Assignment-1

Execute the following cell to load the tidyverse library:

```r
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.3     v tidyr     1.3.1
## v purrr     1.0.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

Execute the following cell to load the data. Refer to this website http://archive.ics.uci.edu/ml/datasets/Auto+MPG for details on the dataset:

```r
autompg = read.table(
  "http://archive.ics.uci.edu/ml/machine-learning-databases/auto-mpg/auto-mpg.data",
  quote = "\"",
  comment.char = "",
  stringsAsFactors = FALSE)
head(autompg,20)
```

```
##    V1 V2  V3    V4   V5   V6 V7 V8                           V9
## 1  18  8 307 130.0 3504 12.0 70  1    chevrolet chevelle malibu
## 2  15  8 350 165.0 3693 11.5 70  1            buick skylark 320
## 3  18  8 318 150.0 3436 11.0 70  1           plymouth satellite
## 4  16  8 304 150.0 3433 12.0 70  1                amc rebel sst
## 5  17  8 302 140.0 3449 10.5 70  1                  ford torino
## 6  15  8 429 198.0 4341 10.0 70  1             ford galaxie 500
## 7  14  8 454 220.0 4354  9.0 70  1             chevrolet impala
## 8  14  8 440 215.0 4312  8.5 70  1            plymouth fury iii
## 9  14  8 455 225.0 4425 10.0 70  1             pontiac catalina
## 10 15  8 390 190.0 3850  8.5 70  1           amc ambassador dpl
## 11 15  8 383 170.0 3563 10.0 70  1          dodge challenger se
## 12 14  8 340 160.0 3609  8.0 70  1           plymouth 'cuda 340
## 13 15  8 400 150.0 3761  9.5 70  1        chevrolet monte carlo
## 14 14  8 455 225.0 3086 10.0 70  1      buick estate wagon (sw)
## 15 24  4 113 95.00 2372 15.0 70  3        toyota corona mark ii
## 16 22  6 198 95.00 2833 15.5 70  1              plymouth duster
## 17 18  6 199 97.00 2774 15.5 70  1                   amc hornet
## 18 21  6 200 85.00 2587 16.0 70  1                ford maverick
## 19 27  4  97 88.00 2130 14.5 70  3                 datsun pl510
## 20 26  4  97 46.00 1835 20.5 70  2 volkswagen 1131 deluxe sedan
```

Question 1.1: print the structure of the unedited data set. How many samples and features are there? Ans - 398 samples and 9 features.

```r
str(autompg)
```

```
## 'data.frame':    398 obs. of  9 variables:
##  $ V1: num  18 15 18 16 17 15 14 14 14 15 ...
##  $ V2: int  8 8 8 8 8 8 8 8 8 8 ...
##  $ V3: num  307 350 318 304 302 429 454 440 455 390 ...
##  $ V4: chr  "130.0" "165.0" "150.0" "150.0" ...
##  $ V5: num  3504 3693 3436 3433 3449 ...
##  $ V6: num  12 11.5 11 12 10.5 10 9 8.5 10 8.5 ...
##  $ V7: int  70 70 70 70 70 70 70 70 70 70 ...
##  $ V8: int  1 1 1 1 1 1 1 1 1 1 ...
##  $ V9: chr  "chevrolet chevelle malibu" "buick skylark 320" "plymouth satellite" "amc rebel sst" ...
```

Execute the following cell to assign names to the columns of the dataframe:

```r
colnames(autompg) = c("mpg", "cyl", "disp", "hp", "wt", "acc", "year", "origin", "name")
str(autompg) # Validate the result
```

```
## 'data.frame':    398 obs. of  9 variables:
##  $ mpg   : num  18 15 18 16 17 15 14 14 14 15 ...
##  $ cyl   : int  8 8 8 8 8 8 8 8 8 8 ...
##  $ disp  : num  307 350 318 304 302 429 454 440 455 390 ...
##  $ hp    : chr  "130.0" "165.0" "150.0" "150.0" ...
##  $ wt    : num  3504 3693 3436 3433 3449 ...
##  $ acc   : num  12 11.5 11 12 10.5 10 9 8.5 10 8.5 ...
##  $ year  : int  70 70 70 70 70 70 70 70 70 70 ...
##  $ origin: int  1 1 1 1 1 1 1 1 1 1 ...
##  $ name  : chr  "chevrolet chevelle malibu" "buick skylark 320" "plymouth satellite" "amc rebel sst"
```

Question 1.2: complete the code segment below to remove samples with missing horsepower (hp) values represented as a "?" in the dataset.

