

CS 151L – Summer 2017

Programming Assignment 7

Due: Wednesday, July 26, 2017 at 11:59 PM

(Submit a MatLab script on Learn called “cs151su17assn7.m”. The script must be well-commented so your code is understandable and will be easier to grade.)

Simple models for population growth (usually exponential ones) do not take into account the fact that when the population increases, survival becomes difficult for each individual because of greater competition for food and other resources. We can get a more accurate model by assuming the birth rate is proportional to the size of the current population and the death rate is proportional to the square of the current population. In both cases, they are also proportional to the sine and cosine functions as well.

Using this idea, it is found that the number of a certain type of animal on an island is modeled by the recursive sequence:

$$R(y) = R(y - 1) + 0.08 \sin\left(\frac{4y}{\pi}\right) R(y - 1) - 0.00004 \cos\left(\frac{4y}{\pi}\right) R(y - 1)^2$$

Where the initial population, $R(1)$ is 10000; $R(y)$ represents the current year's population and $R(y - 1)$ represents the previous year's population. And y represents the current year (year 1 being 1990, year 2 being 1991 and so on).

Your program should ask the user to input the number of years to evaluate (n) then build a matrix of population values (starting with the initial one) up to the n th year. Once you have built the matrix, then you should plot the population versus the year (with the year starting at 1990; not 1) where year is on the horizontal axis. Be sure to label your graph properly (with x and y labels plus a title). You must also create a table of values with the year in the first column and population values in the second column.

Finally, you need to create a report (using Word or something similar) with a table that covers 15 years of values (1990 through 2004), a graph with the same years and answer the following questions:

Is there a pattern in the first 15 years of the data and what do you think it represents?

What happens to the population as n becomes much larger? (You will need to run the program multiple times with different values of n to determine the answer.)

Note that this program does not give you step-by-step procedures so you will need to determine how you want to solve it. You should refer to the examples on the number of saws sold function and on the Fibonacci series as a guide (both of these were done in class). Your program needs to also handle at least these two error conditions: verify that the number of years is not less than 1 year and that it is a scalar value.