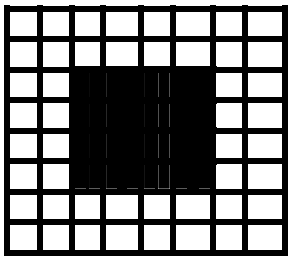
Homework 6: Chapters 10, 11, 12

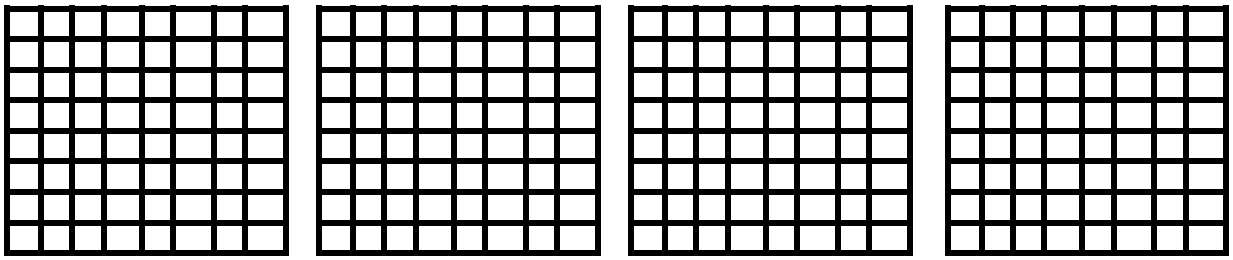
DUE: Monday, Nov 15, start of class.

1. Suppose the following initial pattern was given to the Game of Life cellular automaton.



t = 0

Figure out and draw by hand what the lattice would look like at the next four time steps.



t = 1 t = 2 t = 3 t = 4

2. Explain in your own words (in a few sentences) what it means that elementary cellular automaton rule 110 can "support universal computation".

3. "Communication via sampling" in diffuse complex systems
    a. Consider the discussion of ant-colony task allocation in the book and in the Deborah Gordon video we saw in class. In what ways do ants "communicate via sampling"?
    b. Now consider the discussion of bacterial quorum sensing in the Bonnie Bessler video we say in class. In what ways do bacteria "communicate via sampling"?

4. Using the discussion in Chapter 12 of the book and any additional knowledge you have of ants, describe two different ways in which randomness plays an adaptive role in ant colonies.

5. Answer the same question in 4), but for the immune system.

6. Discuss (in a paragraph or so) four major differences between computation in traditional von-Neumann-style computers and computation in living systems.