```r
autompg = autompg %>% filter(!(hp == '?'))
autompg %>% filter(hp == '?') # Validate the result
```

```
## [1] mpg    cyl    disp   hp     wt     acc    year   origin name  
## <0 rows> (or 0-length row.names)
```

Question 1.3: complete the code segment below to remove samples with the name "plymouth reliant"

```r
autompg = autompg %>% filter(!(name == 'plymouth reliant'))
autompg %>% filter((name == 'plymouth reliant')) # Validate the result
```

```
## [1] mpg    cyl    disp   hp     wt     acc    year   origin name  
## <0 rows> (or 0-length row.names)
```

Question 2.1: complete the code segment below to select all features except 'name'

```r
autompg = autompg %>% select(-name)
str(autompg) # Validate the result
```

```
## 'data.frame':    390 obs. of  8 variables:
##  $ mpg   : num  18 15 18 16 17 15 14 14 14 15 ...
##  $ cyl   : int  8 8 8 8 8 8 8 8 8 8 ...
##  $ disp  : num  307 350 318 304 302 429 454 440 455 390 ...
##  $ hp    : chr  "130.0" "165.0" "150.0" "150.0" ...
##  $ wt    : num  3504 3693 3436 3433 3449 ...
##  $ acc   : num  12 11.5 11 12 10.5 10 9 8.5 10 8.5 ...
##  $ year  : int  70 70 70 70 70 70 70 70 70 70 ...
##  $ origin: int  1 1 1 1 1 1 1 1 1 1 ...
```

Execute the following cell to change the type of hp values from character to numeric:

```r
autompg$hp = as.numeric(autompg$hp)
str(autompg) # Validate that type has changed from chr to num for hp
```

```
## 'data.frame':    390 obs. of  8 variables:
##  $ mpg   : num  18 15 18 16 17 15 14 14 14 15 ...
##  $ cyl   : int  8 8 8 8 8 8 8 8 8 8 ...
##  $ disp  : num  307 350 318 304 302 429 454 440 455 390 ...
##  $ hp    : num  130 165 150 150 140 198 220 215 225 190 ...
##  $ wt    : num  3504 3693 3436 3433 3449 ...
##  $ acc   : num  12 11.5 11 12 10.5 10 9 8.5 10 8.5 ...
##  $ year  : int  70 70 70 70 70 70 70 70 70 70 ...
##  $ origin: int  1 1 1 1 1 1 1 1 1 1 ...
```

Question 2.2: complete the code cell to modify 'origin' column to reflect local (1) and international models (0)

```r
autompg = autompg %>% mutate(origin = ifelse(origin == 1, 'local', 'international'))
head(autompg, 20)
```

```
##    mpg cyl disp  hp   wt  acc year        origin
## 1   18   8  307 130 3504 12.0   70         local
## 2   15   8  350 165 3693 11.5   70         local
## 3   18   8  318 150 3436 11.0   70         local
## 4   16   8  304 150 3433 12.0   70         local
## 5   17   8  302 140 3449 10.5   70         local
## 6   15   8  429 198 4341 10.0   70         local
## 7   14   8  454 220 4354  9.0   70         local
## 8   14   8  440 215 4312  8.5   70         local
## 9   14   8  455 225 4425 10.0   70         local
## 10  15   8  390 190 3850  8.5   70         local
## 11  15   8  383 170 3563 10.0   70         local
## 12  14   8  340 160 3609  8.0   70         local
## 13  15   8  400 150 3761  9.5   70         local
## 14  14   8  455 225 3086 10.0   70         local
## 15  24   4  113  95 2372 15.0   70 international
## 16  22   6  198  95 2833 15.5   70         local
## 17  18   6  199  97 2774 15.5   70         local
## 18  21   6  200  85 2587 16.0   70         local
## 19  27   4   97  88 2130 14.5   70 international
## 20  26   4   97  46 1835 20.5   70 international
```

Question 2.3: print the structure of the dataframe. What types are the columns 'cyl' and 'origin'? Ans - 'cyl' is type int and 'origin' is type chr.

