*\*Please save this file as “LAST NAME\_Assignment 1.docx”*

***Open-Ended Responses***

1. **I.1** If you are defining an object called **vec.x**, you can do so by typing it into a script file first and then executing or by typing it directly into the console. Which way is better for reproducibility and why?

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| Typing into the script is better for reproducibility because the console will only run the command without saving it. The script file can be saved and ran again and again to prove that it works. |

1. **I.5** Explain how R came up with the following result:

x <- 1:10

y <- 1:3

x-y

[1] 0 0 0 3 3 3 6 6 6 9

Warning message:

In x - y : longer object length is not a multiple of shorter object length

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| When R runs this command, it assumes you want to subtract the first integer of matrix Y from the first integer of matrix X. if the vectors are not the same size it assumes the number of integers in your matrix Y is a multiple of the number of integers in matrix X. Since 3 is not a multiple of 10, R gives you a warning to let you know the multiples did not work. |

1. **I.6** Explain the behavior of the **round()** function observed below where 0.5 is rounded down, but 1.5 is rounded up.

round(.5)

[1] 0

round(1.5)

[1] 2

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| In the help tab of this function, it states that R will always round the numbers to an even number with the round function. |

1. **I.7** A researcher wants to create a data set by sampling 100 integers ranging from 50 to 75 with replacement, center those data (subtract the mean from each data point), and then calculate the centered mean divided by the centered standard deviation. Spot the silent error in the following code written to do this:

1 data <- sample(50:75, 100, replace = TRUE) # sample the data

2 data.cen <- data - mean(data) # center data on mean

3 mean(data) / sd(data) # calculate mean / sd

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| This researcher too the mean and standard deviation of his first dataset (data) not the centered dataset (data.cen). His values will be based off of the original dataset. |

1. **I.7** Why does the following generate an error? Special note: if you copy/paste from this word document, it brings what are called “smart quotes” which R can’t recognize. You might need to type the quotes manually.

x <- c(1, 5, 3, 4, “3”) # runs fine

sum(x) # error generated

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| Putting quotes around the number 3 makes it an object rather than an integer. R cannot take the sum of something with no value. |

1. **1.8** Below are two sections of code that accomplish the same thing. Which one would you think is the “best” way? There isn’t necessarily a right answer here, I just want to hear your rationale.

x <- sample(-50:50)

# Code Section 1

x.fil <- x[x > 0] # filter out all negative values

x.fil.sq <- x.fil^2 # square results

mean(x.fil.sq) # compute mean

# Code Section 1

mean((x[x > 0])^2) # filter, square, compute mean

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| The first way is better. Although it is more cumbersome and can be confusing with a lot of steps, the individual steps are more clearly written out and easier to understand |

***Coding Section***

To complete this section, start a new script file with the following layout:

# YOUR NAME

# Assignment 1 Introduction to R

# #1 ---------------- (new section: CTRL + SHIFT + R)

here’s my code # with adequate commenting

# #2 ---------------- (new section: CTRL + SHIFT + R)

here’s my code # with adequate commenting

1. **I.2** Suppose I wrote 2 lines of code and then said the following: “Here, I defined an object x as a numeric vector that contains 5 numeric elements, the numbers 1 through 5. Then I told R to add 1 to each element and print the result.” What are the two lines of code?
2. **I.3** Cohen’s d is a metric that computes the effect size in a comparisons test (if you don’t know what I’m talking about, it’s okay). The formula is:

Graphical user interface

Description automatically generated with medium confidence

, where...

* d is Cohen’s d
* ME, MC are the means of experimental (E) and control (C) groups
* Sample SD pooled is the pooled standard deviation:

Diagram

Description automatically generated

Calculate Cohen’s d in R comparing the two simulated groups below. I would recommend using mean() and sd() to compute means and standard deviations (as opposed to doing them “by hand”). Note: there are functions in other packages that compute Cohen’s d for you, but do not use one of these functions here.

set.seed(42)

exp <- rnorm(100, 1.1, .1) # experimental

set.seed(42)

con <- rnorm(100, 1, .1) # control

1. **I.5** Create an object called **data** and define it as a numeric sequence that starts at 0 and goes to 200 in increments of 0.5 (*i.e.* 0, 0.5, 1, 1.5... ...199, 199.5, 200). Then, take a random sample of 50 points without replacement (cannot sample the same set of points more than once) and assign it to an object called **dat.sample**. Set the seed to 42 prior to sampling so we get the same result. Calculate a 5-number summary of **dat.sample** (minimum, 1st quartile, median, 3rd quartile, and maximum).
2. **I.8** Binning numbers is a pretty common task in research that entails taking a numeric vector and binning them into categories. The following will simulate this process commonly found in educational testing.
   1. Simulate a dataset that contains 200 students’ scores that follow a normal distribution (?rnorm) that have a class average of 80% and a standard deviation of 20%. Use a seed of 42 so we get the same data. You will notice that many of the sampled scored go above 100, which is not possible. Replace any number over 100 with 100.
   2. What is the average and standard deviation of just the students in the top third of the class?
   3. Create a vector that bins scores according to a common grade distribution (below) and tally how many of each grade were given
      * A >= 90%
      * B >= 80%, < 90%
      * C >= 70%, < 80%
      * D >= 60%, < 70%
      * F < 60%