Assignment # 1
MATH/STAT 2300
Winter 2016

This assignment is **due** at the **beginning of class on Thursday, January 21**. All page numbers refer to the text "A First Course in Mathematical Modeling (5th ed.)" (MM). **If you are using a different edition, it is your responsibility to make sure you are working on the correct problems!**

1. Consider the dynamical system

$$a_{n+1} = \frac{1}{2} a_n (a_n - 1), \quad a_0 = 4.$$

Find a_1, a_2 and a_6.

2. A new antibiotic called Blarbomax is on the market. The drug is filtered from the blood by the kidneys. Each 24-hour period, the kidneys filter out about one quarter of the Blarbomax that was in the blood at the beginning of the 24-hour period.

a. Assume a patient was given only a single 500-mg does. Use a difference equation to construct a table of values listing the amount of Blarbomax in this patient's blood at the end of each day, for 7 days.

b. Now assume that the patient takes an additional 500 mg per day. Use a difference equation to construct a table of values listing the amount of Blarbomax in this patient's blood at the end of each day, for 7 days.

c. Compare and interpret these two tables. What happens in each case? Explain your answer mathematically.

3. Your credit card balance is $9,000 with a current rate of 9.0% per year. Interest is charged monthly (so that the interest rate per month is 9.0/12 = 0.75%). Determine what monthly payment *p* (to the nearest penny) will pay off the card in three years, assuming no new charges.

4. Pg. 54, exercise 4 (feel free to insert Maple plots as appropriate).

5. Suppose you have the following system of difference equations:

$$\begin{aligned} R_{n+1} &= \frac{1}{3}R_n + \frac{1}{3}S_n + \frac{1}{3}T_n \\ S_{n+1} &= \frac{1}{2}R_n + \frac{1}{6}S_n \\ T_{n+1} &= \frac{1}{6}R_n + \frac{1}{2}S_n + \frac{2}{3}T_n \end{aligned}$$

(a) Find an equilibrium (R,S,T) where $R \geq 0, S \geq 0, T \geq 0$ and $R + S + T = 1$.

(b) What is the nature of the equilibrium? Explain your answer.