Written Assignment 5

Due Monday, November 7th

1. (1.5 # 2, 4) Write the updating function associated with each of the discrete dynamical systems. Which are linear?

   (a) $m_{t+1} = \frac{m_t}{2}$

   (b) $Q_{t+1} = \frac{1}{Q_t+1}$

2. (1.5 #16, 18) Find and graph the first <u>five</u> steps of the solution to each of the following discrete dynamical systems with the given initial condition.

   (a) $l_{t+1} = l_t - 1.7$, $l_0 = 13.1$ cm

   (b) $M_{t+1} = 0.75M_t + 2.0$, $M_0 = 16.0$.

3. (1.5, # 20, 22)

   (a) Find a formula for the solution l_t for the discrete dynamical system in problem 2a.

   (b) Find a formula for the solution M_t for the discrete dynamical system in problem 2b.

4. (1.5, # 59 with numbers changed) Suppose the fraction of individuals in a population with a certain gene increases by 10% each generation.

   (a) Write the discrete dynamical system for the fraction of organisms with the gene. Use the variable f_t for the fraction of the organisms with the gene.

   (b) What is the experiment for this discrete dynamical system?

   (c) Write the solution for f_t with $f_0 = 0.0001$.

   (d) Will the fraction reach 1.0? Based on this, does this model make sense for all time values?

5. (1.6, #1, 2 with fewer steps)

   (a) Carefully draw a cobweb diagram for the discrete dynamical system $b_{t+1} = 2.0b_t$ with initial condition $b_0 = 1.0$. Include at least four steps.

   (b) Draw a graph of the solution b_t for the first four steps.

   (c) Carefully draw a cobweb diagram for the discrete dynamical system $n_{t+1} = 0.5n_t$ with $n_0 = 1.0$. Include at least four steps.

   (d) Draw a graph of the solution n_t for the first four steps.

6. (1.6, #6) Cobweb the following discrete dynamical system $M_{t+1} = 0.75M_t+2.0$ starting from the initial condition $M_0 = 16.0$. Graph at least three steps in your diagram.

7. (My brain) Find the equilibrium of the discrete dynamical system from problem 6.

8. (1.6 # 44) Consider a bacteria population that doubles every hour, but one million bacteria are removed before reproduction.

   (a) Write down the discrete dynamical system modeling the bacteria population. Use b_t for the population variable.

   (b) Make a cobweb diagram starting from $b_0 = 3$ million bacteria.

   (c) Find the equilibrium of this system.