Week 11 Assignment

Ben Arancibia

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Using the lm function, perform regression analysis and measure independent variables on two datasets.

First Data Set The first data set is heart rate. First create the data set.

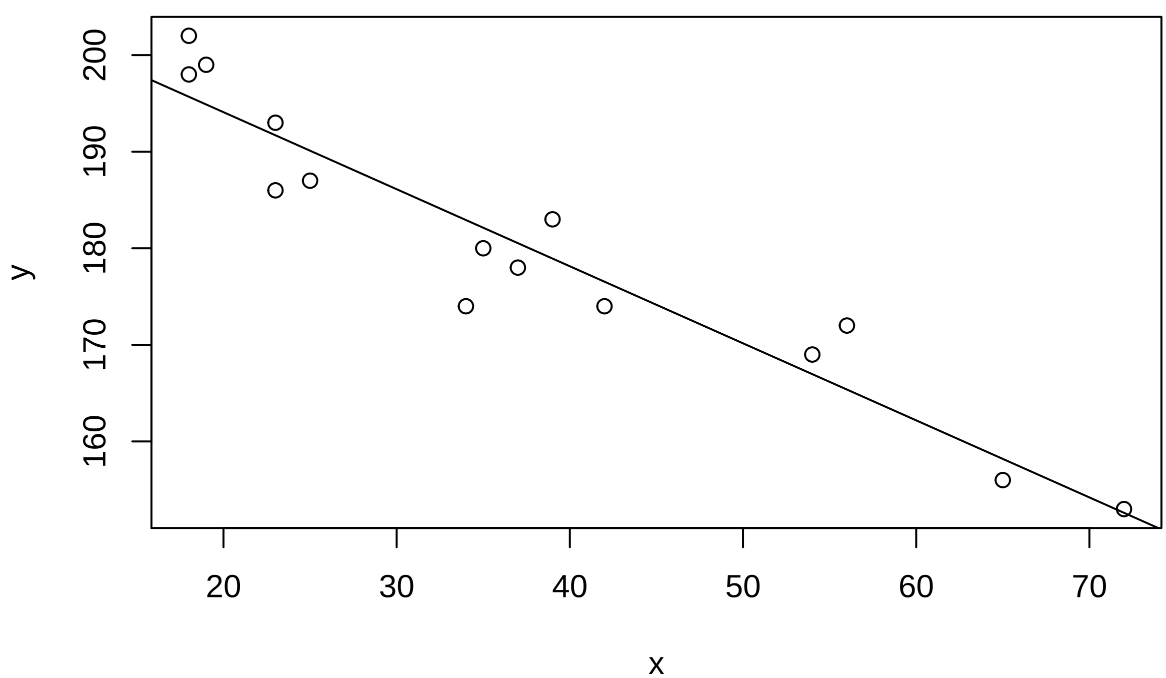
```
x = c(18,23,25,35,65,54,34,56,72,19,23,42,18,39,37)
y = c(202,186,187,180,156,169,174,172,153,199,193,174,198,183,178)
```

Plot x and y with regression line and basic values of regression analysis

```
plot(x,y)
lm_age = lm(y ~ x)
lm_age
```

```
##
## Call:
## lm(formula = y ~ x)
##
## Coefficients:
## (Intercept)            x
##    210.0485      -0.7977
```

```
abline(lm_age)
```



```r
summary(lm_age)
```

```
##
## Call:
## lm(formula = y ~ x)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.9258 -2.5383  0.3879  3.1867  6.6242
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 210.04846    2.86694   73.27  < 2e-16 ***
## x            -0.79773    0.06996  -11.40 3.85e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.578 on 13 degrees of freedom
## Multiple R-squared:  0.9091, Adjusted R-squared:  0.9021
## F-statistic:   130 on 1 and 13 DF,  p-value: 3.848e-08
```

Find that the resulting equation is more like this:

$MaxHR = -0.7977 + 210.0485$

As you can see in summary(lm_age) you have a hypothesis test calculated by R.


```r
summary(lm_age)
```

```
##
## Call:
## lm(formula = y ~ x)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.9258 -2.5383  0.3879  3.1867  6.6242
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## (Intercept) 210.04846    2.86694   73.27  < 2e-16 ***
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```


It does not look like it is significant.

