Lab 1

Stats 20 - Summer A 2020 - Section 1

Due 7/3/2020 by 11:59PM PDT

General Instructions

Please create an R Markdown file (.Rmd) and appropriately label and number each solution (an example/template is given in the next link on CCLE).

Your programming code should appear in "chunks", preferably one for each problem, and verbal explanations should appear outside of the chunks.

Your .Rmd lab solution should render without error on another person's machine. A reasonable way to check if this is true is to quit R Studio, restart R Studio, and then knit your Lab 1 .Rmd file. If it renders and produces a new .html (check the timestamp) for you, it's acceptable and if there are any errors, they are probably only minor. If it does not render a new .html for you, there is a major problem or a small but fundamental error.

1. Numeric Vectors (for full credit, creating these vectors require one line of R code only)

Testing the vector is not counted as a line for the purposes of credit. These are taken from Exercise 2-1 in Cotton Chapter 2.

A Calculate the inverse tangent (a.k.a.arctan) of the reciprocal of all integers from 1 to 1,000. Hint: take a look at the ?Trig help page to find the inverse tangent function. You don't need a function to calculate reciprocals.

B Assign the numbers 1 to 1,000 to a variable x. Calculate the inverse tangent of the reciprocal of x, as in part (a), and assign it to a variable y. Now reverse the operations by calculating the reciprocal of the tangent of y and assigning this value to a variable z.

C Compare the variables x and z from Exercise 2-1 (b) using ==, identical, and all.equal. For all.equal, try changing the tolerance level by passing a third argument to the function. What happens if the tolerance is set to 0?

2. Character and Logical Vectors

A Create a character vector and assign it to new R object. For example:

```
[1] "alpha"   "bravo"   "charlie" "delta"   "echo"
```

B Show how to print the fourth element of the character vector. For example:

```
[1] "delta"
```

C Suppose a student has written the following:

```
a <- c("Able", "Baker", "Charlie")
b <- c(T, T, F)
b + 3
```

```
d <- matrix(c(a,b),nrow=3)
d[,2] + 3
```

Why does d[,2] + 3 result in an error but b + 3 did not?

3. Matrices

A Show us how to create a 100 by 3 numeric matrix using the numbers 1 through 300, like this:

```
        [,1] [,2] [,3]
   [1,]    1  101  201
   [2,]    2  102  202
   [3,]    3  103  203
  (many lines deleted)
   [98,]   98  198  298
   [99,]   99  199  299
  [100,]  100  200  300
```

B show us how to display the values in the 2nd column only.

C show us how to display the odd numbered rows only (for full credit, this is accomplished with only one line of code)

D Demonstrate that you know how to use the R Online Help System by finding the function that we would apply to a square numeric matrix containing the coefficients of the linear system to get its inverse? If you need your memory refreshed, try http://mathworld.wolfram.com/MatrixInverse.html

E Please check the correctness of the function in Part D by using R as a calculator to compute the inverse.

4. Applications

A (briefly) Why might it be a bad idea to create objects named T or F? (hint, try typing a T at the command prompt). Write your response out, no R code here please.

B (briefly) Suppose you have the vector 8 -1 0 1 6 7 5 3 0 9 Inf and then you take the log of the vector. What result do you get when R attempts to compute the log of -1, 0 and Inf? How would you explain the results (using the English language, for example, suppose you were being asked to explain the results to the interviewer for the internship you want...).

C (briefly) Suppose the vector in B was assigned to tone2 a student wrote this command log(tone2 $>$ 0) to eliminate any non-finite results (i.e., remove any results that would give FALSE to is.finite() . Does the student's code work? If not, tell me (using the English language please) why the student's code did not work and then provide a solution in R that will generate the desired result. If it does work, please print out the resulting vector of values, no further explanation required.

D Suppose this is a representation of the game tic-tac-toe:

```
1 | 2 | 3
--+---+--
4 | 5 | 6
--+---+--
7 | 8 | 9
```

Please construct a **list**, name it "wins". It should have 8 components. Each component should consist of one of the 8 ways to win at tic-tac-toe. I'll give you the first one:

```
[[1]]
[1] 1 2 3
```

Please include it and the other 7 in your answer.

What to Turn In

A .Rmd file following the format given to you in the next link on CCLE AND your knit result (.html only). Both of these should be uploaded to CCLE before the due date.