HW3_Do_Quyen

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Problem 4

Some of my takeaways from Google's R programming styles and Hadley Wickham's are naming of variables and functions (use nouns for variables and verbs for function names). Commenting is an important aspect covered in both guidelines. Proper commenting helps the readers understand the code and also help the programmer trace his/her steps while looking back at the script. I particularly like Google's instructions on function documentation that needs to include a descriptive comment on the function's purpose and its required arguments and return values. All in all, the style needs to be consistent throughout the script.

I will pay more attention to the variable and function naming, spacing and indentation when creating my scripts. I will also spend more time on documenting created functions and make sure I include all necessary information. I will also utilize tools like Lintr to keep my style consistent and be aware of common mistakes.

Problem 5

Some common things I need to change in my code are:

- Putting a space after commas
- Putting spaces around all infix operators
- Keeping lines under 80 characters
- Opening curly braces should not be on their own line
- Using lower cases for variable and function names

Problem 6

a. Create a single table of the means, sd, and correlation for each of the 13 Observers in data.rds

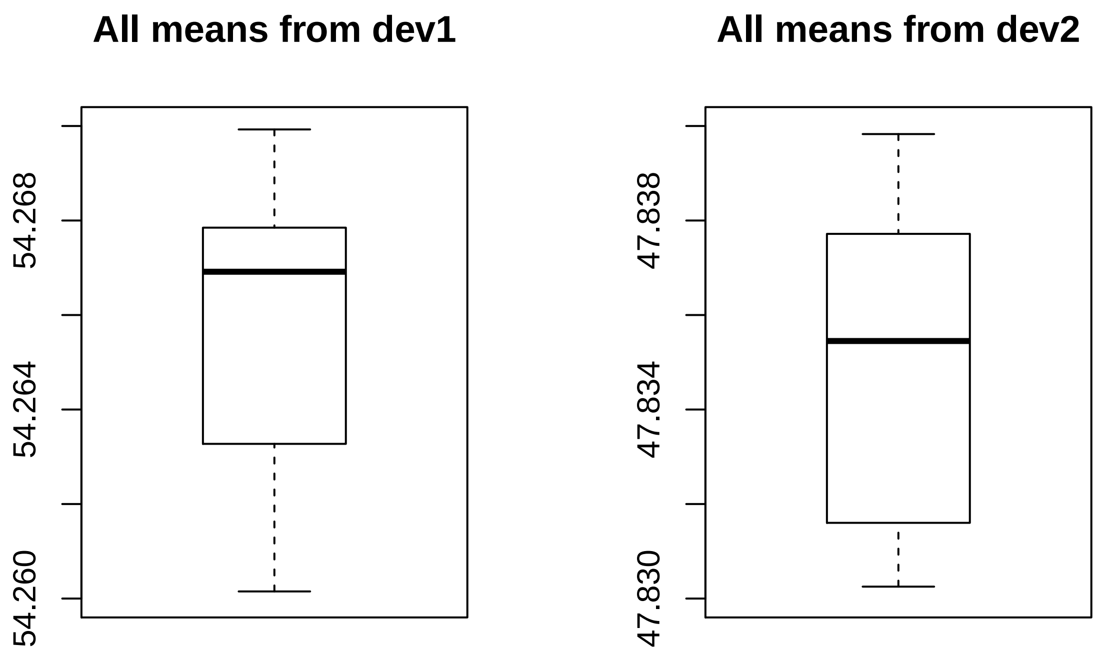
```
data <- readRDS("../03_good_programming_R_functions/HW3_data.rds")

summarizeVectors <- function (dev1,dev2) {
  # Calculates mean, sd and correlation of 2 vectors and return the results in a data frame

  # Args:
  # dev1: One of the two vectors whose mean, sd and correlation is to be calculated
  # dev2: The other vector. dev1 and dev2 must have the same length and no missing values.

  # Returns:
  #  A data frame with 4 columns (2 columns for the mean of each vector, 2 columns for the sd of each v

  #Error handling
  n <- length(dev1)
  if (n <= 1 || n != length(dev2)) {
    stop ("Arguments dev1 and dev2 have different lengths.")
  }
```

```r