```r
es = residuals(lm_age)
b1 = (coef(lm_age))[['x']]
s = sqrt(sum(es^2) / (13)) #plugging in n-2 instead of 13 gives me an error
```

```r
SE = s/sqrt(sum((x-mean(x))^2))
t = (b1 - (-1))/SE
pt(t, 13, lower.tail=FALSE)
```

```
## [1] 0.006310157
```

Not significiant.

Auto Data Set

Perform a linear regression analysis using mpg as the dependent variable and the other 4 as independent variables. First import the data.

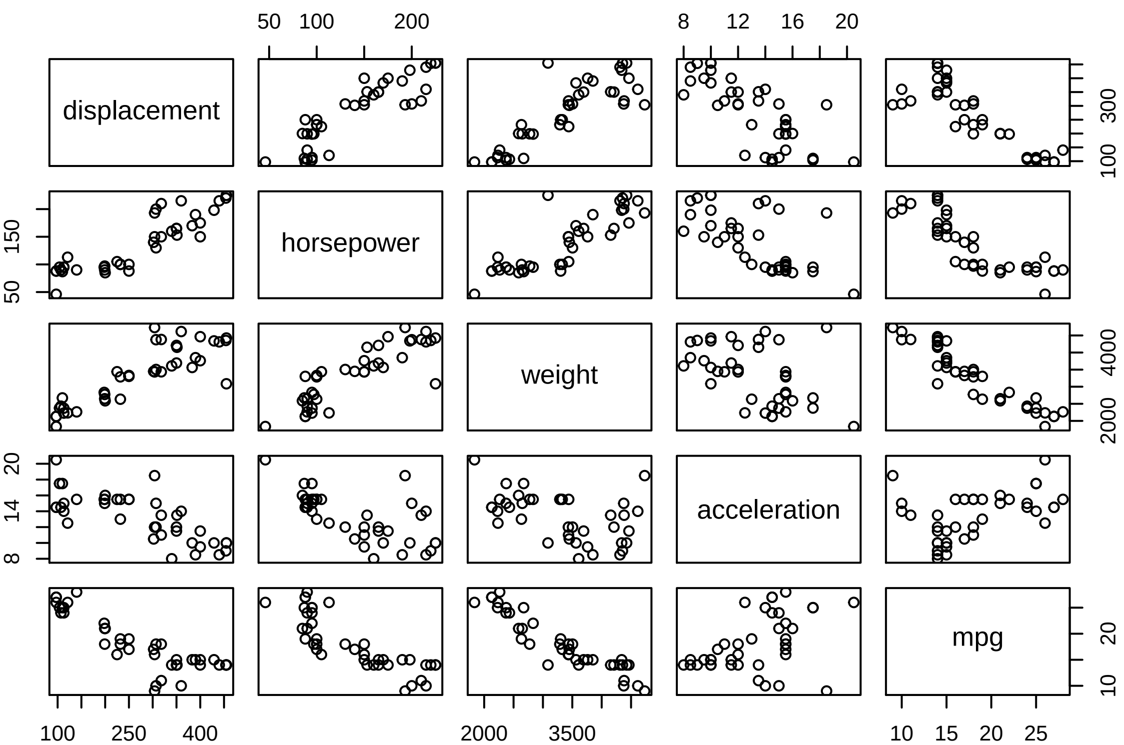
```r
data <- read.table("/Users/bcarancibia/CUNY_IS_605/assign11/auto-mpg.data")
names(data) <- c("displacement", "horsepower", "weight", "acceleration", "mpg")
```

Based on the first take a random 40 points from the data set.

```r
sub_new <- data[1:40,]
```

Plot mpg vs the four other variables for the subset.

