataCenter` — Local data center name
string scalar

This property is read-only.

Local data center name, specified as a string scalar. The name describes the data center that the cluster declares as local for the connection instance. The name matches the data center of the

original contact point for the connection. When you set up the cluster, you define a data center for each node.

Example: `"datacenter1"`

Data Types: `string`

`Keyspaces` — Keyspaces
string scalar | string array

This property is read-only.

Keyspaces in the Cassandra database, specified as a string scalar or string array. A string scalar indicates the Cassandra database has one keyspace, and a string array indicates multiple keyspaces.

Example: `["employeedata" "system"]`

Data Types: `string`

`RequestTimeout` — Request timeout
12 (default) | positive numeric scalar

This property is read-only.

Request timeout, specified as a positive numeric scalar. The request timeout indicates the number of seconds to wait for the database to return a CQL query before throwing an error.

Data Types: `double`

Object Functions

Cassandra Database Connection

close	Close Apache Cassandra database connection
isopen	Determine if Apache Cassandra database connection is open

Import Cassandra Database Data into MATLAB

columninfo	Retrieve column information from Apache Cassandra database table
partitionRead	Import data from partitions of Apache Cassandra database table
tablenames	List names of database tables in Apache Cassandra database

Export MATLAB Data into Cassandra Database

upsert	Insert or update data in Apache Cassandra database

Execute CQL Query

executecql	Execute CQL query on Apache Cassandra database

Examples

Create Apache Cassandra Database Connection

Create a database connection to an Apache™ Cassandra® database using the Apache Cassandra database C++ interface. To create this connection, you must configure a Cassandra data source. For

more information, see the `databaseConnectionOptions` function. Using a local host address, create the database connection and display the keyspaces in the database.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password)
```

```
conn = 
  connection with properties:

            Cluster: "Test Cluster"
      HostAddresses: "127.0.0.1"
    LocalDataCenter: "datacenter1"
     RequestTimeout: 20
          Keyspaces: [6×1 string]
```

`conn` is a `connection` object that contains these properties:

- Cassandra cluster name
- Host address
- Local data center name
- Keyspaces
- Request timeout

Display the keyspaces in the Cassandra database by accessing the `Keyspaces` property of the `connection` object.

```
conn.Keyspaces
```

```
ans = 6×1 string
    "employeedata"
    "system"
    "system_auth"
    "system_distributed"
    "system_schema"
    "system_traces"
```

Close the Cassandra database connection.

```
close(conn)
```

Version History

Introduced in R2021a

See Also

Objects
`CassandraConnectionOptions`

Functions
`databaseConnectionOptions` | `deleteDataSource`

External Websites
Apache Cassandra
Apache Cassandra Documentation

apacheCassandra

Create Apache Cassandra database connection

Syntax

```
conn = apacheCassandra(datasource,username,password)
conn = apacheCassandra(username,password,Name,Value)
```

Description

`conn = apacheCassandra(datasource,username,password)` creates a Cassandra database connection using a data source name, user name, and password.

`conn = apacheCassandra(username,password,Name,Value)` specifies options using one or more name-value arguments. For example, `'PortNumber',9042` creates a Cassandra database connection using the port number `9042`.

Examples

Create Apache Cassandra Database Connection

Create a database connection to an Apache™ Cassandra® database using the Apache Cassandra database C++ interface. To create this connection, you must configure a Cassandra data source. For more information, see the `databaseConnectionOptions` function. Using a local host address, create the database connection and display the keyspaces in the database.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password)
```

```
conn = 
  connection with properties:

            Cluster: "Test Cluster"
      HostAddresses: "127.0.0.1"
    LocalDataCenter: "datacenter1"
     RequestTimeout: 20
          Keyspaces: [6×1 string]
```

`conn` is a `connection` object that contains these properties:

- Cassandra cluster name
- Host address
- Local data center name

- Keyspaces
- Request timeout

Display the keyspaces in the Cassandra database by accessing the `Keyspaces` property of the `connection` object.

```
conn.Keyspaces
```

```
ans = 6×1 string
    "employeedata"
    "system"
    "system_auth"
    "system_distributed"
    "system_schema"
    "system_traces"
```

Close the Cassandra database connection.

```
close(conn)
```

Create Apache Cassandra Database Connection Using Additional Options

Create a database connection to an Apache™ Cassandra® database with additional options using the Apache Cassandra database C++ interface. Using an additional option for request timeout, create the database connection and display the keyspaces in the database.

Create a Cassandra database connection using a blank user name and password. Specify an additional option for a request timeout of 20 seconds.

```
username = "";
password = "";
conn = apacheCassandra(username,password, ...
    'RequestTimeout',20)
```

```
conn =
  connection with properties:

            Cluster: "Test Cluster"
      HostAddresses: "127.0.0.1"
    LocalDataCenter: "datacenter1"
     RequestTimeout: 20
          Keyspaces: [6×1 string]
```

`conn` is a `connection` object that contains these properties:

- Cassandra cluster name
- Host address
- Local data center name
- Keyspaces
- Request timeout

Display the keyspaces in the Cassandra database by accessing the `Keyspaces` property of the `connection` object.

```
conn.Keyspaces
```

```
ans = 6×1 string
    "employeedata"
    "system"
    "system_auth"
    "system_distributed"
    "system_schema"
    "system_traces"
```

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

`datasource` — Data source name
character vector | string scalar

Data source name, specified as a character vector or string scalar. Specify the name of an existing data source.

Example: `"myDataSource"`

Data Types: `char` | `string`

`username` — User name
character vector | string scalar

User name, specified as a character vector or string scalar. If the cluster requires authentication, use the `username` input argument for the user name.

Data Types: `char` | `string`

`password` — Password
character vector | string scalar

Password, specified as a character vector or string scalar. If the cluster requires authentication, use the `password` input argument for the password.

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `conn = apacheCassandra(username,password,'SSLEnabled',true,'RequestTimeout',15)`

creates a Cassandra database connection with SSL encryption enabled and a request timeout of 15 seconds.

`ContactPoints` — Contact points
`"localhost"` (default) | character vector | string scalar | cell array of character vectors | string array

Contact points, specified as a character vector, string scalar, cell array of character vectors, or string array. Contact points are host addresses for one node or for multiple nodes in the Cassandra cluster. Specify a string scalar for one node. Or, specify a string array for multiple nodes.

You can specify a local host or the IP address of a different machine in the Cassandra cluster.

When you specify multiple nodes, if the connection to one host fails, then the `apacheCassandra` function connects to the other nodes in the cell array or string array until a connection succeeds. If a connection attempt fails for all specified nodes, the function displays an error message. If one or more nodes are not available, enter multiple nodes in the cell array or string array to increase the likelihood of a successful connection.

Data Types: `char` | `string` | `cell`

`PortNumber` — Port number
`9042` (default) | positive numeric scalar

Port number for connection to the host, specified as a positive numeric scalar.

Data Types: `double`

`SSLEnabled` — SSL-enabled connection
`false` (default) | `true`

SSL-enabled connection, specified as the value `false` or `true`. Setting this argument to `true` creates an SSL-enabled connection to the Cassandra database.

Data Types: `logical`

`LoginTimeout` — Login timeout
`5` (default) | positive numeric scalar

Login timeout, specified as a positive numeric scalar. The login timeout specifies the number of seconds that the C++ driver waits while trying to connect to the Cassandra database before throwing an error.

Data Types: `double`

`RequestTimeout` — Request timeout
`12` (default) | positive numeric scalar

This property is read-only.

Request timeout, specified as a positive numeric scalar. The request timeout indicates the number of seconds the database waits to return a CQL query before throwing an error.

Data Types: `double`

Output Arguments

conn — Apache Cassandra database connection
`connection` object

Apache Cassandra database connection, returned as a `connection` object.

Version History
Introduced in R2021a

See Also

Objects
`CassandraConnectionOptions` | `connection`

Functions
`isopen` | `tablenames` | `columninfo` | `partitionRead` | `upsert` | `executecql` | `close`

External Websites
Apache Cassandra
Apache Cassandra Documentation

isopen

Namespace: database.apacheCassandra

Determine if Apache Cassandra database connection is open

Syntax

```
val = isopen(conn)
```

Description

val = isopen(conn) returns 1 if the Cassandra database connection is open and 0 if it is closed.

Examples

Verify Cassandra Connection

Using the Apache™ Cassandra® database C++ interface, create a Cassandra database connection and verify that the connection is open. Display the keyspaces in the Cassandra database, and then close the connection.

Create a Cassandra database connection using the configured data source CassandraDataSource and a blank user name and password. The apacheCassandra function returns conn as a connection object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Verify that the Cassandra database connection is open.

```
val = isopen(conn)
```

```
val = logical
   1
```

The database connection is open because the isopen function returns 1. Otherwise, the database connection is closed.

Display the keyspaces in the Cassandra database.

```
conn.Keyspaces
```

```
ans = 6×1 string
    "employeedata"
    "system"
    "system_auth"
    "system_distributed"
    "system_schema"
```

```
    "system_traces"
```

Close the Cassandra database connection.

```
close(conn)
```

Verify that the Cassandra database connection is closed.

```
val = isopen(conn)
```

```
val = logical
   0
```

Input Arguments

conn — Apache Cassandra database connection
`connection` object

Apache Cassandra database connection, specified as a `connection` object.

Version History

Introduced in R2021a

See Also

Objects
`CassandraConnectionOptions` | `connection`

Functions
`apacheCassandra` | `tablenames` | `columninfo` | `partitionRead` | `executecql` | `close`

Topics
"Explore and Import Data from Cassandra Database Table" on page 9-11
"Import Data from Cassandra Database Table Using CQL" on page 9-14

External Websites
Apache Cassandra Documentation

close

Namespace: `database.apacheCassandra`

Close Apache Cassandra database connection

Syntax

`close(conn)`

Description

`close(conn)` closes the Cassandra database connection.

