These programs calculate the statistics for the dLIF model described in the paper ``The transfer of correlations by integrate--and--fire neurons with point process inputs'' by Robert Rosenbaum and Kresimir Josic, published in Neural Computation. See the article for the definition of the model and parameters discussed below.

All calculations are performed for the dLIF with no leak. The first few lines of code in each program converts the system with leak (I_L>0) into an equivalent one without leak (I_L=0).

The input and output parameters in the code can be understood using the following rules:

re: excitatory input rate
ri: inhibitory input rate
IL: leak rate (i.e., mean leak current)
lb: the reflecting lower boundary
th: threshold
ce: correlation between excitatory inputs
ci: correlation between inhibitory inputs
ce1i2: correlation between the first excitatory input and the second inhibitory input
ci1e2: correlation between the first inhibitory input and the second excitatory input

When computing bivariate statistics, a "1" or a "2" after a parameter name indicates that it corresponds to neuron 1 or neuron 2 respectively. For example, re2 is the excitatory input rate for neuron 2.

The file names can be understood using the following interpretations:

gamma: output (spike count) covariance
sigma: output standard deviation (sqrt of variance)
rho: output correlation
ccg: cross-covariance function
acg: auto-covariance function
fpt: first passage time
cdf: cumulative distribution function
biv: bivariate
u: univariate
stat: stationary
cond: statistics of neuron 1 conditioned on a spike in neuron 2
tau: waiting time until next spike
generator: infinitesimal generator matrix
abs: distribution with absorbing state at threshold

The following is a brief description of each program.
See the comments within each program and the Neural Comp article for more information.

Etau_cond:
The expected waiting time until a spike in neuron 1, conditioned on a spike in neuron 2 at time 0.

Etau_stat:
The expected waiting time until a spike in a neuron, beginning from its stationary distribution (i.e., the expected recurrence time).

Fout:
Output Fano factor (over an infinitely large window).

M:
The 'memory' of the cell. See the Neural Comp article for more info.

acg:
Auto-covariance function.

bivgenerator:
Generator matrix for the bivariate (two-cell) system.

bivstat:
Stationary distribution of membrane potentials for the bivariate (two-cell) system.

ccg:
Cross-covariance function.

fpt_cdf:
Cumulative distribution function of the first passage time to threshold, starting from a specified initial distribution.

fpt_cdf_cond:
Cumulative distribution function of the first passage time to threshold for neuron 1, conditioned on a spike in neuron 2 at time 0.

fpt_cdf_stat:
Cumulative distribution function of the first passage time to threshold, starting from the stationary distribution.

fpt_density:
Density of the first passage time to threshold, starting from a specified initial distribution.

fpt_denisty_cond:
Density of the first passage time to threshold for neuron 1, conditioned on a spike in neuron 2 at time 0.

fpt_density_stat:
Density of the first passage time to threshold, starting from the stationary distribution.

gammaT:
Covariance of spike counts over a window of width T.

gammaout:
Asymptotic covariance of spike counts for infinitely large window (i.e., area of full CCG).

inst_rate:
Instantaneous firing rate starting from some specified initial distribution.

nuout:
Stationary firing rate.

pcond:
Distribution of membrane potential of neuron 1, conditioned on a spike in neuron 2.

rhoT:
Correlation coefficient between spike counts over a window of width T.

rhoout:
Asymptotic correlation coefficient between spike counts (over infinite window).

sigmaT:
Spike count variance over a window of width T.

sigmaout:
Asymptotic spike count variance for infinitely large window (i.e., area of full ACG).

spnull2:
Helper function for bivstat. Finds nullspace of a large sparse matrix. Only works with Matlab 2009b or higher; otherwise bivstat uses egis to get nullspace. Original version of this was file written by Bruno Luong, see: http://www.mathworks.com/matlabcentral/fileexchange/27550

synchout:
Output synchrony (proportion of precisely synchronous spikes).

taumem:
Memory timescale. See the Neural Comp article for more info.

udist:
Time dependent univariate distribution beginning at some specified initial distribution.

udist_abs:
Time dependent univariate distribution beginning at some specified initial distribution. Here, there is an absorbing boundary at threshold. This is used to get the CDF of the FPT in fpt_cdf.

univgenerator:
Generator matrix for the univariate (one-cell) process.

univgenerator_abs:
Generator matrix for the univariate (one-cell) process. Here, there is an absorbing boundary at threshold.

univstat:
Stationary distribution of the univariate (one-cell) process.