IT 468- Introduction to Natural Computation

Home Work 5

Chemical Computing

Due date: October 13, 2013

(1) Describe a set of Stochastic Chemical Reactions Network (SCRN) for computing the maxima of n positive integers. **Hint:** First design it for 2 integers and then try to generalize it.
(2) Can we modify the algorithm proposed in Q_1 to compute the minima of n positive integers? If so (or otherwise), describe a set of SCRN for doing so.
(3) Describe a set of SCRN for a 2-bit binary counter $(00, 01, 10, 11)$.
(4) Describe a set of SCRN for adding two positive integers.
(5) Download and install the software Cain Stochastic Simulator from http://cain.sourceforge.net/ and run the different algorithms that we discussed in the class (multiplication, 2^x, x^p, basic logic gates) for specific inputs and for Q_1, Q_2, Q_3 and Q_4 and plot the graph or make a table to show the computations.
(6) Download and install strand displacement software from http://research.microsoft.com/en-us/projects/dna/ (or run directly on web browser visual DSD at http://lepton.research.microsoft.com/webdna/) Show the simulations of at least 3 SCRN of your choice from above questions and attach a report.
(7) Download and install Seesaw Compiler from http://www.dna.caltech.edu/SeesawCompiler/ . Use one example given in the following paper.

Scaling up digital circuit computation with DNA strand displacement cascades, Lulu Qian & Erik Winfree Science, June 3, 2011 332:1196-1201