Introduction to Mathematical Modeling

Professor:
Dr. Joanna Bieri
joanna_bieri@redlands.edu
OFFICE: DUKE 209

Homework 2

Your task is to create a personal budget and then build a model of the amount of money you will have, or owe, in the next few years. You are making assumptions about your current spending and earning to project into the future your financial situation.

1. Write a list of all your expenses and income. Be as detailed as possible. Consider:
   - expenses: food, rent, utility bills, music/magazine/movie/tv expenses, fun, etc.
   - tuition and school costs
   - income: income from jobs, scholarships, or allowance
   - savings that you have and the interest rate
   - debt that you have and the interest rate: credit cards for example

   list all assumptions that you are making
2. Draw a compartmental diagram that represents your budget. Remember arrows in imply things that increase your money each month and arrows out decrease your money. Include equations for how you calculate or define each variable and parameter.
3. Write down a difference equation that represents your budget.
4. Program a spreadsheet (or a Python script) that calculates how much money you will have, or owe, when you graduate and beyond.
5. Now play with the numbers, make graphs, and analyze your results. Some possible questions you might ask your model:
   - What would it take for you to come out ahead in the next few years?
   - What is the minimum amount that you need to work each month (monthly income) that will allow you to pay your bills and not be in debt when you graduate. Put this number into perspective. (Hours of work maybe?)
   - What parameters make the biggest difference? For example, does eating less make more of a difference than getting a scholarship?
   - For the debt that is not paid by student loans, did you account for the fact that once you owe money you will have to pay interest? What is the typical credit card interest rate? How might having credit card dept change your results?

HAND IN

- A printed graph of your projected money vs month number (Money as a function of month)
- A drawing of your compartmental diagram and your equation.
- A short typed analysis of your budget. Discuss what you found. Were there any surprises? Report some of your most interesting numbers and report what you find most interesting about your projection. Include a description of your process: How did you build your model and what were your main assumptions?

SOME HINTS

- Start simple, even just copy what we did in class and make sure you understand how to do the spreadsheet. Then refine your model to in include more complicated things one at a time. Each time making sure your results make sense.
- Many students have different financial situations depending on the season. For example: in the summer some work a lot more to save up money. To deal with this in the spreadsheet, you will need an "if-statement" that says, *if the month = June, July, august then add some extra money to my income*
- I usually have a separate column for each major type of account. For example:
  - Checking Account: my basic account with which I pay all my bills
  - Savings Account: my account(s) that earn interest. Often there is a monthly transfer from Banking to Savings, but there is also interest earned on the balance.
  - Loans or Credit Cards: my account(s) the charge interest. Often there is a transfer from Checking when I may these monthly, but there is also interest charged on the balance.

  It's only when I am figuring out my final answer that I add/subtract theses accounts together to figure out my "net-worth".