

**Assignment #5 GEOG 264 Winter 2020: Programming for Environmental Sciences – Revisiting Assignments 3 and 4 with functions.**

**Due date:** March 22nd by midnight. (You will not lose marks past the due date)

**Cut-off date:** April 1<sup>st</sup> by midnight. (You will receive 0 past the cut-off date).

This is worth 30 marks of assignment 5. Lab exercises 7 and 8 are worth another 10 marks of assignment 5. 40 points in total in this assignment.

1. [5 marks] Take your version of Assignment #4 – lynxes and hares and modify it so it stores all the variables from a simulation run in a matrix or data frame. At the end of the simulation run, produce a graph showing all the values of the numbers of lynxes, hares, baby lynxes and hares, dead lynxes and hares and eaten hares for each year of the simulation run. Make the graph as handsome as possible. Hand in the graph for the run of 20 years, 30 initial lynxes and 200 initial hares. If you don't like your version of Assignment #4, you may modify the solutions and hand that in for full marks. If you use your version and if Mitchell told you there are faults, correct the faults before handing this assignment in.
2. [25 marks] Go back to either my solution of Assignment 3 or yours. Basically, you will rewrite a subset of the assignment solution using **functions**.
  - a. Write a function **MeanMonth()** that takes **Raw** as its input, and computes and returns the means of all the individual months as a vector. You may use `mean(x, na.rm=T)` here.
  - b. Write a function **MonthlyMeanPlot()** that takes the above vector as its input to output a plot of the mean monthly temperatures. The x-axis will consist of the 12 months, labelled either by 1 thru 12 or as character strings if you can figure out how to do this. **Hint:** you can't assign a `plot()` as a variable, but a function will return your plot if the plot code is the last code of the function instructions.
  - c. Write a function **HotMonths()** that takes **Raw** as its input, and computes and returns the total number of months in the data where the mean monthly temperature is greater than or equal to 20 °C and the mean temperature of these hot months. Two values must be returned here, bundled together using whatever data structure you like.
  - d. Write a function **Extend()** that takes **Raw** as its input, and adds a 14<sup>th</sup> column consisting of the annual January-December average, creating a new data frame called **completed**. **Extend()** then returns **completed**.
  - e. Write a function **AnnualPlot()** that takes **completed** as its input and outputs a plot of the annually averaged temperatures. The x-axis will consist of the years 1877-2017.
  - f. Hand in all your functions, a run of your code, calling all of your functions, and the two plots. Hints: much of the code in Assignment 3 can be recycled here. You just have to figure out how to write functions and practice passing data among them.  
Good luck!

**There are many parts to this assignment and you should not forget any parts.** People have been losing points unnecessarily by this mistake. Make sure that you use good programming style so that your programs are readable to others and yourself. Mitchell will be beginning to start marking style so use comments, good variable names, space, indenting, etc.

Moodle submission instructions:

Submit a single file to Moodle in PDF (.pdf) file format. The file should contain your script for this assignment, as well as Labs 7-8. Make sure that all answers are included in the script (in comments). You can copy-paste your R script to a text editor such as Word and then save it in the .pdf format. **Please use Courier or Courier New font.**

Remember to include all questions and all parts of each question.

**Save the file as** : ass5\_FirstName\_LastName\_StudentID