Examples

Create Apache Cassandra Database Connection

Create a database connection to an Apache™ Cassandra® database using the Apache Cassandra database C++ interface. To create this connection, you must configure a Cassandra data source. For more information, see the `databaseConnectionOptions` function. Using a local host address, create the database connection and display the keyspaces in the database.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password)
```

```
conn = 
  connection with properties:

            Cluster: "Test Cluster"
      HostAddresses: "127.0.0.1"
    LocalDataCenter: "datacenter1"
     RequestTimeout: 20
          Keyspaces: [6×1 string]
```

`conn` is a `connection` object that contains these properties:

- Cassandra cluster name
- Host address
- Local data center name
- Keyspaces
- Request timeout

Display the keyspaces in the Cassandra database by accessing the `Keyspaces` property of the `connection` object.

```
conn.Keyspaces
```

```
ans = 6×1 string
    "employeedata"
    "system"
    "system_auth"
    "system_distributed"
    "system_schema"
    "system_traces"
```

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Apache Cassandra database connection
`connection` object

Apache Cassandra database connection, specified as a `connection` object.

Version History

Introduced in R2021a

See Also

Objects
`CassandraConnectionOptions` | `connection`

Functions
`apacheCassandra` | `isopen` | `columninfo` | `tablenames` | `partitionRead` | `executecql`

Topics
“Explore and Import Data from Cassandra Database Table” on page 9-11
“Import Data from Cassandra Database Table Using CQL” on page 9-14

External Websites
Apache Cassandra Documentation

tablenames

Namespace: `database.apacheCassandra`

List names of database tables in Apache Cassandra database

Syntax

```
t = tablenames(conn)
t = tablenames(conn,keyspace)
```

Description

`t = tablenames(conn)` returns a list that contains the names of Cassandra database tables and their corresponding keyspaces of the Cassandra database.

`t = tablenames(conn,keyspace)` returns a list that contains the names of Cassandra database tables in the specified keyspace of the Cassandra database.

Examples

Return Database Table Names in Cassandra Database

Using a Cassandra® database connection and the Apache™ Cassandra database C++ interface, return the names of all database tables in the Cassandra database.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Return the names of all database tables in the Cassandra database using the Cassandra database connection. `t` is a table that contains the names of all Cassandra database tables and their corresponding keyspaces.

```
t = tablenames(conn);
```

Display the first few rows of the returned data.

```
head(t)
```

```
ans=8×2 table
       Keyspace              Table
    ______________    ___________________

    "employeedata"    "employees_by_id"
    "employeedata"    "employees_by_job"
    "employeedata"    "employees_by_name"
```

```
    "system"          "IndexInfo"
    "system"          "available_ranges"
    "system"          "batches"
    "system"          "batchlog"
    "system"          "built_views"
```

The `Keyspace` variable indicates the keyspace. The `Table` variable indicates the name of the Cassandra database table in the corresponding keyspace.

Close the Cassandra database connection.

```
close(conn)
```

Return Database Table Names in Cassandra Database Keyspace

Using an Apache™ Cassandra® database connection and the Apache Cassandra database C++ interface, return the names of all database tables in a specific keyspace of the Cassandra database—in this case, the `employeedata` keyspace.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Return and display all database tables in the `employeedata` keyspace of the Cassandra database by using the Cassandra database connection. `t` is a string array that contains the names of all database tables in the `employeedata` keyspace.

```
keyspace = "employeedata";
t = tablenames(conn,keyspace)
```

```
t = 3×1 string
    "employees_by_id"
    "employees_by_job"
    "employees_by_name"
```

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Apache Cassandra database connection
`connection` object

Apache Cassandra database connection, specified as a `connection` object.

keyspace — Keyspace
character vector | string scalar

Keyspace, specified as a character vector or string scalar. If you do not know the keyspace, then access the `Keyspaces` property of the `connection` object using dot notation to view the keyspaces in the Cassandra database.

Example: `"employeedata"`

Data Types: `char` | `string`

Output Arguments

`t` — Database table names
string array | table

Database table names in the Cassandra database, specified as a string array or table. If you specify a keyspace in the `keyspace` input argument, the `tablenames` function returns a string array that contains all the database table names in the specified keyspace of the Cassandra database. If you do not specify a keyspace, the `tablenames` function returns a table with the `Keyspace` and `Table` variables. The `Keyspace` variable is a string array that contains all keyspaces in the Cassandra database. The `Table` variable is a string array that contains the names of all database tables in the Cassandra database for their corresponding keyspaces.

Version History

Introduced in R2021a

See Also

Objects
`CassandraConnectionOptions` | `connection`

Functions
`apacheCassandra` | `columninfo` | `partitionRead` | `upsert` | `executecql` | `close`

Topics
“Explore and Import Data from Cassandra Database Table” on page 9-11

External Websites
Apache Cassandra Documentation

columninfo

Namespace: `database.apacheCassandra`

Retrieve column information from Apache Cassandra database table

Syntax

```
cols = columninfo(conn,keyspace,tablename)
[cols,keyValues] = columninfo(conn,keyspace,tablename)
```

Description

`cols = columninfo(conn,keyspace,tablename)` returns column information from a specified Cassandra database table in a specified keyspace using the Cassandra database connection.

`[cols,keyValues] = columninfo(conn,keyspace,tablename)` also returns the key values for each partition in the Cassandra database table.

Examples

Return Column Information from Cassandra Database Table

Using an Apache™ Cassandra® database connection and the Apache Cassandra database C++ interface, return column information for a Cassandra database table. Specify the keyspace and the name of the table. In this case, the Cassandra database has the `employeedata` keyspace, which contains the `employees_by_job` database table.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Return column information for the `employees_by_job` database table in the `employeedata` keyspace.

```
keyspace = "employeedata";
tablename = "employees_by_job";
cols = columninfo(conn,keyspace,tablename);
```

Display the first few rows of column information.

```
head(cols)
```

```
ans=8×4 table
          Name            DataType     PartitionKey     ClusteringColumn
    ________________     ________     ____________     ________________
```

```
    "job_id"            "text"         true              ""
    "hire_date"         "date"         false             "DESC"
    "employee_id"       "int"          false             "ASC"
    "commission_pct"    "double"       false             ""
    "department_id"     "int"          false             ""
    "email"             "text"         false             ""
    "first_name"        "text"         false             ""
    "last_name"         "text"         false             ""
```

`cols` is a table with these variables:

- `Name` — Cassandra database column name
- `DataType` — Cassandra Query Language (CQL) data type of the Cassandra database column
- `PartitionKey` — Partition key indicator
- `ClusteringColumn` — Clustering column indicator

Close the Cassandra database connection.

```
close(conn)
```

Return Partition Key Values from Cassandra Database Table

Using an Apache™ Cassandra® database connection and the Apache Cassandra database C++ interface, return partition key values for a Cassandra database table. Specify the keyspace and name of the table. In this case, the Cassandra database has the `employeedata` keyspace, which contains the `employees_by_job` database table.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Return column information for the `employees_by_job` database table in the `employeedata` keyspace.

```
keyspace = "employeedata";
tablename = "employees_by_job";
[cols,keyValues] = columninfo(conn,keyspace,tablename);
```

`keyValues` is a table that contains a variable for each partition key. The rows are partition key values.

Display the first few partition key values of the Cassandra database table.

```
head(keyValues)
```

```
ans=8×1 table
      job_id
```

```
__________

"ST_CLERK"
"SA_MAN"
"HR_REP"
"IT_PROG"
"FI_MGR"
"PR_REP"
"PU_MAN"
"AD_PRES"
```

`job_id` is the only partition key in the `employees_by_job` database table. Each row is a partition key value that is a unique partition in `employees_by_job`.

Use the partition key values with the `partitionRead` function to import data from a Cassandra database table.

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Apache Cassandra database connection

`connection` object

Apache Cassandra database connection, specified as a `connection` object.

keyspace — Keyspace

character vector | string scalar

Keyspace, specified as a character vector or string scalar. If you do not know the keyspace, then access the `Keyspaces` property of the `connection` object using dot notation to view the keyspaces in the Cassandra database.

Example: `"employeedata"`

Data Types: `char` | `string`

tablename — Cassandra database table name

character vector | string scalar

Cassandra database table name, specified as a character vector or string scalar. If you do not know the name of the table, then use the `tablenames` function to find it.

Example: `"employees_by_job"`

Data Types: `char` | `string`

Output Arguments

cols — Column information

table

Column information from a Cassandra database table, returned as a MATLAB table containing these variables.

Variable Name	Variable Description	Variable Data Type
`Name`	Cassandra database column name	`string`
`DataType`	CQL data type of the Cassandra database column	`string`
`PartitionKey`	Whether the Cassandra database table column is a partition key (`true` indicates a partition key)	`logical`
`ClusteringColumn`	Whether the Cassandra database table column is a clustering column (`"ASC"` indicates ascending order, `"DESC"` indicates descending order, and `""` indicates that the column is not a clustering column)	`string`

If the data type of a column in a Cassandra database table is a collection (for example, a `list`, `map`, and so on), then the value of the `DataType` variable contains angle brackets (<>). These angle brackets surround the data type of the items in the collection. The value for user-defined types (UDTs) contains the type name. For example, if the UDT is `person`, then the value of the `DataType` variable is `person` in the MATLAB table. For details about valid CQL data types, see CQL Data Types.

`keyValues` — Partition key values
table

Partition key values, returned as a table. The MATLAB table contains one variable for each partition key in the Cassandra database table. Each row in the MATLAB table represents a unique partition in the Cassandra database table.

You can use the partition key values with the `partitionRead` function to import data from a Cassandra database table.

For details about the MATLAB data types of the partition key values, see “Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface” on page 9-2.

Version History

Introduced in R2021a

See Also

Objects
`CassandraConnectionOptions` | `connection`

Functions
`apacheCassandra` | `tablenames` | `partitionRead` | `upsert` | `executecql` | `close`

Topics
“Explore and Import Data from Cassandra Database Table” on page 9-11

External Websites
Apache Cassandra Documentation
CQL Data Types

upsert

Namespace: database.apacheCassandra

Insert or update data in Apache Cassandra database

Syntax

