

PHYS 597A, CMPSC 497E: Graphs and networks in systems biology

Homework assignment 9, due Tuesday Nov 17

1. Read the article “Boolean network simulations for life scientists” by I. Albert, J. Thakar, S. Li, R Zhang and R. Albert, in Source Code for Biology and Medicine 3, 16 (2008). You can download the article from the journal’s webpage

<http://www.scfbm.org/content/3/1/16>

Write down three questions or ideas that you had while reading it. Follow up on your questions and let me know what you find.

2. Construct a network of four nodes, such that each node’s in-degree is one or two. Associate a Boolean rule to each node. Assume that each node’s state changes at the same time (synchronous update).

a) Determine analytically (by taking away time from the Boolean rules, and solving the resulting system of equations) the fixed points of the system.

b) Map the state transitions in the system. Start with an initial state, and update the state of the nodes for a sufficient number of steps for determining the attractor. Then start from a state that was not encountered yet, and repeat until all states were considered. Draw a state transition network in which the nodes are the states of the system and the directed edges mean that the state at the end of the edge follows from the state at the beginning of the edge by updating the nodes once. How many attractors does the network have?

Extra credit: Do point b), or part of it, using the software library Boolean-Net: <http://code.google.com/p/booleannet/>

Tip: Start with reviewing the tutorials in BooleanNet.