Write R code to solve the following problems in an R markdown file name HW4. Submit your work to GitHub. Read the GitHub documentation and see how you might use a pull request to notify your grader that your assignment is ready for grading or that you have a question about your code.

Vectors

1. Create the vectors:
   a) (1,2,3,...,19,20)
   b) (20,19,...,2,1)
   c) (1,2,3,...,19,20,19,18,...,2,1)
   d) (4, 6, 3) and assign it to the name tmp.

   For parts (e), (f) and (g) look at the help for the function rep.

   e) (4,6,3, 4,6,3,...,4,6,3) where there are 10 occurrences of 4.
   f) (4,6,3, 4,6,3,...,4,6,3,4) where there are 11 occurrences of 4, 10 occurrences of 6 and 10 occurrences of 3.
   g) (4,4,...,4, 6,6,...,6, 3,3,...,3) where there are 10 occurrences of 4, 20 occurrences of 6 and 30 occurrences of 3.

2. Create a vector of the values of $e^x \cos(x)$ at x = 3,3.1,3.2,...,5.9,6.

3. Create the following vectors:
   a) $(0.1^3 0.2^1, 0.1^6 0.2^4, 0.1^9 0.2^7, ..., 0.1^{36} 0.2^{34})$
   b) $\left(2, \frac{2^2}{2}, \frac{2^3}{3}, ..., \frac{2^{25}}{25}\right)$

4. Calculate the following:
   a) $\sum_{i=10}^{100}(i^3 + 4i^2)$
   b) $\sum_{i=1}^{25}(\frac{2^i}{i} + \frac{3^i}{i^2})$

5. Use the function paste to create the following character vectors of length 30:
   a) ("label 1", "label 2", ..., "label 30"). Note that there is a single space between label and the number following.
   b) ("fn1", "fn2", ..., "fn30"). In this case, there is no space between fn and the number following.

6. Execute the following lines which create two vectors of random integers

which are chosen with replacement from the integers 0, 1, . . . , 999.
Both vectors have length 250.

```
set.seed(50)
xVec <- sample(0:999, 250, replace=T)
yVec <- sample(0:999, 250, replace=T)
```

Suppose x = (x1,x2,...,xn) denotes the vector xVec and y = (y1,y2,...,yn)
denotes the vector yVec.

a) Create the vector $(y_2 - x_1, \ldots, y_n - x_{n-1})$

b) Create the vector $\left(\frac{\sin (y_1)}{\cos (x_2)}, \frac{\sin (y_2)}{\cos (x_3)}, \ldots, \frac{\sin (y_{n-1})}{\cos (x_n)} \right)$

c) Create the vector $(x_1 + 2x_2 - x_3, \ldots, x_{n-2} + 2x_{n-1} - x_n)$

d) **_Calculate_** $\sum_{i=1}^{n-1} \frac{e^{-x_{i+1}}}{X_i + 10}$

7. This question uses the vectors xVec and yVec created in the previous
   question and the functions sort, order, mean, sqrt, sum and abs.
   a) Pick out the values in yVec which are > 600.
   b) What are the index positions in yVec of the values which are > 600?
   c) What are the values in xVec which correspond to the values in yVec
      which are > 600? (By correspond, we mean at the same index
      positions.)
   d) Create the vector ($|x_1 - \bar{x}|^{1/2}$, $|x_2 - \bar{x}|^{1/2}$, . . . , $|x_n - \bar{x}|^{1/2}$) where $\bar{x}$
      denotes the mean of the vector x = $(x_1, x_2, \ldots, x_n)$.
   e) How many values in yVec are within 200 of the maximum value of
      the terms in yVec?
   f) How many numbers in xVec are divisible by 2? (Note that the mod
      operator is denoted %%.)
   g) Sort the numbers in the vector xVec in the order of increasing values
      in yVec.
   h) Pick out the elements in yVec at index positions 1,4,7,10,13,…
8. By using the function cumprod or otherwise, calculate:

$$1 + \frac{2}{3} + \left(\frac{2 * 4}{3 * 5} \right) + \left(\frac{2 * 4 * 6}{3 * 5 * 7} \right) + \cdots + \left(\frac{2 * 4}{3 * 5} \cdots \frac{* 38}{* 39} \right)$$