```
upsert(conn,keyspace,tablename,data)
upsert(conn,keyspace,tablename,data,Name,Value)
```

Description

upsert(conn,keyspace,tablename,data) exports data from MATLAB by inserting or updating it in an Apache Cassandra database table.

upsert(conn,keyspace,tablename,data,Name,Value) specifies options using one or more name-value arguments. For example, 'ConsistencyLevel',"TWO" sets the consistency level to specify that two nodes must respond for the CQL query to execute.

Examples

Insert MATLAB Data into Cassandra Database

Insert data from MATLAB® into an Apache™ Cassandra® database using the Apache Cassandra database C++ interface, and display the data by using a Cassandra database connection.

The Cassandra database includes the employees_by_job database table, which contains employee data and the job_id partition key.

Create a Cassandra database connection using the configured data source CassandraDataSource and a blank user name and password. The apacheCassandra function returns conn as a connection object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Return the names of the Cassandra database tables in the employeedata keyspace. t is a string array that contains the names of these tables.

```
keyspace = "employeedata";
t = tablenames(conn,keyspace)
```

```
t = 3×1 string
    "employees_by_id"
    "employees_by_job"
    "employees_by_name"
```

Import employee data into MATLAB from the `employees_by_job` table by using the Cassandra database connection.

```
keyspace = "employeedata";
tablename = "employees_by_job";
results = partitionRead(conn,keyspace,tablename);
```

Display the last few rows of the imported employee data.

```
tail(results)
```

```
ans=8×13 table
      job_id        hire_date     employee_id    commission_pct    department_id      email
    _____________    ___________    ___________    ______________    _____________    ___________

    "SH_CLERK"      27-Jan-2004       184             NaN               50           "NSARCHAN"
    "MK_REP"        17-Aug-2005       202             NaN               20           "PFAY"
    "PU_CLERK"      10-Aug-2007       119             NaN               30           "KCOLMENA"
    "PU_CLERK"      15-Nov-2006       118             NaN               30           "GHIMURO"
    "PU_CLERK"      24-Dec-2005       116             NaN               30           "SBAIDA"
    "PU_CLERK"      24-Jul-2005       117             NaN               30           "STOBIAS"
    "PU_CLERK"      18-May-2003       115             NaN               30           "AKHOO"
    "AC_ACCOUNT"    07-Jun-2002       206             NaN              110           "WGIETZ"
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Display the CQL data types of the columns in the `employees_by_job` database table.

```
cols = columninfo(conn,keyspace,tablename);
cols(:,1:2)
```

```
ans=13×2 table
            Name               DataType
    _____________________    ___________

    "job_id"                 "text"
    "hire_date"              "date"
```

```
    "employee_id"           "int"
    "commission_pct"        "double"
    "department_id"         "int"
    "email"                 "text"
    "first_name"            "text"
    "last_name"             "text"
    "manager_id"            "int"
    "office"                "office"
    "performance_ratings"   "list<int>"
    "phone_number"          "text"
    "salary"                "int"
```

Create a table of data representing one employee to insert into the Cassandra database. Specify the names of the variables. Create a table for the office information. Then, create a table with the employee information that contains the nested table of office information. Set the names of the variables.

```
varnames = ["job_id" "hire_date" "employee_id" ...
    "commission_pct" "department_id" "email" "first_name" ...
    "last_name" "manager_id" "office" "performance_ratings" ...
    "phone_number" "salary"];
office = table("South",160, ...
    'VariableNames',["building" "room"]);
data = table("IT_ADMIN",datetime('today'),301,0.25,30,"SMITH123", ...
    "Alex","Smith",114,office,{[4 5]},"515.123.2345",3000);
data.Properties.VariableNames = varnames;
```

Insert the employee information into the Cassandra database.

```
upsert(conn,keyspace,tablename,data)
```

Display the inserted data by importing it into MATLAB using the partition key `IT_ADMIN`. The `employees_by_job` table contains a new row.

```
keyValue = "IT_ADMIN";
results = partitionRead(conn,keyspace,tablename,keyValue)
```

```
results=1×13 table
      job_id       hire_date     employee_id    commission_pct    department_id      email

    __________    ___________    ___________    ______________    _____________    __________

    "IT_ADMIN"    06-Oct-2020        301             0.25              30          "SMITH123"
```

Close the Cassandra database connection.

```
close(conn)
```

Update Data in Cassandra Database Using Consistency Level

Using the Apache™ Cassandra® database C++ interface, update data in an Apache Cassandra database with MATLAB® data. Display the updated data by using a Cassandra database connection. Specify a consistency level for the write operation.

The Cassandra database includes the `employees_by_job` database table, which contains employee data and the `job_id` partition key.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Return the names of the Cassandra database tables in the `employeedata` keyspace. `t` is a string array that contains the names of these tables.

```
keyspace = "employeedata";
t = tablenames(conn,keyspace)
```

```
t = 3×1 string
    "employees_by_id"
    "employees_by_job"
    "employees_by_name"
```

Import employee data into MATLAB from the `employees_by_job` table by using the Cassandra database connection.

```
keyspace = "employeedata";
tablename = "employees_by_job";
results = partitionRead(conn,keyspace,tablename);
```

Display the last few rows of the imported employee data.

```
tail(results)
```

```
ans=8×13 table
       job_id         hire_date      employee_id    commission_pct    department_id      email
    ____________    ___________    ___________    ______________    _____________    __________

    "SH_CLERK"      27-Jan-2004        184              NaN                50         "NSARCHAN"
    "MK_REP"        17-Aug-2005        202              NaN                20         "PFAY"
    "PU_CLERK"      10-Aug-2007        119              NaN                30         "KCOLMENA"
    "PU_CLERK"      15-Nov-2006        118              NaN                30         "GHIMURO"
    "PU_CLERK"      24-Dec-2005        116              NaN                30         "SBAIDA"
    "PU_CLERK"      24-Jul-2005        117              NaN                30         "STOBIAS"
    "PU_CLERK"      18-May-2003        115              NaN                30         "AKHOO"
    "AC_ACCOUNT"    07-Jun-2002        206              NaN               110         "WGIETZ"
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage

- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Display the CQL data types of the columns in the `employees_by_job` database table.

```
cols = columninfo(conn,keyspace,tablename);
cols(:,1:2)
```

```
ans=13×2 table
            Name               DataType
    _____________________    ___________

    "job_id"                 "text"
    "hire_date"              "date"
    "employee_id"            "int"
    "commission_pct"         "double"
    "department_id"          "int"
    "email"                  "text"
    "first_name"             "text"
    "last_name"              "text"
    "manager_id"             "int"
    "office"                 "office"
    "performance_ratings"    "list<int>"
    "phone_number"           "text"
    "salary"                 "int"
```

Import the data to update by using the `partitionRead` function with the partition key value `MK_REP`. The data is for an employee who is a marketing representative.

```
keyValue = "MK_REP";
data = partitionRead(conn,keyspace,tablename,keyValue)
```

```
data=1×13 table
     job_id      hire_date     employee_id    commission_pct    department_id    email     first_

    ________    ___________    ___________    ______________    _____________    ______    ______

    "MK_REP"    17-Aug-2005        202             NaN               20          "PFAY"      "Pa
```

Update the commission percentage to 0.25 for the marketing representative. Also, specify the consistency level `"ONE"` to ensure that one replica node commits the write operation.

```
data.commission_pct = 0.25;
level = "ONE";
upsert(conn,keyspace,tablename,data,'ConsistencyLevel',level)
```

Display the updated data by importing it into MATLAB using the partition key value `MK_REP`. The updated commission percentage for the marketing representative is 0.25.

```
keyValue = "MK_REP";
results = partitionRead(conn,keyspace,tablename,keyValue)
```

```
results=1×13 table
     job_id      hire_date     employee_id    commission_pct    department_id    email     first_