  if (TRUE %in% is.na(dev1) || TRUE %in% is.na(dev2)) {
    stop ("There is missing value within argument dev1 or dev2.")
  }

  # Calculate mean, sd and correlation of dev1 and dev2
  mean_dev1 <- mean(dev1)
  mean_dev2 <- mean(dev2)
  sd_dev1 <- sd(dev1)
  sd_dev2 <- sd(dev2)
  correlation <- cor(dev1,dev2)

  # Put the summary statistics in a data frame
  df <- data.frame(mean_dev1, mean_dev2, sd_dev1, sd_dev2, correlation)

  return(df)
}

# Create a dataframe to hold the results
Observers_summary <- data.frame(matrix(ncol = 6,nrow = 0))
names(Observers_summary) <- c("Observer", "mean_dev1", "mean_dev2",
                              "sd_dev1","sd_dev2","correlation")

# Loop through each observer's data to calculate the necessary statistics
for (obs in unique(data$Observer))
{
  current_dev1 <- data[which(data$Observer ==obs),"dev1"]
  current_dev2 <- data[which(data$Observer ==obs),"dev2"]
  result <- summarizeVectors(current_dev1,current_dev2)
  result$Observer <- obs
  Observers_summary <- rbind(Observers_summary,result)

}
# Rearrange the order of columns in the summary table and sort the row by Observer
Observers_summary <- Observers_summary[,c(6,1:5)] %>% arrange(Observer)

#Print the result
Observers_summary
```

```
##    Observer mean_dev1 mean_dev2  sd_dev1  sd_dev2 correlation
## 1         1  54.26610  47.83472 16.76982 26.93974 -0.06412835
## 2         2  54.26873  47.83082 16.76924 26.93573 -0.06858639
## 3         3  54.26732  47.83772 16.76001 26.93004 -0.06834336
## 4         4  54.26327  47.83225 16.76514 26.93540 -0.06447185
## 5         5  54.26030  47.83983 16.76774 26.93019 -0.06034144
## 6         6  54.26144  47.83025 16.76590 26.93988 -0.06171484
## 7         7  54.26881  47.83545 16.76670 26.94000 -0.06850422
## 8         8  54.26785  47.83590 16.76676 26.93610 -0.06897974
## 9         9  54.26588  47.83150 16.76885 26.93861 -0.06860921
## 10       10  54.26734  47.83955 16.76896 26.93027 -0.06296110
## 11       11  54.26993  47.83699 16.76996 26.93768 -0.06944557
## 12       12  54.26692  47.83160 16.77000 26.93790 -0.06657523
## 13       13  54.26015  47.83972 16.76996 26.93000 -0.06558334
```