```r
pairs(sub_new)
```

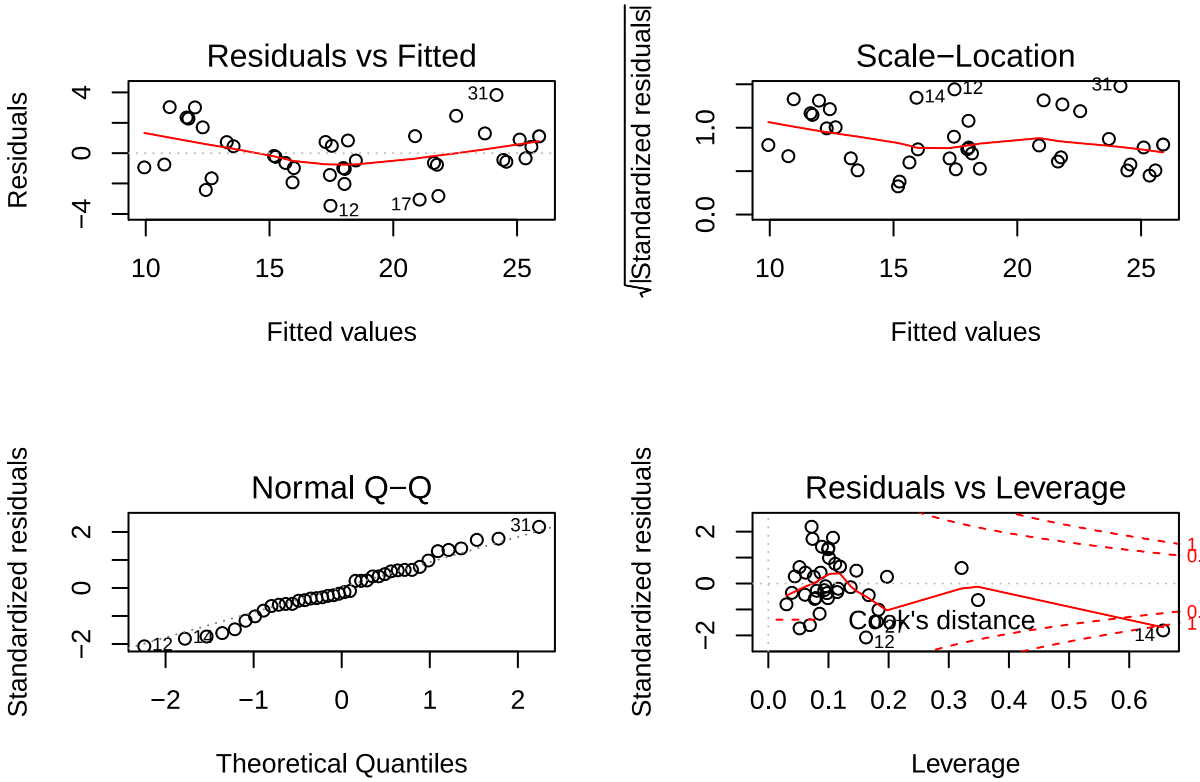



```r
auto_sub <- lm(sub_new$mpg ~ sub_new$displacement + sub_new$horsepower+ sub_new$weight +
                 sub_new$acceleration, data=sub_new)

auto_sub
```

```
##
## Call:
## lm(formula = sub_new$mpg ~ sub_new$displacement + sub_new$horsepower +
##     sub_new$weight + sub_new$acceleration, data = sub_new)
##
## Coefficients:
##          (Intercept)  sub_new$displacement    sub_new$horsepower
##            41.627570             -0.019708             -0.007327
##       sub_new$weight  sub_new$acceleration
##            -0.003706             -0.364520
```

```r
layout(matrix(c(1,2,3,4),2,2))
plot(auto_sub)
```




```r
summary(auto_sub)
```

```
##
## Call:
## lm(formula = sub_new$mpg ~ sub_new$displacement + sub_new$horsepower +
##     sub_new$weight + sub_new$acceleration, data = sub_new)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.4627 -0.9808 -0.2936  1.1086  3.8319
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)          41.6275702  2.8843945  14.432 2.65e-16 ***
```