    ________    ___________    ___________    ______________    _____________    ______    ______

    "MK_REP"    17-Aug-2005        202             0.25              20          "PFAY"      "Pa
```

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Apache Cassandra database connection
connection object

Apache Cassandra database connection, specified as a `connection` object.

keyspace — Keyspace
character vector | string scalar

Keyspace, specified as a character vector or string scalar. If you do not know the keyspace, then access the `Keyspaces` property of the `connection` object using dot notation to view the keyspaces in the Cassandra database.

Example: "employeedata"

Data Types: char | string

tablename — Cassandra database table name
character vector | string scalar

Cassandra database table name, specified as a character vector or string scalar. If you do not know the name of the table, then use the `tablenames` function to find it.

Example: "employees_by_job"

Data Types: char | string

data — Data to insert or update
table

Data to insert or update in a Cassandra database, specified as a table. You must specify the primary keys of the Cassandra database table, but you can ignore other Cassandra columns. The names of the variables in the table must match the names of the Cassandra columns in the database table, without case sensitivity. The data types of the variables in the table must be compatible with the CQL data types of the Cassandra columns. For details, see “Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface” on page 9-2.

Data Types: table

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `upsert(conn,keyspace,tablename,data,'ConsistencyLevel',"ONE",'RequestTimeout',15)` exports data by receiving a write response from one node, and the database must wait 15 seconds to perform the write operation before throwing an error.

`ConsistencyLevel` — Consistency level

`"ONE"` (default) | character vector | string scalar

Consistency level, specified as one of these values.

Consistency Level Value	Write Operation
`"ALL"`	Commit on all replica nodes.
`"EACH_QUORUM"`	Commit on a majority of replica nodes in each data center.
`"QUORUM"`	Commit on most replica nodes.
`"LOCAL_QUORUM"`	Commit on most replica nodes in the local data center.
`"ONE"` (default)	Commit on one replica node.
`"TWO"`	Commit on two replica nodes.
`"THREE"`	Commit on three replica nodes.
`"LOCAL_ONE"`	Commit on one replica node in the local data center.
`"ANY"`	Commit on at least one replica node.

You can specify the value of the consistency level as a character vector or string scalar.

For details about consistency levels, see Configuring Data Consistency.

Data Types: `char` | `string`

`RequestTimeout` — Request timeout

12 (default) | positive numeric scalar

This property is read-only.

Request timeout, specified as a positive numeric scalar. The request timeout indicates the number of seconds the database waits to return a CQL query before throwing an error.

Data Types: `double`

Version History

Introduced in R2021a

See Also

Objects
`connection`

Functions
`apacheCassandra` | `tablenames` | `columninfo` | `partitionRead` | `executecql` | `close`

Topics
"Explore and Import Data from Cassandra Database Table" on page 9-11
"Export MATLAB Data into Cassandra Database" on page 9-16
"Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface" on page 9-2

External Websites
Apache Cassandra Documentation
CQL Data Types
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partitionRead

Namespace: `database.apacheCassandra`

Import data from partitions of Apache Cassandra database table

Syntax

```
results = partitionRead(conn,keyspace,tablename)
results = partitionRead(conn,keyspace,tablename,keyValue1...keyValueN)
results = partitionRead( ___ ,Name,Value)
```

Description

`results = partitionRead(conn,keyspace,tablename)` returns imported data by reading all Cassandra database columns from all partitions of a Cassandra database table. The `partitionRead` function imports data from a Cassandra database into MATLAB without using a Cassandra Query Language (CQL) query.

`results = partitionRead(conn,keyspace,tablename,keyValue1...keyValueN)` returns imported data by reading all Cassandra columns from one or more partitions specified by the partition key values.

`results = partitionRead( ___ ,Name,Value)` specifies options using one or more name-value arguments in addition to any of the previous input argument combinations. For example, `'ConsistencyLevel',"TWO"` sets the consistency level to specify that two nodes must respond for the CQL query to execute.

Examples

Import Data from Cassandra Database Table

Using the Apache™ Cassandra® database C++ interface, create a Cassandra database connection and import data from a Cassandra database table into MATLAB®. The Cassandra database contains a database table with employee data.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Import employee data into MATLAB from the employeedata keyspace and the `employees_by_job` database table by using the Cassandra database connection.

```
keyspace = "employeedata";
tablename = "employees_by_job";
results = partitionRead(conn,keyspace,tablename);
```

Display the first few rows of the returned employee data.

```
head(results)
```

```
ans=8×13 table
      job_id       hire_date     employee_id    commission_pct    department_id      email
    __________    ___________    ___________    ______________    _____________    __________

    "ST_CLERK"    08-Mar-2008        128              NaN               50         "SMARKLE"
    "ST_CLERK"    06-Feb-2008        136              NaN               50         "HPHILTAN"
    "ST_CLERK"    12-Dec-2007        135              NaN               50         "KGEE"
    "ST_CLERK"    10-Apr-2007        132              NaN               50         "TJOLSON"
    "ST_CLERK"    14-Jan-2007        127              NaN               50         "JLANDRY"
    "ST_CLERK"    28-Sep-2006        126              NaN               50         "IMIKKILI"
    "ST_CLERK"    26-Aug-2006        134              NaN               50         "MROGERS"
    "ST_CLERK"    09-Jul-2006        144              NaN               50         "PVARGAS"
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close the Cassandra database connection.

```
close(conn)
```

Import Data Using Multiple Partition Key Values

Using the Apache™ Cassandra® database C++ interface, create a Cassandra® database connection and import data from a Cassandra database table into MATLAB®. Use the values of two partition keys in the database table to import data. The Cassandra database contains a database table with employee data.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Import employee data into MATLAB from the `employeedata` keyspace and the `employees_by_name` database table by using the Cassandra database connection. This database table has the `first_name` and `last_name` partition keys. Specify the first and last names of two employees as values of the partition keys to import data for those two employees.

```
keyspace = "employeedata";
tablename = "employees_by_name";
keyValue1 = ["Christopher","Alexander"];
keyValue2 = ["Olsen","Hunold"];
results = partitionRead(conn,keyspace,tablename,keyValue1,keyValue2);
```

Display the returned employee data for the two employees.

```
results
```

```
results=2×13 table
     first_name       last_name      hire_date      employee_id     commission_pct     department_id
    _____________     _________     ___________     ___________     ______________     _____________

    "Alexander"       "Hunold"      03-Jan-2006         103              NaN                 60
    "Christopher"     "Olsen"       30-Mar-2006         153              0.2                 80
```

`results` is a table that contains these variables:

- `first_name` — First name
- `last_name` — Last name
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address
- `job_id` — Job identifier
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close the Cassandra database connection.

```
close(conn)
```

Import Data Using Consistency Level

Using the Apache™ Cassandra® database C++ interface, create a Cassandra database connection and import data from a Cassandra database table into MATLAB®. Use the value of the partition key in the database table to import data. Specify a consistency level for returning results. The Cassandra database contains a database table with employee data.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Import employee data into MATLAB from the `employeedata` keyspace and the `employees_by_job` database table by using the Cassandra database connection. This database table has the `job_id` partition key. Specify the `IT_PROG` value of the partition key to import all data for only those employees who are programmers. Also, specify the consistency level as one node.

```
keyspace = "employeedata";
tablename = "employees_by_job";
keyValue = "IT_PROG";
level = "ONE";
results = partitionRead(conn,keyspace,tablename,keyValue, ...
    'ConsistencyLevel',level);
```

One replica node responds with the returned data.

Display the returned employee data.

```
results
```

```
results=5×13 table
     job_id       hire_date     employee_id    commission_pct    department_id      email

    _________    ___________    ___________    ______________    _____________    __________

    "IT_PROG"    21-May-2007        104             NaN               60          "BERNST"
    "IT_PROG"    07-Feb-2007        107             NaN               60          "DLORENTZ"
    "IT_PROG"    05-Feb-2006        106             NaN               60          "VPATABAL"
    "IT_PROG"    03-Jan-2006        103             NaN               60          "AHUNOLD"
    "IT_PROG"    25-Jun-2005        105             NaN               60          "DAUSTIN"
```

`results` is a table that contains these variables:

- `job_id` — Job identifier
- `hire_date` — Hire date
- `employee_id` — Employee identifier
- `commission_pct` — Commission percentage
- `department_id` — Department identifier
- `email` — Email address

- `first_name` — First name
- `last_name` — Last name
- `manager_id` — Manager identifier
- `office` — Office location (table that contains two variables for the building and room)
- `performance_ratings` — Performance ratings
- `phone_number` — Phone number
- `salary` — Salary

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Apache Cassandra database connection
`connection` object

Apache Cassandra database connection, specified as a `connection` object.

keyspace — Keyspace
character vector | string scalar

Keyspace, specified as a character vector or string scalar. If you do not know the keyspace, then access the `Keyspaces` property of the `connection` object using dot notation to view the keyspaces in the Cassandra database.

Example: `"employeedata"`

Data Types: `char` | `string`

tablename — Cassandra database table name
character vector | string scalar

Cassandra database table name, specified as a character vector or string scalar. If you do not know the name of the table, then use the `tablenames` function to find it.

Example: `"employees_by_job"`

Data Types: `char` | `string`

keyValue1...keyValueN — Partition key values
numeric scalar | numeric array | character vector | cell array of character vectors | ...

Partition key values, specified as one of these data types:

- numeric scalar
- numeric array
- character vector
- cell array of character vectors
- string scalar
- string array

- `logical`
- `logical` array
- `datetime` array
- `duration` array

If you do not specify the `keyValue1...keyValueN` input argument, then the `partitionRead` function imports data from all partitions of the Cassandra database table (same as the CQL query `SELECT * FROM tablename`).

Specify one key value for each partition key of the Cassandra database table. The maximum number of partition key values that you can specify is the number of primary keys, which includes the partition keys and clustering columns in the Cassandra database.

If you specify a scalar value, then the CQL query equivalent is an = clause in the CQL `WHERE` clause. If you specify an array of values, then the CQL query equivalent is an `IN` clause in the CQL `WHERE` clause.

If all partition key values are scalar values, then the `partitionRead` function imports data from one partition. If some partition key values are arrays, then the `partitionRead` function imports data by searching multiple partitions that correspond to all possible key combinations.

The following table describes supported Cassandra partition keys.

