CAAM 210-Sarah Hooper

Boolean Gene Networks

Lab Overview

- We have a gene net, which is just a network of many genes (nodes). Each individual gene can either be on (represented by a 1), or off (represented by a 0).
- Each gene within the net is connected to only three neighboring genes; depending on which of its three neighboring genes is on/off, each gene can be effected differently. These changes are prescribed by a set of "rules".
- The point of this lab is to look at how the behavior of the developing genes changes when there is a mutation in the "rules".

Lab Overview (cont.)

- In this lab, we are supposed to…
  - Plot the gene net.
  - Determine how each gene will be effected by its neighbors and create a graph of how it changes.
    - This graph is called a State Transition Diagram. We will create two of them with two different sets of rules.

Basic Outline

- Four functions:
  - genestmdriver
  - genestm
  - d2b
  - b2d

genestmdriver

- No inputs/outputs
- Purpose is to…
  - Create the wire adjacency matrix of 1's and 0's
    - This tells us which genes are connected.
  - Create the rule vector
    - Use this to find the action occurring at each gene
  - Call 2nd function, genestm
  - Plot gene net
    - Use wire adjacency matrix and biograph
  - Plot State Transition Diagram
    - Use output from genestm and biograph

genestmdriver

- Last step…
  - You have to change one bit of the rule vector and repeat the whole thing.
  - This allows us to see how one mutation effects the attractors.

genestm

- Construct the rule matrix from the rule vector
  - Call function d2b for help
- Build the State Transition Matrix
  - Call function b2d for help
  - Use wire matrix and the rule matrix for each gene to figure out each gene's next binary value
    - Record this transition in an adjacency matrix for the state transition biograph
  - This is the output of genestm

d2b

- Function to go from a decimal to a binary expression, given the decimal and size for the binary expression.

b2d

- Function to go from binary expression with a size to a decimal.