STAT0030_ICA2

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R Question 1

Question 1(a)

```
rawdata <- read.table("cars.dat", #input data
                      header=TRUE) #the first line as the names of the variables
```

Read the data into R.

Question 1(b)

```
summary(rawdata)
```

```
##        tr               hp              wt             mpg
##  Min.   :0.0000   Min.   : 52.0   Min.   :1513   Min.   :10.40
##  1st Qu.:0.0000   1st Qu.: 96.5   1st Qu.:2581   1st Qu.:15.43
##  Median :0.0000   Median :123.0   Median :3325   Median :19.20
##  Mean   :0.4062   Mean   :146.7   Mean   :3217   Mean   :20.09
##  3rd Qu.:1.0000   3rd Qu.:180.0   3rd Qu.:3610   3rd Qu.:22.80
##  Max.   :1.0000   Max.   :335.0   Max.   :5425   Max.   :33.90
```

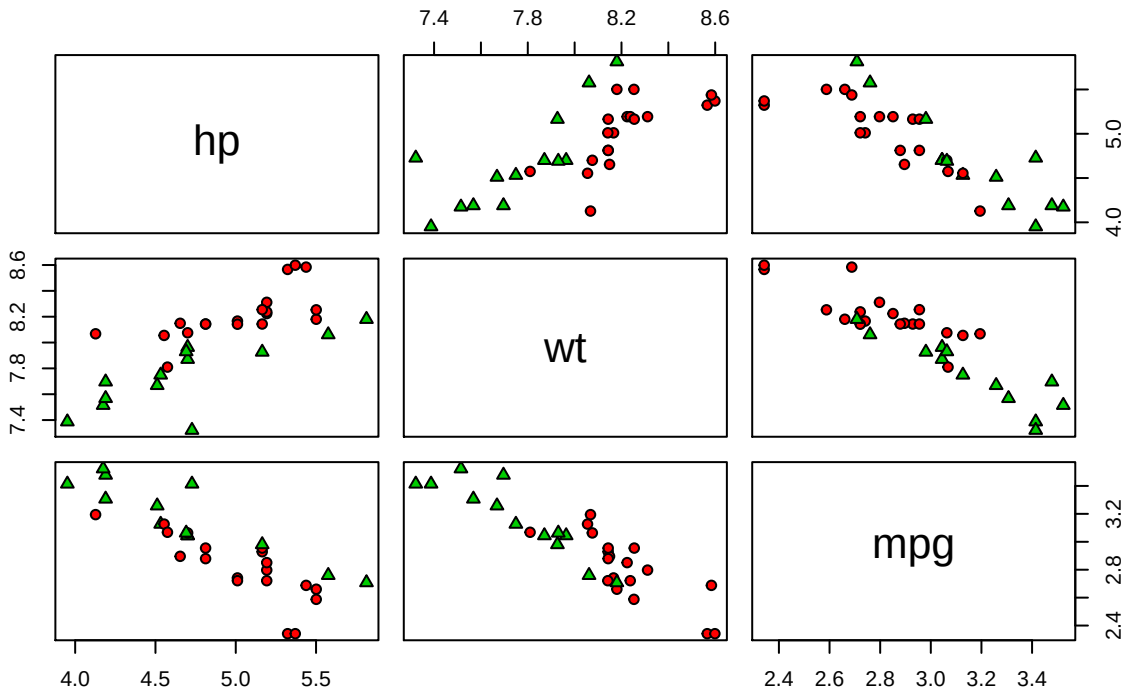
```
table(rawdata$tr)
```

```
##
##  0  1
## 19 13
```

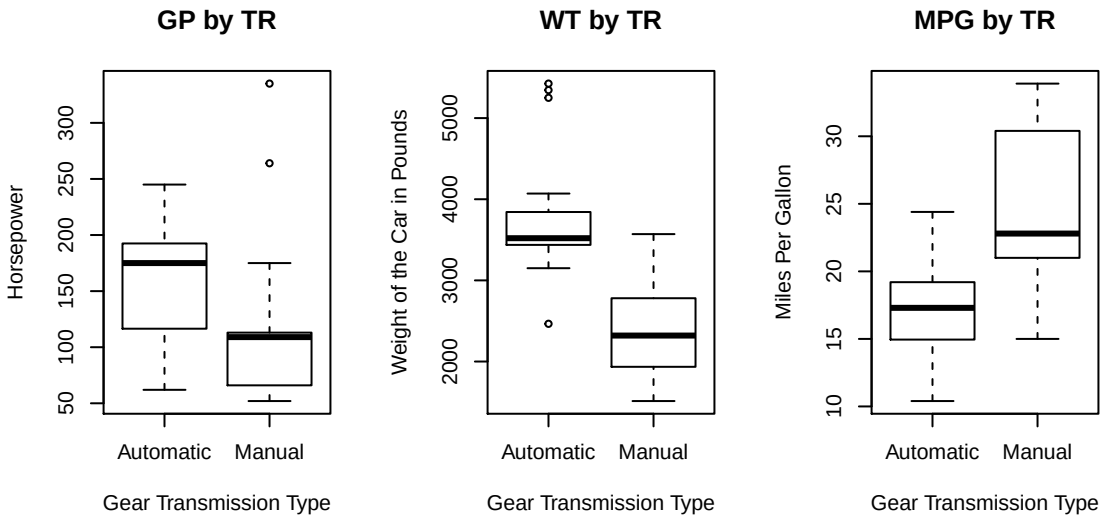
From this result, it shows that there are four variables. The range of the values between the last three variables is relatively large, so it is necessary to log the original data. From the table results, the sample is divided into manual and automatic transmissions, of which 19 are automatic and 13 are manual.

```
logdata <- cbind(rawdata[,1],log(rawdata[,c(2,3,4)])) #log the data
names(logdata) <- c("tr","hp","wt","mpg")#rename the names of the variables
pairs(logdata[,2:4], # plot log(hp), log(wt), log(mpg)
      main = "Plot Between log Variables", #add the main title
      pch = c(21,24)[unclass(logdata$tr)+1], #different tr shows different shape
      bg = c("red", "green3")[unclass(logdata$tr)+1]) #different tr shows different colour
```