Supported Cassandra Partition Key	MATLAB Valid Data Types for One Partition	MATLAB Valid Data Types for Multiple Partitions
`ascii`	character vector or string scalar	cell array of character vectors or string array
`bigint`	numeric scalar or `logical` scalar	numeric array or `logical` array
`blob`	numeric array	cell array of numeric arrays
`boolean`	numeric scalar or `logical` scalar	numeric array or `logical` array
`date`	`datetime` array, string scalar, or character vector	`datetime` array, string array, or cell array of character vectors
`decimal`	numeric scalar, `logical` scalar, or `string` scalar	numeric array, `logical` array, or `string` array
`double`	numeric scalar or `logical` scalar	numeric array or `logical` array
`float`	numeric scalar or `logical` scalar	numeric array or `logical` array
`inet`	character vector or string scalar	cell array of character vectors or string array
`int`	numeric scalar or `logical` scalar	numeric array or `logical` array
`smallint`	numeric scalar or `logical` scalar	numeric array or `logical` array
`text`	character vector or string scalar	cell array of character vectors or string array
`time`	`duration` array, string scalar, or character vector	`duration` array, string array, or cell array of character vectors
`timestamp`	`datetime` array, string scalar, or character vector	`datetime` array, string array, or cell array of character vectors

Supported Cassandra Partition Key	MATLAB Valid Data Types for One Partition	MATLAB Valid Data Types for Multiple Partitions
`timeuuid`	character vector or string scalar	cell array of character vectors or string array
`tinyint`	numeric scalar or `logical` scalar	numeric array or `logical` array
`uuid`	character vector or string scalar	cell array of character vectors or string array
`varchar`	character vector or string scalar	cell array of character vectors or string array
`varint`	numeric scalar, `logical` scalar, or `string`	numeric array, `logical` array, or `string` array

These Cassandra partition keys are not supported:

- `counter`
- `list`
- `map`
- `set`
- `tuple`
- user-defined types (UDTs)

Example: `["MA","CT"]`

Example: `1,2,'DataProvider1','AmbientTemp'`

Data Types: `double` | `logical` | `char` | `string` | `struct` | `cell` | `datetime` | `duration`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = partitionRead(conn,keyspace,tablename,'ConsistencyLevel',"ONE",'RequestTimeout',15)` returns imported data by receiving a read response from one node, and the database must wait 15 seconds to perform the read operation before throwing an error.

`ConsistencyLevel` — Consistency level

`"ONE"` (default) | character vector | string scalar

Consistency level, specified as one of these values.

Consistency Level Value	Consistency Level Description
`"ALL"`	Return query results when all replica nodes respond.
`"QUORUM"`	Return query results when most replica nodes respond.

Consistency Level Value	Consistency Level Description
"LOCAL_QUORUM"	Return query results when most replica nodes in the local data center respond.
"ONE" (default)	Return query results when one replica node responds.
"TWO"	Return query results when two replica nodes respond.
"THREE"	Return query results when three replica nodes respond.
"LOCAL_ONE"	Return query results when one replica node in the local data center responds.
"SERIAL"	Return query results for current (and possibly uncommitted) data for replica nodes in any data center.
"LOCAL_SERIAL"	Return query results for current (and possibly uncommitted) data for replica nodes in the local data center.

You can specify the value of the consistency level as a character vector or string scalar.

For details about consistency levels, see Configuring Data Consistency.

Data Types: `char` | `string`

`RequestTimeout` — Request timeout
12 (default) | positive numeric scalar

This property is read-only.

Request timeout, specified as a positive numeric scalar. The request timeout indicates the number of seconds the database waits to return a CQL query before throwing an error.

Data Types: `double`

Output Arguments

`results` — Imported data results
table

Imported data results, returned as a table. The table contains imported data from the partitions that correspond to the `keyValue1...keyValueN` input argument. Each Cassandra database column from the partitions becomes a variable in the table. The variable names match the names of the Cassandra database columns in the specified partitions.

The data types of the variables in the table depend on the Cassandra data types. For details about how CQL data types convert to MATLAB data types, see “Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface” on page 9-2.

Version History

Introduced in R2021a

See Also

Objects
`connection`

Functions

`apacheCassandra` | `tablenames` | `columninfo` | `upsert` | `executecql` | `close`

Topics

"Explore and Import Data from Cassandra Database Table" on page 9-11
"Export MATLAB Data into Cassandra Database" on page 9-16
"Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface" on page 9-2
"Fill Values for Missing Data from Database Using Apache Cassandra Database C++ Interface" on page 9-9

External Websites

Apache Cassandra Documentation
CQL Reference Documentation
CQL Data Types
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executecql

Namespace: `database.apacheCassandra`

Execute CQL query on Apache Cassandra database

Syntax

```
results = executecql(conn,query)
results = executecql(conn,query,Name,Value)
```

Description

`results = executecql(conn,query)` returns the results of executing a Cassandra Query Language (CQL) query on the Cassandra database using the Cassandra database connection. The `executecql` function imports the query results into MATLAB.

`results = executecql(conn,query,Name,Value)` specifies options using one or more name-value arguments. For example, `'ConsistencyLevel',"TWO"` sets the consistency level to specify that two nodes must respond for the CQL query to execute.

Examples

Execute CQL Query

Using an Apache® Cassandra® database C++ interface, create a Cassandra® database connection and execute a CQL query to import data from a Cassandra database table into MATLAB®. In this case, the Cassandra database contains the `employees_by_job` database table with employee data in the `employeedata` keyspace.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Write a CQL query that selects all employees who are programmers or shop clerks hired before April 30, 2006, and retrieves their job identifiers, hire dates, and email addresses. `job_id` is the partition key of the `employees_by_job` database table, and `hire_date` is a clustering column.

```
query = strcat("SELECT job_id,hire_date,email ", ...
    "FROM employeedata.employees_by_job ", ...
    "WHERE job_id IN ('IT_PROG','SH_CLERK') ", ...
    "AND hire_date < '2006-04-30';");
```

Execute the CQL query and display the first few rows of results.

```
results = executecql(conn,query);
head(results)
```

```
ans=8×3 table
      job_id       hire_date       email
    __________    ___________    __________

    "IT_PROG"     05-Feb-2006    "VPATABAL"
    "IT_PROG"     03-Jan-2006    "AHUNOLD"
    "IT_PROG"     25-Jun-2005    "DAUSTIN"
    "SH_CLERK"    24-Apr-2006    "AWALSH"
    "SH_CLERK"    23-Feb-2006    "JFLEAUR"
    "SH_CLERK"    24-Jan-2006    "WTAYLOR"
    "SH_CLERK"    13-Aug-2005    "JDILLY"
    "SH_CLERK"    14-Jun-2005    "KCHUNG"
```

`results` is a table with the `job_id`, `hire_date`, and `email` variables. The `hire_date` variable is a `datetime` array and the `job_id` and `email` variables are string arrays.

Close the Cassandra database connection.

```
close(conn)
```

Execute CQL Query Using Consistency Level

Using the Apache® Cassandra® database C++ interface, create a Cassandra database connection and execute a CQL query to import data from a Cassandra database table into MATLAB®. Specify a consistency level for returning query results. In this case, the Cassandra database contains the `employees_by_job` database table with employee data in the `employeedata` keyspace.

Create a Cassandra database connection using the configured data source `CassandraDataSource` and a blank user name and password. The `apacheCassandra` function returns `conn` as a `connection` object.

```
datasource = "CassandraDataSource";
username = "";
password = "";
conn = apacheCassandra(datasource,username,password);
```

Write a CQL query that selects all employees who are programmers and retrieves their hire dates and email addresses. `job_id` is the partition key of the `employees_by_job` database table. Limit the returned data to three rows.

```
query = strcat("SELECT hire_date,email ", ...
    "FROM employeedata.employees_by_job ", ...
    "WHERE job_id = 'IT_PROG'", ...
    "LIMIT 3;");
```

Execute the CQL query with the consistency level set to one node and display the results.

```
level = "ONE";
results = executecql(conn,query,'ConsistencyLevel',level)
```

```
results=3×2 table
     hire_date        email
```

```
    ___________    __________

    21-May-2007    "BERNST"
    07-Feb-2007    "DLORENTZ"
    05-Feb-2006    "VPATABAL"
```

In this case, only one replica node responds with returned data. `results` is a table with the `hire_date` and `email` variables. The `hire_date` variable is a `datetime` array and the `email` variable is a string array.

Close the Cassandra database connection.

```
close(conn)
```

Input Arguments

conn — Apache Cassandra database connection
`connection` object

Apache Cassandra database connection, specified as a `connection` object.

query — CQL query
character vector | string scalar

CQL query, specified as a character vector or string scalar. For details about CQL, see the Apache Software Foundation's CQL Reference Documentation.

Example: `"SELECT * FROM dev.maps"`

Data Types: `char` | `string`

Name-Value Pair Arguments

Specify optional pairs of arguments as `Name1=Value1,...,NameN=ValueN`, where `Name` is the argument name and `Value` is the corresponding value. Name-value arguments must appear after other arguments, but the order of the pairs does not matter.

Before R2021a, use commas to separate each name and value, and enclose `Name` *in quotes.*

Example: `results = executecql(conn,query,'ConsistencyLevel',"TWO",'RequestTimeout',15)` specifies to return query results when two nodes respond for the CQL query execution, and the database must wait 15 seconds to return the query before throwing an error.

ConsistencyLevel — Consistency level
`"ONE"` (default) | character vector | string scalar

Consistency level, specified as one of these values.

Consistency Level Value	Consistency Level Description
`"ALL"`	Return query results when all replica nodes respond (read operation) or commit the change (write operation).

Consistency Level Value	Consistency Level Description
"EACH_QUORUM"	Finish execution when most replica nodes in each data center commit the change (write operation only).
"QUORUM"	Return query results when most replica nodes respond (read operation) or commit the change (write operation).
"LOCAL_QUORUM"	Return query results when most replica nodes in the local data center respond (read operation) or commit the change (write operation).
"ONE" (default)	Return query results when one replica node responds (read operation) or commits the change (write operation).
"TWO"	Return query results when two replica nodes respond (read operation) or commit the change (write operation).
"THREE"	Return query results when three replica nodes respond (read operation) or commit the change (write operation).
"LOCAL_ONE"	Return query results when one replica node in the local data center responds (read operation) or commits the change (write operation).
"ANY"	Finish execution even if all replica nodes for the specified partition are not available (write operation only).
"SERIAL"	Return query results for current (and possibly uncommitted) data for replica nodes in any data center (read operation only).
"LOCAL_SERIAL"	Return query results for current (and possibly uncommitted) data for replica nodes in the local data center (read operation only).

You can specify the value of the consistency level as a character vector or string scalar.