```
## sub_new$displacement -0.0197082  0.0076703  -2.569 0.014606 *
## sub_new$horsepower   -0.0073270  0.0141243  -0.519 0.607200
## sub_new$weight       -0.0037062  0.0008949  -4.141 0.000207 ***
## sub_new$acceleration -0.3645195  0.1757330  -2.074 0.045472 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.82 on 35 degrees of freedom
## Multiple R-squared:  0.8933, Adjusted R-squared:  0.8811
## F-statistic: 73.22 on 4 and 35 DF,  p-value: < 2.2e-16
```

The final regression fit (40 data points) looks to be:

$mpg = 41.628 - .0197 displacement - .00733 horsepower - .00371 weight - .365 acceleration$

Weight has a sifnifcant impact on mpg (if you look at at summary auto_sub)

The corresponding significance levels are:

displacement: 0.014606

horsepower: 0.607200

weight: .000207

acceleration: .045472

Standard errors for each of the coefficients:

displacement: 0.00767703

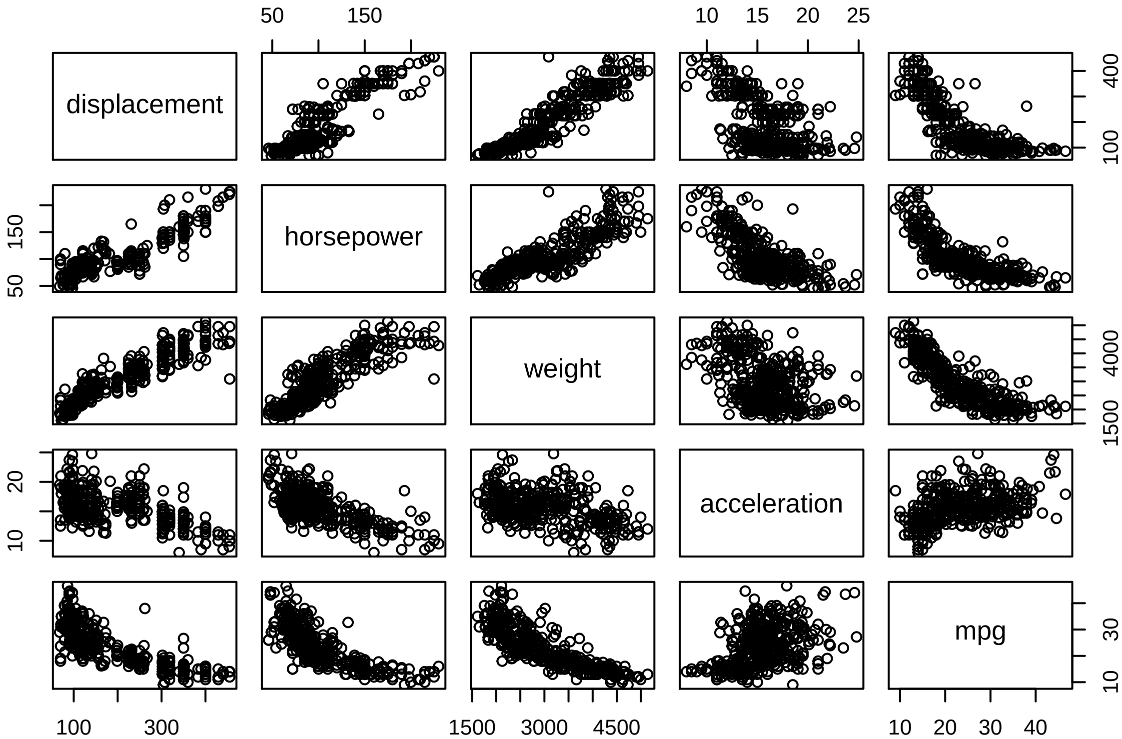
horsepower: 0.0141243

weight: 0.0008949

acceleration: 0.1757330

Plot mpg vs the four other variables.