Plot Between log Variables




```
par(mfrow=c(1,3))
boxplot(hp~tr, #HP by TR
        data=rawdata, #set the dataset
        xlab="Gear Transmission Type" , #add the xlab title
        ylab="Horsepower", #add the ylab title
        main="GP by TR", #add the main title
        names=c("Automatic","Manual")) #change xlab value to character
boxplot(wt~tr, #WT by TR
        data=rawdata, #set the dataset
        xlab="Gear Transmission Type" , #add the xlab title
        ylab="Weight of the Car in Pounds", #add the ylab title
        main="WT by TR", #add the main title
        names=c("Automatic","Manual")) #change xlab value to character
boxplot(mpg~tr, #MPG by TR
        data=rawdata, #set the dataset
        xlab="Gear Transmission Type" , #add the xlab title
        ylab="Miles Per Gallon", #add the ylab title
        main="MPG by TR", #add the main title
        names=c("Automatic","Manual")) #change xlab value to character
```



The box plot shows a significant change between the automatic and manual gears between the various variables.

```
t.test(mpg~tr, data=logdata)# the t-test above MPG is related to TR.
```

```
##
##  Welch Two Sample t-test
##
## data:  mpg by tr
## t = -3.8257, df = 23.958, p-value = 0.0008194
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.5336626 -0.1596180
## sample estimates:
## mean in group 0 mean in group 1
##        2.816692        3.163332
```

question 1(c)

```
rawdata_model<-lm(mpg~tr+hp+wt, data=rawdata) #rawdata linear model
summary(rawdata_model)
```

```
##
## Call:
## lm(formula = mpg ~ tr + hp + wt, data = rawdata)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.4222 -1.7921 -0.3788  1.2250  5.5318
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) 34.0016421  2.6423265  12.868 2.82e-13 ***
## tr           2.0841138  1.3763314   1.514 0.141169
## hp          -0.0374810  0.0096049  -3.902 0.000546 ***
```

```
## wt          -0.0028781  0.0009048  -3.181 0.003574 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.538 on 28 degrees of freedom
## Multiple R-squared:  0.8399, Adjusted R-squared:  0.8227
## F-statistic: 48.96 on 3 and 28 DF,  p-value: 2.908e-11
```

```
logdata_model<-lm(mpg~tr+hp+wt, data=logdata) #logdata linear model
summary(logdata_model)
```

```
##
## Call:
## lm(formula = mpg ~ tr + hp + wt, data = logdata)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.204243 -0.081099 -0.003198  0.080083  0.197919
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  8.59990    0.86159   9.981    1e-10 ***
## tr           0.01069    0.06040   0.177 0.860813
## hp          -0.25971    0.06438  -4.034 0.000384 ***
## wt          -0.54535    0.13062  -4.175 0.000262 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1072 on 28 degrees of freedom
## Multiple R-squared:  0.883,  Adjusted R-squared:  0.8705
## F-statistic: 70.44 on 3 and 28 DF,  p-value: 3.686e-13
```

```
best_model<-step(logdata_model, direction="both")
```

```
summary(best_model)
```

```
##
## Call:
## lm(formula = mpg ~ hp + wt, data = logdata)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.201439 -0.079566  0.002144  0.078778  0.196144
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  8.71876    0.53056  16.433 3.12e-16 ***
## hp          -0.25531    0.05840  -4.372 0.000145 ***
## wt          -0.56228    0.08741  -6.433 4.89e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1054 on 29 degrees of freedom
## Multiple R-squared:  0.8829, Adjusted R-squared:  0.8748
## F-statistic: 109.3 on 2 and 29 DF,  p-value: 3.133e-14
```

```
par(mfrow=c(2,2)) #put 4 graphes together
plot(best_model)#plot 4 graphes as following.
```