For details about consistency levels, see Configuring Data Consistency.

Data Types: `char` | `string`

`RequestTimeout` — Request timeout
12 (default) | positive numeric scalar

This property is read-only.

Request timeout, specified as a positive numeric scalar. The request timeout indicates the number of seconds the database waits to return a CQL query before throwing an error.

Data Types: `double`

Output Arguments

`results` — CQL query results
table

CQL query results, returned as a table. Each Cassandra database column from the result of the CQL query is a variable in the table. The variable names match the names of the Cassandra database columns from the result of the CQL query.

The data types of the variables in the table depend on the CQL data types. For details about how CQL data types convert to MATLAB data types, see “Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface” on page 9-2.

For read or write operations that return no data, the `executecql` function returns an empty table.

Version History

Introduced in R2021a

See Also

Objects

`connection`

Functions

`apacheCassandra` | `tablenames` | `columninfo` | `partitionRead` | `upsert` | `close`

Topics

“Import Data from Cassandra Database Table Using CQL” on page 9-14
“Convert CQL Data Types to MATLAB Data Types Using Apache Cassandra Database C++ Interface” on page 9-2
“Fill Values for Missing Data from Database Using Apache Cassandra Database C++ Interface” on page 9-9

External Websites

Apache Cassandra Documentation
CQL Reference Documentation
CQL Data Types
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database.orm.mixin.Mappable Class

Namespace: `database.orm.mixin`

Provide attributes for defining how subclasses map to relational database tables

Description

`database.orm.mixin.Mappable` is an abstract class that provides attributes for defining how subclasses are mapped to relational database tables. Methods such as `ormread`, `ormwrite`, and `ormupdate` use these attributes to directly read and write objects to databases.

Class Attributes

`Abstract`	`true`
`HandleCompatible`	`true`

For information on class attributes, see “Class Attributes”.

Methods

Public Methods

`rowfilter`	Return an unconstrained `rowfilter` object for filtering by the objects' properties

More About

`Mappable` Class Attributes

These class attributes are specific to `Mappable` subclasses.

`TableName`	Defines the name of the corresponding table on the database.
`Catalog`	Defines the catalog where the corresponding table resides.
`Schema`	Defines the schema where the corresponding table resides.

Standard attributes also apply to `Mappable` subclasses. For details see “Class Attributes”.

`Mappable` Property Attributes

These property attributes are specific to Mappable subclasses.

`ExcludeFromDatabase`	If true, identifies a property that should not be saved as a database column.
`PrimaryKey`	If true, the associated column is a part of the table's primary key. Requires `ExcludeFromDatabase` to be false. At least one property must have the `PrimaryKey` property.

<table>
<tr><td>ColumnName</td><td>Defines the name of the associated column on the database table.</td></tr>
<tr><td>ColumnType</td><td>Defines the type of the associated column on the database table.</td></tr>
<tr><td>AutoIncrement</td><td>If true and if data type is integer
• The database automatically creates values for the PrimaryKey property when you insert the property with the ormwrite method. Requires PrimaryKey to be true.
• The ormwrite method creates a table definition with an autoincrementing primary key column.
Supported databases include:
• PostgreSQL
• MySQL
• MariaDB
• SQLite
• Microsoft SQL Server
• Microsoft Access
• Oracle</td></tr>
</table>

Standard attributes also apply to `Mappable` subclasses. For details see “Property Attributes”.

Version History

Introduced in R2023b

See Also

`ormwrite` | `ormread` | `ormupdate` | `orm2sql`

ormwrite

Namespace: `database.orm.mixin`

Insert mappable objects into database

Syntax

```
ormwrite(conn,ormObject)
ormObject = ormwrite(conn,ormObject)
```

Description

`ormwrite(conn,ormObject)` inserts one or more mappable objects into rows of a database table, where `conn` is a database connection object and `ormObject` contains the objects to be inserted. For more information on mappable objects, see `database.orm.mixin.Mappable`.

`ormObject = ormwrite(conn,ormObject)` returns mappable objects from the database. The database automatically generates `PrimaryKey` property values for objects whose properties are labeled with the `AutoIncrement` property attribute.

Examples

Insert Database Row into New Table

This example depends on the `Product` class that maps to a database table. This class contains several properties that map to the database, as well as some methods that alter those properties.

```
classdef (TableName = "products") Product < database.orm.mixin.Mappable

    properties(PrimaryKey,ColumnName = "ProductNumber")
        ID int32
    end

    properties
        Name string
        Description string
        Quantity int32
    end

    properties(ColumnName = "UnitCost")
        CostPerItem double
    end

    properties(ColumnName = "Manufacturer")
        Supplier string
    end

    properties(ColumnType = "date")
        InventoryDate datetime
    end
```

```
        methods
            function obj = Product(id,name,description,supplier,cost,quantity,inventoryDate)
                if nargin ~= 0
                    inputElements = numel(id);
                    if numel(name) ~= inputElements || ...
                            numel(description) ~= inputElements || ...
                            numel(supplier) ~= inputElements || ...
                            numel(cost) ~= inputElements || ...
                            numel(quantity) ~= inputElements || ...
                            numel(inventoryDate) ~= inputElements
                        error('All inputs must have the same number of elements')
                    end

                    % Preallocate by creating the last object first
                    obj(inputElements).ID = id(inputElements);
                    obj(inputElements).Name = name(inputElements);
                    obj(inputElements).Description = description(inputElements);
                    obj(inputElements).Supplier = supplier(inputElements);
                    obj(inputElements).CostPerItem = cost(inputElements);
                    obj(inputElements).Quantity = quantity(inputElements);
                    obj(inputElements).InventoryDate = inventoryDate(inputElements);

                    for n = 1:inputElements-1
                        % Fill in the rest of the objects
                        obj(n).ID = id(n);
                        obj(n).Name = name(n);
                        obj(n).Description = description(n);
                        obj(n).Supplier = supplier(n);
                        obj(n).CostPerItem = cost(n);
                        obj(n).Quantity = quantity(n);
                        obj(n).InventoryDate = inventoryDate(n);
                    end
                end
            end
            function obj = adjustPrice(obj,amount)
                arguments
                    obj (1,1) Product
                    amount (1,1) {mustBeNumeric}
                end
               obj.CostPerItem = obj.CostPerItem + amount;
            end

            function obj = shipProduct(obj,amount)
                arguments
                    obj (1,1) Product
                    amount (1,1) {mustBePositive,mustBeInteger}
                end

                obj.Quantity = obj.Quantity - amount;
            end

            function obj = recieveProduct(obj,amount)
                arguments
                    obj (1,1) Product
                    amount (1,1) {mustBePositive,mustBeInteger}
                end
```

```
            obj.Quantity = obj.Quantity + amount;
            obj.InventoryDate = datetime('today');
        end

    end

end
```

First, create an `sqlite` database file that does not require a connection to a live database.

```
filename = "orm_demo.db";
if exist(filename,"file")
    conn = sqlite(filename);
else
    conn = sqlite(filename,"create");
end

% Remove it to maintain consistency
execute(conn,"DROP TABLE IF EXISTS products");
```

Use the `orm2sql` function to display the database column information based on the class defined in Product.m.

```
orm2sql(conn,"Product")
```

```
ans = 
    "CREATE TABLE products
     (ProductNumber double,
     Name text,
     Description text,
     Quantity double,
     UnitCost double,
     Manufacturer text,
     InventoryDate date,
     PRIMARY KEY (ProductNumber))"
```

Create a `Product` object to create and populate a table.

```
toy = Product(1,"Toy1","Descr1","CompanyA",24.99,0,datetime(2023,1,1))
```

```
toy = 
  Product with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 0
      CostPerItem: 24.9900
         Supplier: "CompanyA"
    InventoryDate: 01-Jan-2023
```

Use the `ormwrite` function to populate the database with the data from `toy`, then use the `sqlread` function to read the table and verify the results.

```
ormwrite(conn,toy);
sqlread(conn,"products")
```

```
ans=1×7 table
    ProductNumber     Name      Description     Quantity     UnitCost     Manufacturer          Inve
    _____________    ______    ___________     ________     ________     ____________      __________

          1          "Toy1"      "Descr1"          0          24.99       "CompanyA"       "2023-01-0
```

```
clear toy
close(conn)
```

Insert Database Rows Using Autoincrementing Primary Keys

This example depends on the `ProductAutoInc` class that maps to a database table. This class contains several properties that map to the database, as well as some methods that alter those properties. The ID property attribute is the primary key and it is set to `AutoIncrement`.

```
classdef ProductAutoInc < database.orm.mixin.Mappable

    properties(PrimaryKey, ColumnName = "ProductNumber", AutoIncrement)
        ID int32
    end

    properties
        Name string
        Description string
        Quantity int32
    end

    properties(ColumnName = "UnitCost")
        CostPerItem int32
    end

    properties(ColumnName = "Manufacturer")
        Supplier string
    end

    properties(ColumnType = "date")
        InventoryDate datetime
    end

    methods
        function obj = ProductAutoInc(name,description,supplier,cost,quantity,inventoryDate)
            if nargin ~= 0
                inputElements = numel(name);
                if numel(description) ~= inputElements || ...
                        numel(supplier) ~= inputElements || ...
                        numel(cost) ~= inputElements || ...
                        numel(quantity) ~= inputElements || ...
                        numel(inventoryDate) ~= inputElements
                    error('All inputs must have the same number of elements')
                end

                % Preallocate by creating the last object first
                obj(inputElements).Name = name(inputElements);
                obj(inputElements).Description = description(inputElements);
```

```
                obj(inputElements).Supplier = supplier(inputElements);
                obj(inputElements).CostPerItem = cost(inputElements);
                obj(inputElements).Quantity = quantity(inputElements);
                obj(inputElements).InventoryDate = inventoryDate(inputElements);

                for n = 1:inputElements-1
                    % Fill in the rest of the objects
                    obj(n).Name = name(n);
                    obj(n).Description = description(n);
                    obj(n).Supplier = supplier(n);
                    obj(n).CostPerItem = cost(n);
                    obj(n).Quantity = quantity(n);
                    obj(n).InventoryDate = inventoryDate(n);
                end
            end
        end
        function obj = adjustPrice(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBeNumeric}
            end
           obj.CostPerItem = obj.CostPerItem + amount;
        end

        function obj = shipProduct(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBePositive,mustBeInteger}
            end

            obj.Quantity = obj.Quantity - amount;
        end

        function obj = recieveProduct(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBePositive,mustBeInteger}
            end

            obj.Quantity = obj.Quantity + amount;
            obj.InventoryDate = datetime('today');
        end

    end

end
```

