Computer Exercise 3: R (continued)

Due Friday, February 22, at the beginning of class

Last week you learned some elementary syntax for the computer language R. This week we’re going to combine that syntax with basic control structures, typically embedded within scripts and functions. The short term goals of this week’s assignment include:

- learn how to write and call R functions
- learn how to write and use FOR and WHILE loops
- learning how to form plots in R
- learning appropriate protocols for writing comments in code

The longer term goal is to become proficient in using R as a means of exploring numerical facets of ordinary differential equations.

The assignment: Put the answer to the following questions in a Latex document. Make sure to include your figures.

1) Write an R function which takes as input a number \( y \) and returns as output the value of \( f(y) = y(1-y/10)(y-1) - 2 \). Make sure you include some error checking and an appropriate level of commenting.

2) Plot the graph of the function \( f(y) \) for \( y \) in the range \([0,10]\). Add gridlines to the plot, and make it a line graph (not just a bunch of dots.)

3) Suppose \( y \) represents the size of a certain population of fish, where \( \frac{dy}{dt} = f(y) \). (Note that the carrying capacity is 10 and harvest rate is 2.) Use the previous plot to visually estimate the minimum population size necessary to avoid extinction. Also estimate the maximum harvest rate that won’t lead to extinction, and the steady state equilibrium population.

4) Use the function “eulersmethod.R” (on the class website) to calculate the value of \( y \) at \( t=3 \) if \( y(0) = 2.2 \). Do it again with \( y(0) = 2.1 \). Are your results consistent with your estimates in the previous problem?

5) [Challenge] Write a function to calculate the value of the depensation threshold (the minimum sustainable population size) to an accuracy of .0000001.