1. The precision of a floating point number is determined by its mantissa. R uses a double floating point number which has a mantissa of length 52 bits plus one “implied” bit for a total of 53 bits. To explore this concept, complete the following:
   1. Use R code to determine how large of a number can be expressed with 53 bits. Express your number in scientific notation with base 10 (this is how R will read out your number so no conversion is needed).
   2. R cannot store numbers with perfect precision that are larger than the answer to 1.a. To demonstrate this, create an object called bigNum1 and assign a value of 99999….9 where the total number of 9’s in bigNum1 is equal to the exponent from the answer to 1.a. Next, create a second object called bigNum2 and assign a value of 999999….98 where the number of digits in bigNum2 is the same as the number of digits in bigNum1. Subtract bigNum2 from bigNum1. If R stored the numbers correctly, the result should be 1. Did R calculate the result correctly?

NOTE: Do not create bigNum2 with the code: bigNum1 - 1. This will defeat the purpose of the exercise. bigNum1 and bigNum2 can be typed in manually or you could create these numbers using a for loop.

* 1. Update the value of bigNum1 by multiplying it by 10 and adding 9. Update the value of bigNum2 by multiplying it by 10 and adding 18. Subtract bigNum2 from bigNum1. Again, the answer should be 1. Did R calculate the result correctly? Why or why not?

1. Use the as.integer() function to determine the integer versions of the following numbers: 1.0, 1.2, 1.5, 1.9, 1.99999. What do the answers tell you about how R treats rounding when converting a float into an integer?
2. Create an object called longFloat and assign a value of 1.9999…9 where the total number of 9’s in longFloat is equal to the exponent from the answer to 1.a. Use the as.integer()function to convert to an integer. Did you receive the answer you expected? Now add one more 9 to the end of longFloat by dividing it by 10 and adding 1.8. Use the as.integer()function to convert the new value to an integer. Did you get the same result? Why do you think R behaves this way?
3. Import the data file called “Students\_Data” as a data frame and do the following:
   1. Using the qplot() function from the “ggplot” package, create a histogram of the grades of the students in the class. Label the x-axis “Grades”.
   2. The ‘study session’ column indicates whether or not a student attended the optional study session, with TRUE indicating that the student did attend and FALSE indicating that they did not attend. Use R code to determine what percentage of the students attended the study session.
   3. Extract the “gender” column from “Students\_Data” as a vector of character strings and store in an object called genders. Use this new vector to calculate how many people in the class are men.