First, create an `sqlite` database file that does not require a connection to a live database.

```
filename = "autoIncrementDemo.db";
if exist(filename,"file")
    conn = sqlite(filename);
else
    conn = sqlite(filename,"create");
end

% Remove it to maintain consistency
execute(conn,"DROP TABLE IF EXISTS ProductAutoInc");
```

Create a `ProductAutoInc` object and store it on the database using the `ormwrite` function. You can return the object to the workspace by using the optional output argument.

```
obj = ProductAutoInc("Toy1","Descr1","CompanyA",18.99,100,datetime(2023,7,5))
```

```
obj = 
  ProductAutoInc with properties:

               ID: []
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 100
      CostPerItem: 19
         Supplier: "CompanyA"
    InventoryDate: 05-Jul-2023
```

```
obj = ormwrite(conn,obj)
```

```
obj = 
  ProductAutoInc with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 100
      CostPerItem: 19
         Supplier: "CompanyA"
    InventoryDate: 05-Jul-2023
```

In this example, the `ID` property of the output object has a value of `1`. Use the `sqlread` function to read the table and verify that the database automatically filled in the primary key value.

```
sqlread(conn,"ProductAutoInc")
```

```
ans=1×7 table
    ProductNumber     Name     Description    Quantity    UnitCost    Manufacturer          Inve
    _____________    ______    ___________    ________    ________    ____________    __________

          1          "Toy1"     "Descr1"        100          19        "CompanyA"     "2023-07-0
```

Instantiate a `ProductAutoInc` class with an array of objects with the ID property attribute chosen as the primary key and set it to `AutoIncrement`. The ID property is initially empty for all products.

```
products = ProductAutoInc(["Toy2";"Toy3";"Toy4"],["Descr2";"Descr3";"Descr4"], ...
    ["CompanyB";"CompanyC";"CompanyD"],[15.99;24.99;249.99],[500;250;150],datetime(2013,8,12:14)
```

```
products=1×3 ProductAutoInc array with properties:
    ID
    Name
    Description
    Quantity
    CostPerItem
    Supplier
    InventoryDate
```

```
IDS = [products.ID]

IDS =

  0x0 empty int32 matrix
```

Store the array of objects on the database using the `ormwrite` function and verify that the database automatically fills in the IDs.

```
products = ormwrite(conn,products)

products=1×3 ProductAutoInc array with properties:
    ID
    Name
    Description
    Quantity
    CostPerItem
    Supplier
    InventoryDate



IDS = [products.ID]

IDS = 1x3 int32 row vector

   2   3   4
```

Input Arguments

conn — Database connection

`connection` object

Database connection, specified as a `connection` object created from any of the following:

- `database`
- `mysql`
- `postgresql`
- `sqlite`

ormObject — Mappable object

scalar | vector

Mappable object to be inserted in the database table, specified as a scalar or vector. For more information on mappable objects, see `database.orm.mixin.Mappable`.

Version History

Introduced in R2023b

See Also

`database.orm.mixin.Mappable` | `ormread` | `ormupdate` | `orm2sql`

ormread

Namespace: `database.orm.mixin`

Read mappable objects from database

Syntax

```
obj = ormread(conn,ormClass)
obj = ormread(conn,ormClass,RowFilter=rf)
obj = ormread(conn,ormObject)
```

Description

`obj = ormread(conn,ormClass)` reads one or more mappable objects from a database connection of a given class and returns a vector of mappable objects. For more information on mappable objects, see `database.orm.mixin.Mappable`.

`obj = ormread(conn,ormClass,RowFilter=rf)` specifies a subset of objects to read from the database.

`obj = ormread(conn,ormObject)` returns an array of objects containing the most recent property values from the database, where `ormObject` specifies a vector of objects to refresh.

Examples

Read Mappable Object from Database

This example depends on the `Product` class that maps to a database table. This class contains several properties that map to the database, as well as some methods that alter those properties.

```
classdef (TableName = "products") Product < database.orm.mixin.Mappable

    properties(PrimaryKey,ColumnName = "ProductNumber")
        ID int32
    end

    properties
        Name string
        Description string
        Quantity int32
    end

    properties(ColumnName = "UnitCost")
        CostPerItem double
    end

    properties(ColumnName = "Manufacturer")
        Supplier string
    end
```

```
    properties(ColumnType = "date")
        InventoryDate datetime
    end

    methods
        function obj = Product(id,name,description,supplier,cost,quantity,inventoryDate)
            if nargin ~= 0
                inputElements = numel(id);
                if numel(name) ~= inputElements || ...
                        numel(description) ~= inputElements || ...
                        numel(supplier) ~= inputElements || ...
                        numel(cost) ~= inputElements || ...
                        numel(quantity) ~= inputElements || ...
                        numel(inventoryDate) ~= inputElements
                    error('All inputs must have the same number of elements')
                end

                % Preallocate by creating the last object first
                obj(inputElements).ID = id(inputElements);
                obj(inputElements).Name = name(inputElements);
                obj(inputElements).Description = description(inputElements);
                obj(inputElements).Supplier = supplier(inputElements);
                obj(inputElements).CostPerItem = cost(inputElements);
                obj(inputElements).Quantity = quantity(inputElements);
                obj(inputElements).InventoryDate = inventoryDate(inputElements);

                for n = 1:inputElements-1
                    % Fill in the rest of the objects
                    obj(n).ID = id(n);
                    obj(n).Name = name(n);
                    obj(n).Description = description(n);
                    obj(n).Supplier = supplier(n);
                    obj(n).CostPerItem = cost(n);
                    obj(n).Quantity = quantity(n);
                    obj(n).InventoryDate = inventoryDate(n);
                end
            end
        end
        function obj = adjustPrice(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBeNumeric}
            end
           obj.CostPerItem = obj.CostPerItem + amount;
        end

        function obj = shipProduct(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBePositive,mustBeInteger}
            end

            obj.Quantity = obj.Quantity - amount;
        end

        function obj = recieveProduct(obj,amount)
            arguments
                obj (1,1) Product
```

```
                amount (1,1) {mustBePositive,mustBeInteger}
            end

            obj.Quantity = obj.Quantity + amount;
            obj.InventoryDate = datetime('today');
        end

    end

end
```

First, create an `sqlite` database file that does not require a connection to a live database.

```
filename = "orm_demo.db";
if exist(filename,"file")
    conn = sqlite(filename);
else
    conn = sqlite(filename,"create");
end

% Remove it to maintain consistency
execute(conn,"DROP TABLE IF EXISTS products");
```

Use the `orm2sql` function to display the database column information based on the class defined in Product.m.

```
orm2sql(conn,"Product")
```

```
ans = 
    "CREATE TABLE products
     (ProductNumber double,
     Name text,
     Description text,
     Quantity double,
     UnitCost double,
     Manufacturer text,
     InventoryDate date,
     PRIMARY KEY (ProductNumber))"
```

Create a `Product` object to create and populate a table.

```
toy = Product(1,"Toy1","Descr1","CompanyA",24.99,0,datetime(2023,1,1))
```

```
toy = 
  Product with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 0
      CostPerItem: 24.9900
         Supplier: "CompanyA"
    InventoryDate: 01-Jan-2023
```

Use the `ormwrite` function to populate the database with the data from `toy`.

```
ormwrite(conn,toy);
```

Use the `ormread` method to read data from the database. This method uses the mapping to determine which tables to read, and also determines how the column values correspond to the properties.

```
clear toy
ormread(conn,"Product")
```

```
ans =
  Product with properties:

                ID: 1
              Name: "Toy1"
       Description: "Descr1"
          Quantity: 0
       CostPerItem: 24.9900
          Supplier: "CompanyA"
     InventoryDate: 01-Jan-2023
```

```
clear ans
close(conn)
```

Input Arguments

`conn` — Database connection
scalar `database.relational.connection` object

Database connection, specified as a scalar `database.relational.connection` object.

`ormClass` — Class identity
character vector | string scalar | scalar `matlab.metadata.Class` object

Class identity, specified as a character vector, string scalar, or scalar `matlab.metadata.Class` object containing the class name to read from the database. Use `matlab.metadata.Class` to resolve class name conflicts such as two classes with the same name in different packages.

`rf` — Row filter condition
scalar | vector

Row filter condition, specified as a scalar or vector of `matlab.io.RowFilter` objects returned from the `rowfilter` function.

Example: `rf = rowfilter("productnumber"); rf = rf.productnumber <= 5; ormread(conn,tablename,RowFilter=rf)`

`ormObject` — Mappable object
vector

Mappable object to refresh, specified as a vector. For more information on mappable objects, see `database.orm.mixin.Mappable`.

Version History
Introduced in R2023b

See Also

database.orm.mixin.Mappable | ormwrite | ormupdate | orm2sql

ormupdate

Namespace: `database.orm.mixin`

Update database tables using object relational mapping

Syntax

`ormupdate(conn,ormObject)`

Description

`ormupdate(conn,ormObject)` updates a database table with the properties of the mappable objects in `ormObject` based on a connection object `conn`. This method identifies which row of the database each object represents, and then updates each one using the current object properties. For more information on mappable objects, see `database.orm.mixin.Mappable`.

