BSDS 100: Intro to Data Science with `R`
Assignment 4

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Directions: For all questions in this assignment, write complete sentences and fully answer any question that is asked. Provide all `R` code and solutions by *knitting* your final `R`Studio file into a single file named `[your_name]_CA4.pdf`. This assignment is due next Tuesday at the beginning of class. Late assignments will automatically have 10 points deducted.

1. Create the vector

    ```
    > myAtomicVector <- c(1, 4, 3, 2, NA, 3.22, -44, 2, NA, 0, 22, 34)
    ```

    Now, create code that runs to answer each of the following questions.

    (a) How many positive numbers (> 0) are there in this vector?

    (b) How many negative numbers (< 0) are there in this vector?

    (c) How many 0's are there in this vector?

    (d) How many `NA`s are there is this vector?

    (e) How many numbers in the vector are non-zero **and** not `NA`s?

    (f) What is the sum of the positive numbers is this vector?

    (g) What is the sum of the negative numbers is this vector?

2. Consider a vector of length 1000, where F_n is the nth number in the sequence. Then the Fibonacci sequence is the vector where the following recursion holds:

$$F_n = F_{n-1} + F_{n-2}$$

    That is, the nth number in the sequence will be the sum of the previous two numbers.

    (a) Using the `rep()` and `seq()` commands, create a vector named `Fib.vec` (but don't print it out!) that contains the first 1000 Fibonacci numbers starting from the first two numbers $(1, 1)$.

    (b) What are the first 8 and last 8 entries of `Fib.vec`?

    (c) Using the Fibonacci numbers generated above, generate a vector (of length 999) with values (again, don't print these out)

$$Z_n = \frac{F_{n+1}}{F_n}$$

    (d) Plot the vector Z_n using the command `plot(Z_n)`. Then add a line to the plot using the following command `abline(h = (1 + sqrt(5)/2))`. This value is known as the golden ratio in mathematics.

    (e) Comment on the plot that you obtain. What do you observe?

3. Using the Fibonacci vector above, create the following data structures.

- A matrix of size 100×10 named `Fib.matrix1` whose columns, when stacked on top of one another will return the original vector.

- A matrix of size 100×10 named `Fib.matrix2` whose rows, when stacked side by side will return the original vector.

- An array of dimension $10 \times 10 \times 10$ names `Fib.array` where each 10×10 matrix in the array is such that when its columns are stacked on top of one another would generate a Fibbonaci vector of length 100.

Answer the following questions

(a) What is the mean of the 18th row of `Fib.matrix1`?

(b) What is the standard deviation of the 8th column of `Fib.matrix2`?

(c) What is the entry in the 5th row of the 2nd column of the 8th matrix in `Fib.array`?