```r
str(autompg)
```

```
## 'data.frame':    390 obs. of  8 variables:
##  $ mpg   : num  18 15 18 16 17 15 14 14 14 15 ...
##  $ cyl   : int  8 8 8 8 8 8 8 8 8 8 ...
##  $ disp  : num  307 350 318 304 302 429 454 440 455 390 ...
##  $ hp    : num  130 165 150 150 140 198 220 215 225 190 ...
##  $ wt    : num  3504 3693 3436 3433 3449 ...
##  $ acc   : num  12 11.5 11 12 10.5 10 9 8.5 10 8.5 ...
##  $ year  : int  70 70 70 70 70 70 70 70 70 70 ...
##  $ origin: chr  "local" "local" "local" "local" ...
```

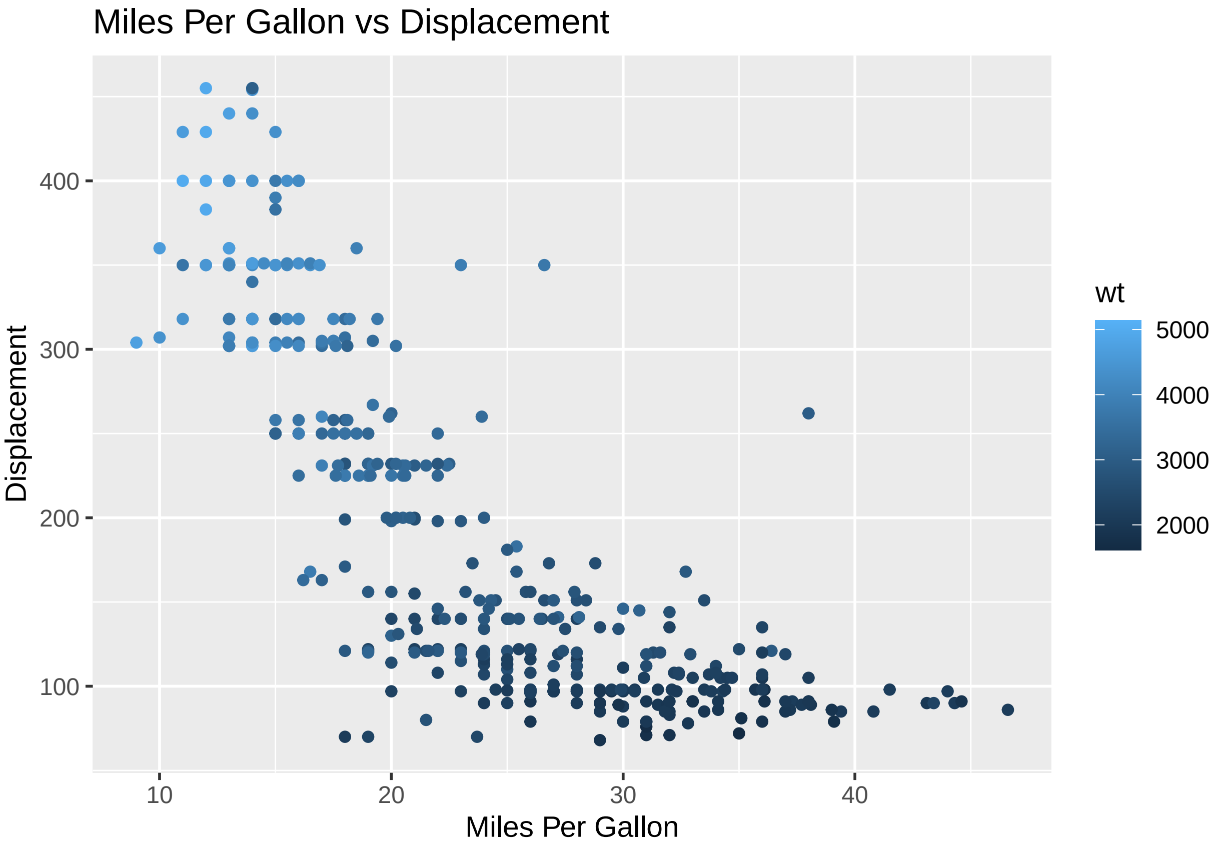
Question 3.1: complete the code segment below to change the types of ‘cyl’ and ‘origin’ columns to factor

```
catcols = c('cyl', 'origin')
autompg[catcols] = lapply(autompg[catcols], as.factor)
str(autompg) # Validate the change
```

```
## 'data.frame':    390 obs. of  8 variables:
##  $ mpg   : num  18 15 18 16 17 15 14 14 14 15 ...
##  $ cyl   : Factor w/ 5 levels "3","4","5","6",..: 5 5 5 5 5 5 5 5 5 5 ...
##  $ disp  : num  307 350 318 304 302 429 454 440 455 390 ...
##  $ hp    : num  130 165 150 150 140 198 220 215 225 190 ...
##  $ wt    : num  3504 3693 3436 3433 3449 ...
##  $ acc   : num  12 11.5 11 12 10.5 10 9 8.5 10 8.5 ...
##  $ year  : int  70 70 70 70 70 70 70 70 70 70 ...
##  $ origin: Factor w/ 2 levels "international",..: 2 2 2 2 2 2 2 2 2 2 ...
```

Question 3.2: complete the code segment below to create a scatter plot of mpg vs. displacement by color coding the points according to the origin (local or international). Add axes labels and title for the plot. Comment on what you observe: mpg and displacement are inversely proportional. As displacement increases, miles per gallon decreases and vice-versa.

```
p = ggplot(data = autompg, aes(x = mpg, y = disp, color = wt)) +
            geom_point() +
            labs(x = 'Miles Per Gallon', y = 'Displacement', title = 'Miles Per Gallon vs Displacement
p
```


Miles Per Gallon vs Displacement
Displacement
Miles Per Gallon
wt