Examples

Update Mappable Objects in a Database

This example depends on the `Product` class that maps to a database table. This class contains several properties that map to the database, as well as some methods that alter those properties.

```
classdef (TableName = "products") Product < database.orm.mixin.Mappable

    properties(PrimaryKey,ColumnName = "ProductNumber")
        ID int32
    end

    properties
        Name string
        Description string
        Quantity int32
    end

    properties(ColumnName = "UnitCost")
        CostPerItem double
    end

    properties(ColumnName = "Manufacturer")
        Supplier string
    end

    properties(ColumnType = "date")
        InventoryDate datetime
    end

    methods
        function obj = Product(id,name,description,supplier,cost,quantity,inventoryDate)
            if nargin ~= 0
                inputElements = numel(id);
```

```
                if numel(name) ~= inputElements || ...
                        numel(description) ~= inputElements || ...
                        numel(supplier) ~= inputElements || ...
                        numel(cost) ~= inputElements || ...
                        numel(quantity) ~= inputElements || ...
                        numel(inventoryDate) ~= inputElements
                    error('All inputs must have the same number of elements')
                end

                % Preallocate by creating the last object first
                obj(inputElements).ID = id(inputElements);
                obj(inputElements).Name = name(inputElements);
                obj(inputElements).Description = description(inputElements);
                obj(inputElements).Supplier = supplier(inputElements);
                obj(inputElements).CostPerItem = cost(inputElements);
                obj(inputElements).Quantity = quantity(inputElements);
                obj(inputElements).InventoryDate = inventoryDate(inputElements);

                for n = 1:inputElements-1
                    % Fill in the rest of the objects
                    obj(n).ID = id(n);
                    obj(n).Name = name(n);
                    obj(n).Description = description(n);
                    obj(n).Supplier = supplier(n);
                    obj(n).CostPerItem = cost(n);
                    obj(n).Quantity = quantity(n);
                    obj(n).InventoryDate = inventoryDate(n);
                end
            end
        end
        function obj = adjustPrice(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBeNumeric}
            end
           obj.CostPerItem = obj.CostPerItem + amount;
        end

        function obj = shipProduct(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBePositive,mustBeInteger}
            end

            obj.Quantity = obj.Quantity - amount;
        end

        function obj = recieveProduct(obj,amount)
            arguments
                obj (1,1) Product
                amount (1,1) {mustBePositive,mustBeInteger}
            end

            obj.Quantity = obj.Quantity + amount;
            obj.InventoryDate = datetime('today');
        end

    end
```

```
end
```

First, create an `sqlite` database file that does not require a connection to a live database.

```
filename = "orm_demo.db";
if exist(filename,"file")
    conn = sqlite(filename);
else
    conn = sqlite(filename,"create");
end

% Remove it to maintain consistency
execute(conn,"DROP TABLE IF EXISTS products");
```

Use the `orm2sql` function to display the database column information based on the class defined in Product.m.

```
orm2sql(conn,"Product")
```

```
ans = 
    "CREATE TABLE products
     (ProductNumber double,
     Name text,
     Description text,
     Quantity double,
     UnitCost double,
     Manufacturer text,
     InventoryDate date,
     PRIMARY KEY (ProductNumber))"
```

Create a `Product` object to create and populate a table.

```
toy = Product(1,"Toy1","Descr1","CompanyA",24.99,0,datetime(2023,1,1))
```

```
toy = 
  Product with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 0
      CostPerItem: 24.9900
         Supplier: "CompanyA"
    InventoryDate: 01-Jan-2023
```

Use the `ormwrite` function to populate the database with the data from `toy`, and use the `sqlread` function to read the table and verify the results.

```
ormwrite(conn,toy);
sqlread(conn,"products")
```

```
ans=1×7 table
    ProductNumber     Name      Description     Quantity     UnitCost     Manufacturer          Inve
    _____________    ______    ____________    ________    ________    ____________    __________
```

```
         1          "Toy1"     "Descr1"        0         24.99       "CompanyA"     "2023-01-01
```

Use the `receiveProduct` method of the `Product` class to increase the inventory of `Toy1`.

```
toy = recieveProduct(toy,500)
```

```
toy = 
  Product with properties:

               ID: 1
             Name: "Toy1"
      Description: "Descr1"
         Quantity: 500
      CostPerItem: 24.9900
         Supplier: "CompanyA"
    InventoryDate: 14-Dec-2023
```

Use the `ormupdate` method to push the changes made in MATLAB® to the database. Then, use the `fetch` function to verify that `Quantity` and `InventoryDate` are updated in the database.

```
ormupdate(conn,toy);
fetch(conn,"SELECT * FROM products WHERE Name = 'Toy1'")
```

```
ans=1×7 table
    ProductNumber     Name      Description     Quantity    UnitCost    Manufacturer          Inve
    _____________    ______    ___________    ________    ________    ____________    __________

          1          "Toy1"     "Descr1"         500        24.99       "CompanyA"     "2023-12-14
```

```
clear ans toy
close(conn)
```

Input Arguments

conn — Database connection

connection object

Database connection, specified as a `connection` object created by any of the following:

- `database`
- `mysql`
- `postgresql`
- `sqlite`

ormObject — Mappable object

scalar | vector

Mappable object, specified as a scalar or vector. For more information on mappable objects, see `database.orm.mixin.Mappable`.

Version History

Introduced in R2023b

See Also

`database.orm.mixin.Mappable` | `ormwrite` | `ormread` | `orm2sql`

orm2sql

Convert object relational mapping class to query

Syntax

`query = orm2sql(conn,classInfo)`

Description

`query = orm2sql(conn,classInfo)` returns the SQL CREATE statement that corresponds to the class definition in `classInfo` based on the database connection object `conn`. You can use the `orm2sql` function to check whether the attributes set in the class definition have the intended effect.

Examples

Display Database Column Information for Mappable Class

This example depends on the `Product` class that maps to a database table. This class contains several properties that map to the database, as well as some methods that alter those properties.

```
classdef (TableName = "products") Product < database.orm.mixin.Mappable

    properties(PrimaryKey,ColumnName = "ProductNumber")
        ID int32
    end

    properties
        Name string
        Description string
        Quantity int32
    end

    properties(ColumnName = "UnitCost")
        CostPerItem double
    end

    properties(ColumnName = "Manufacturer")
        Supplier string
    end

    properties(ColumnType = "date")
        InventoryDate datetime
    end

    methods
        function obj = Product(id,name,description,supplier,cost,quantity,inventoryDate)
            if nargin ~= 0
                inputElements = numel(id);
                if numel(name) ~= inputElements || ...
                        numel(description) ~= inputElements || ...
                        numel(supplier) ~= inputElements || ...
```

```
                    numel(cost) ~= inputElements || ...
                    numel(quantity) ~= inputElements || ...
                    numel(inventoryDate) ~= inputElements
                error('All inputs must have the same number of elements')
            end

            %Preallocate by creating the last object first
            obj(inputElements).ID = id(inputElements);
            obj(inputElements).Name = name(inputElements);
            obj(inputElements).Description = description(inputElements);
            obj(inputElements).Supplier = supplier(inputElements);
            obj(inputElements).CostPerItem = cost(inputElements);
            obj(inputElements).Quantity = quantity(inputElements);
            obj(inputElements).InventoryDate = inventoryDate(inputElements);

            for n = 1:inputElements-1
                %Fill in the rest of the objects
                obj(n).ID = id(n);
                obj(n).Name = name(n);
                obj(n).Description = description(n);
                obj(n).Supplier = supplier(n);
                obj(n).CostPerItem = cost(n);
                obj(n).Quantity = quantity(n);
                obj(n).InventoryDate = inventoryDate(n);
            end
        end
    end
    function obj = adjustPrice(obj,amount)
        arguments
            obj (1,1) Product
            amount (1,1) {mustBeNumeric}
        end
       obj.CostPerItem = obj.CostPerItem + amount;
    end

    function obj = shipProduct(obj,amount)
        arguments
            obj (1,1) Product
            amount (1,1) {mustBePositive,mustBeInteger}
        end

        obj.Quantity = obj.Quantity - amount;
    end

    function obj = recieveProduct(obj,amount)
        arguments
            obj (1,1) Product
            amount (1,1) {mustBePositive,mustBeInteger}
        end

        obj.Quantity = obj.Quantity + amount;
        obj.InventoryDate = datetime('today');
    end

end

end
```

First, create an `sqlite` database file that does not require a connection to a live database.

```
filename = "orm_demo.db";
if exist(filename,"file")
    conn = sqlite(filename);
else
    conn = sqlite(filename,"create");
end
```

Use the `orm2sql` function to display the database column information based on the class defined in Product.m.

```
orm2sql(conn,"Product")

ans = 
    "CREATE TABLE products
     (ProductNumber double,
     Name text,
     Description text,
     Quantity double,
     UnitCost double,
     Manufacturer text,
     InventoryDate date,
     PRIMARY KEY (ProductNumber))"


close(conn)
```

Input Arguments

conn — Database connection

connection object

Database connection, specified as a `connection` object created by any of the following:

- `database`
- `mysql`
- `postgresql`
- `sqlite`

classInfo — Mapped class

character vector | string scalar | scalar `matlab.metadata.Class` object

Mapped class, specified as a character vector, string scalar, or scalar `matlab.metadata.Class` object containing the name or meta-information that identifies the class to generate the query from.

Output Arguments

query — SQL CREATE statement

string scalar

SQL CREATE statement representing the class, returned as a string scalar.

Version History

Introduced in R2023b

See Also

`database.orm.mixin.Mappable` | `ormwrite` | `ormread` | `ormupdate`