```r
pairs(data)
```

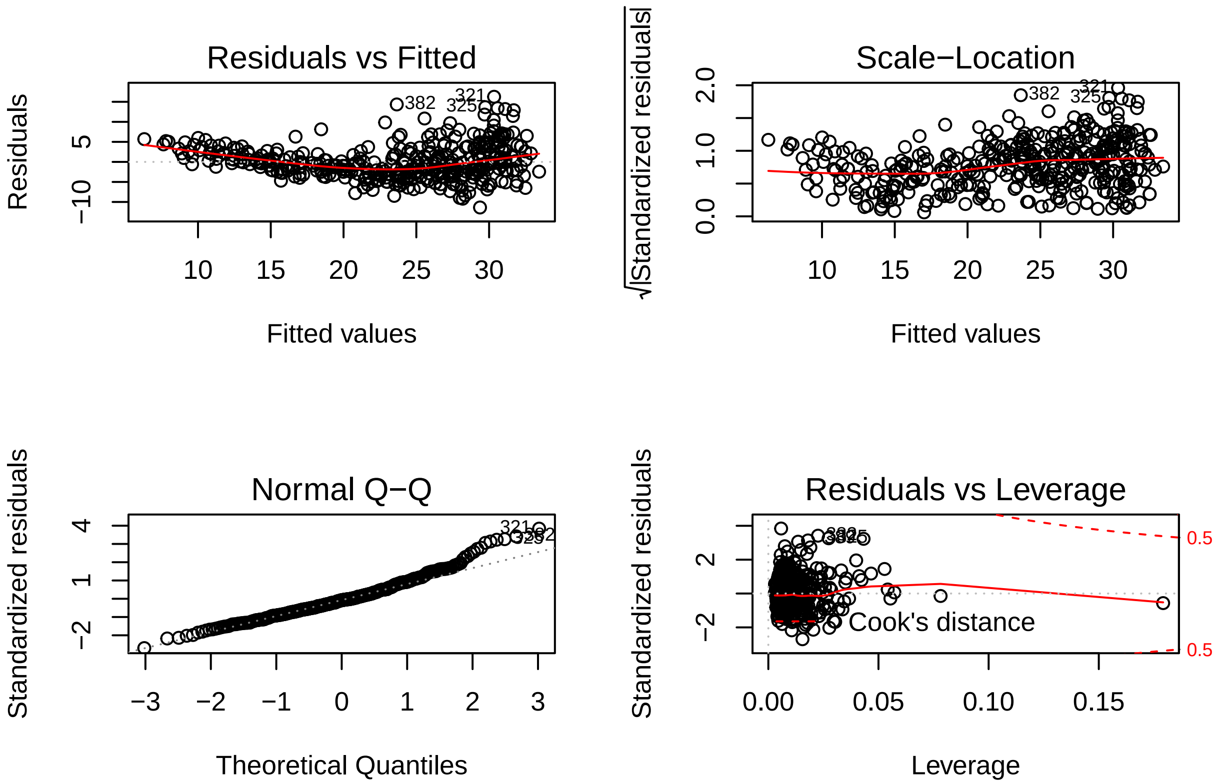



```
auto <- lm(data$mpg ~ data$displacement + data$horsepower
           + data$weight+ data$acceleration, data=data)

auto
```

```
##
## Call:
## lm(formula = data$mpg ~ data$displacement + data$horsepower +
##     data$weight + data$acceleration, data = data)
##
## Coefficients:
##       (Intercept)  data$displacement    data$horsepower
##         45.251140          -0.006001          -0.043608
##       data$weight  data$acceleration
##         -0.005281          -0.023148
```

```
layout(matrix(c(1,2,3,4),2,2))
plot(auto)
```




```r
summary(auto)
```

```
##
## Call:
## lm(formula = data$mpg ~ data$displacement + data$horsepower +
##     data$weight + data$acceleration, data = data)
##
## Residuals:
##     Min       1Q  Median      3Q     Max
## -11.378  -2.793  -0.333   2.193  16.256
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)       45.2511397  2.4560447  18.424  < 2e-16 ***
## data$displacement -0.0060009  0.0067093  -0.894  0.37166
## data$horsepower   -0.0436077  0.0165735  -2.631  0.00885 **
## data$weight       -0.0052805  0.0008109  -6.512  2.3e-10 ***
## data$acceleration -0.0231480  0.1256012  -0.184  0.85388
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.247 on 387 degrees of freedom
## Multiple R-squared:  0.707,  Adjusted R-squared:  0.704
## F-statistic: 233.4 on 4 and 387 DF,  p-value: < 2.2e-16
```

The final regression fit (all data) looks to be:

$mpg = 45.25 - 0.006001displacement - 0.0436007horsepower - 0.005281weight - 0.023148accerleration

Again weight seems to have the most signifcant impact on mpg, but horsepower also is significant.

The corresponding significance levels are:

displacement:0.37166

horsepower: 0.00885

weight: 2.3e-10

acceleration: 0.85388

Standard errors for each of the coefficients:

displacement: 0.0067093

horsepower: 0.0165735

weight: 0.0008109

acceleration: 0.1256012

Measure the the 95% confidence intervals

```
confint(auto_sub, level=0.95)
```

```
##                            2.5 %       97.5 %
## (Intercept)          35.771937980 47.483202434
## sub_new$displacement -0.035279860 -0.004136631
## sub_new$horsepower   -0.036000844  0.021346886
## sub_new$weight       -0.005523005 -0.001889364
## sub_new$acceleration -0.721276383 -0.007762633
```

```
confint(auto, level=0.95)
```

```
##                        2.5 %       97.5 %
## (Intercept)       40.422278855 50.080000544
## data$displacement -0.019192122  0.007190380
## data$horsepower   -0.076193029 -0.011022433
## data$weight       -0.006874738 -0.003686277
## data$acceleration -0.270094049  0.223798050
```