b. Create a boxplot of all the means to compare the spread of means from dev1 to dev2

```r
par(mfrow=c(1,2))
boxplot(Observers_summary$mean_dev1,main="All means from dev1",ylim=c(54.260,54.270))
boxplot(Observers_summary$mean_dev2,main="All means from dev2",ylim=c(47.830,47.840))
```




```r
#g <- ggplot(data = gather(Observers_summary,key="Dev",value="mean","mean_dev1","mean_dev2"),aes(x=Dev,
```

c. Create a violin plot of all means to compare the spread of sds from dev1 to dev2

```r
par(mfrow=c(1,2))
vioplot(Observers_summary$sd_dev1,ylim=c(16.750,16.780),names="sd_dev1")
vioplot(Observers_summary$sd_dev2,ylim=c(26.920,26.950),names="sd_dev2")
#g <- ggplot(data = gather(Observers_summary,key="Dev",value="sd","sd_dev1","sd_dev2"),aes(x=Dev,y=sd)
```

Problem 7

Import and clean Blood Pressure data

Summary tables

```r
#Show the first 10 rows of the cleaned data
kable(head(bloodPressure_cleaned,10),caption="First 10 rows of cleaned blood pressure data")
```

Table 1: First 10 rows of cleaned blood pressure data

Day	Reading_By	Reading
1	Dev1	133.34
2	Dev1	110.94
3	Dev1	118.54
4	Dev1	137.94
5	Dev1	139.52
6	Dev1	139.23
7	Dev1	117.96
8	Dev1	119.59
9	Dev1	116.12
10	Dev1	128.38

```r
#Create a summary table
kable(summary(bloodPressure_cleaned),caption="Blood Pressure Data Summary")
```

Table 2: Blood Pressure Data Summary

	Day	Reading_By	Reading
	Min. : 1	Length:90	Min. :110.8
	1st Qu.: 4	Class :character	1st Qu.:125.5
	Median : 8	Mode :character	Median :130.4
	Mean : 8	NA	Mean :129.0
	3rd Qu.:12	NA	3rd Qu.:134.3
	Max. :15	NA	Max. :139.6
##Pro	blem 8		

Find solution to (1) using Newton's method

$$f(x) = 3^x - sin(x) + cos(5x) \tag{1}$$

```r
#Define function (1)
fun1 <- function(x) {
  3^x - sin(x) + cos(5*x)
}

get_solution_using_Newtons_method <- function(guess, FUN, tolerance) {
  # solve for the solution of a function using iterations by Newton's method

  # Args:
  #   guess: the initial solution guess to star the iteration
  #   FUN: the function to be solved
  #   tolerance: the tolerance if absolute difference between 0 and the value of a function
  #              at a point is within this tolerance, then the point is an acceptable solution

  # Returns:
  #   A list containing the solution, the tolerance, and a graph visualzing all iterations

  # Set up the max iteration
  max_iteration <- 100
```

```r
iteration_index <- 0

# Retrive the derivati ve of FUN using Deriv package
FUN_deriv <- Deriv(FUN)

# Find the value of FUN based on guess
x_n <- guess
f_n <- FUN(guess)

# Set up vectors to hold iteration data
x_vect <- c()
y_vect <- c()
deriv_vect <- c()

# Set up the plot of iterations to return
p <- ggplot(data=data.frame(x=0),mapping=aes(x=x))
p <- p+ stat_function(fun=FUN)

#Iterations to find the best solution within given tolerance
while(abs(f_n) > tolerance & iteration_index <= max_iteration){

  #Save iteration data
  x_vect <- c(x_vect,x_n)
  y_vect <- c(y_vect,f_n)
  deriv_vect <- c(deriv_vect,FUN_deriv(x_n))

  #Generate new x to check for solution
  x_n <- x_n - (FUN(x_n)/FUN_deriv(x_n))
  f_n <- FUN(x_n)

  #add visualization of the iteration on the plot
  p <- p + geom_segment(x=x_vect[length(x_vect)],xend=x_n,y=y_vect[length(y_vect)],yend=0)
  p <- p + geom_segment(x=x_n,xend=x_n,y=0,yend=f_n,lty="dashed")

  #update interation_index
  iteration_index <- iteration_index + 1
}

#Loop breaks when a solution within tolerance is found
#Save the last iteration, which is also the final solution
x_vect <- c(x_vect,x_n)
y_vect <- c(y_vect,f_n)


#Add the iteration points to the plot
p <- p + geom_point(data.frame(x_vect,y_vect),
               mapping=aes(x=x_vect,y=y_vect), colour="red")

p <- p + geom_point(x=x_vect[1],y=y_vect[1],color="darkgreen",size = 2) # The guess point
p <- p + geom_point(x=x_n,y=f_n,color="blue",size = 2) #  The solution

#Reframe the axes for the plot
p <- p + xlim(min(x_vect)-1,max(x_vect)+1)
```

```r
  return(list(x_n,tolerance,p))
}
```

```r
get_solution_using_Newtons_method(0.5,fun1,10^-7)
```

```
## [[1]]
## [1] -2.887058
##
## [[2]]
## [1] 1e-07
##
## [[3]]
```