Lab 2 - STA250

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1. Create the following matrix: X = (1 2, 3 4). Calculate XXˆT and the inverse of XXˆT.

```
x = matrix(1:4, nrow=2, byrow=TRUE)
print(x)
```

```
##      [,1] [,2]
## [1,]    1    2
## [2,]    3    4
```

```
y = x*t(x)
print(y)
```

```
##      [,1] [,2]
## [1,]    1    6
## [2,]    6   16
```

```
z = solve(y)
print(z)
```

```
##      [,1]  [,2]
## [1,] -0.8  0.30
## [2,]  0.3 -0.05
```

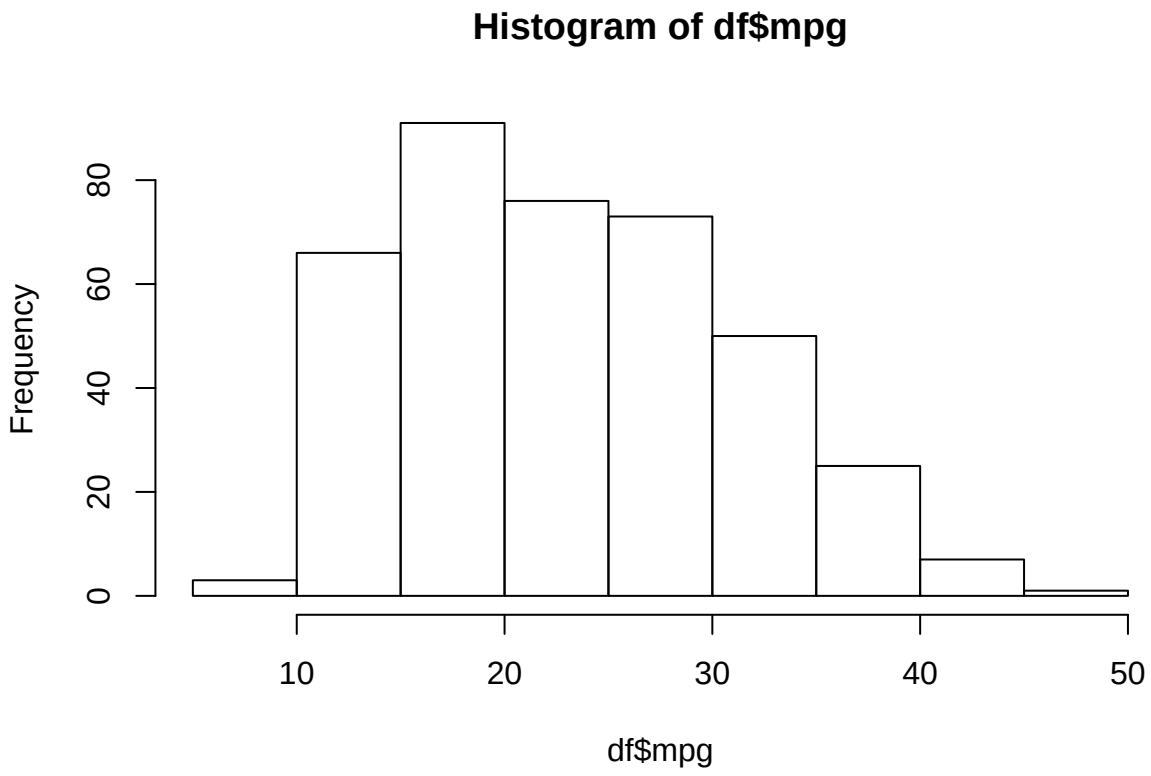
2. There is a dataset "auto.dat" on Sakai that you should download for this assignment. This dataset contains information on automobiles sold in 1983. • Read the dataset into a data frame. • Provide a summary of the dataset using the summary. • Create a histogram of vehicle gas mileage (as provided by the column mpg).

```
#read into data frame
df = read.table("Lab2_auto.dat",header=T)
#print summary
print(summary(df))
```

```
##       mpg          cylinders      displacement     horsepower
##  Min.   : 9.00   Min.   :3.000   Min.   : 68.0   Min.   : 46.0
##  1st Qu.:17.00   1st Qu.:4.000   1st Qu.:105.0   1st Qu.: 75.0
##  Median :22.75   Median :4.000   Median :151.0   Median : 93.5
##  Mean   :23.45   Mean   :5.472   Mean   :194.4   Mean   :104.5
##  3rd Qu.:29.00   3rd Qu.:8.000   3rd Qu.:275.8   3rd Qu.:126.0
##  Max.   :46.60   Max.   :8.000   Max.   :455.0   Max.   :230.0
##
##      weight      acceleration        year           origin
##  Min.   :1613   Min.   : 8.00   Min.   :70.00   Min.   :1.000
##  1st Qu.:2225   1st Qu.:13.78   1st Qu.:73.00   1st Qu.:1.000
```

```
##  Median :2804   Median :15.50   Median :76.00   Median :1.000
##  Mean   :2978   Mean   :15.54   Mean   :75.98   Mean   :1.577
##  3rd Qu.:3615   3rd Qu.:17.02   3rd Qu.:79.00   3rd Qu.:2.000
##  Max.   :5140   Max.   :24.80   Max.   :82.00   Max.   :3.000
##
##                  name
##  amc matador       :  5
##  ford pinto        :  5
##  toyota corolla    :  5
##  amc gremlin       :  4
##  amc hornet        :  4
##  chevrolet chevette:  4
##  (Other)           :365
```

```
#histogram of mpg
hist(df$mpg)
```



3. Using a for-loop, calculate the mean(s?) of the first three columns of the auto dataset. Store your results in a vector. You can check your answer against the output of the summary function in question 1. Please note that there are several ways to do this, any of which are acceptable.

```
#mpg
outputVector = c(0,0,0)
size = 0.0
sum = 0.0
```

```
for(i in df$mpg) {
  size = size + 1
  sum = sum + i
}
outputVector[1] = sum/size

#cylinders
size = 0.0
sum = 0.0
for(i in df$cylinders) {
  size = size + 1
  sum = sum + i
}
outputVector[2] = sum/size

#displacement
size = 0.0
sum = 0.0
for(i in df$displacement) {
  size = size + 1
  sum = sum + i
}
outputVector[3] = sum/size
print(outputVector)
```

```
## [1]  23.445918   5.471939 194.411990
```

This looks to be in sync with the summary values!

4. Modify the code for Newton's method in the section on while loops to find the value of x in the range (0, 2) for which the function x^2 - x^4 + sin(x) + e^x equals zero. You may have to try different starting values to get a value x in (0, 2).

```
f = function(x){return(x^2-x^4+sin(x)+exp(x))}
f.prime <- function(x){return(2*x-4*x^3+cos(x)+exp(x))}

diff = 2
tol = 0.0001
root = 2
while(diff > tol){
  new.root <- root - (f(root)/f.prime(root))
  diff = abs(f(new.root))
  root = new.root
}
print(root)
```

```
## [1] 1.782834
```