Regression Models Project - Motor Trend Data 'mtcars' Miles Per Gallon Analysis

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12/1/2016

Executive Summary:

```
## Add after completing analysis
```

Analysis plan:

```
Descriptive
        any(is.na)
        head(data)
        str(data)
        summary(data)
Exploratory
        Pairs
        Histograms
        Boxplots
        QQ plots
OLS Ordinary least squares
        General least squares for linear equations
Regression to the mean - Simple linear regression
Statistical linear regression
        Basic - w additive Gaussian error
        Interpretation of regression coefficients (intercept, slope)
        Regression - prediction
Residuals
        Residual variation
        Influence
        Leverage
        Estimate residual variation
        R squared
Regression inference



Multivariate regression analysis
        The linear model
        Two variable simple linear regression (additive) / (multiplicative)
        Coefficients
        Fitted values, residuals and residual variation
        Coefficients
Residuals
        Deviance
        Anova
Inferential
```

```
        Null Hypothesis
        Alternative Hypothesis
        Power or Alpha
        Confidence Interval = .95, one or two sided?
        pValue
        R^2
Predictive ~ NA
Causal ~ NA
Mechanistic ~ NA
```

Accessing this data:

```
How to get this data:
```

```
library(datasets)
data("mtcars")
head(mtcars)
```

```
##                   mpg cyl disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4         21.0   6  160 110 3.90 2.620 16.46  0  1    4    4
## Mazda RX4 Wag     21.0   6  160 110 3.90 2.875 17.02  0  1    4    4
## Datsun 710        22.8   4  108  93 3.85 2.320 18.61  1  1    4    1
## Hornet 4 Drive    21.4   6  258 110 3.08 3.215 19.44  1  0    3    1
## Hornet Sportabout 18.7   8  360 175 3.15 3.440 17.02  0  0    3    2
## Valiant           18.1   6  225 105 2.76 3.460 20.22  1  0    3    1
```

Process the data:

```
Transformations;
        1 factor variables 8:11;
        2 change variable labels in columns 8 & 9;
                a Note; for column header 8 = vs; V = V block motor, & S = Straight block motor;
                b Note; for column header 9 = am; A = automatic transmission = A, & M = manual trans
```

```
data("mtcars")
mtcars$vs <- factor(mtcars$vs, labels = c("V", "S")); mtcars$am <- factor(mtcars$am, labels = c("A", "M
str(mtcars); head(mtcars)
```

```
## 'data.frame':    32 obs. of  11 variables:
##  $ mpg : num  21 21 22.8 21.4 18.7 18.1 14.3 24.4 22.8 19.2 ...
##  $ cyl : num  6 6 4 6 8 6 8 4 4 6 ...
##  $ disp: num  160 160 108 258 360 ...
##  $ hp  : num  110 110 93 110 175 105 245 62 95 123 ...
##  $ drat: num  3.9 3.9 3.85 3.08 3.15 2.76 3.21 3.69 3.92 3.92 ...
##  $ wt  : num  2.62 2.88 2.32 3.21 3.44 ...
##  $ qsec: num  16.5 17 18.6 19.4 17 ...
##  $ vs  : Factor w/ 2 levels "V","S": 1 1 2 2 1 2 1 2 2 2 ...
##  $ am  : Factor w/ 2 levels "A","M": 2 2 2 1 1 1 1 1 1 1 ...
##  $ gear: Factor w/ 3 levels "3","4","5": 2 2 2 1 1 1 1 2 2 2 ...
##  $ carb: Factor w/ 6 levels "1","2","3","4",..: 4 4 1 1 2 1 4 2 2 4 ...
```

```
##                    mpg cyl disp  hp drat    wt  qsec vs am gear carb
## Mazda RX4         21.0   6  160 110 3.90 2.620 16.46  V  M    4    4
## Mazda RX4 Wag     21.0   6  160 110 3.90 2.875 17.02  V  M    4    4
## Datsun 710        22.8   4  108  93 3.85 2.320 18.61  S  M    4    1
## Hornet 4 Drive    21.4   6  258 110 3.08 3.215 19.44  S  A    3    1
## Hornet Sportabout 18.7   8  360 175 3.15 3.440 17.02  V  A    3    2
## Valiant           18.1   6  225 105 2.76 3.460 20.22  S  A    3    1
```

Statistical modeling, regression & model fit:

```
Assumptions:
        A
        B
        C
Simple Linear Regression
Multivariate Linear Regression
        lm - simple
        lm - multivariate
        lm - nested
        lm - remove the intercept (-1)
        lm - step function
Coefficients / Slope
Standard Error
T-Vales
pValues
Residuals
        Leverage
        Influence
Confidence Intervals
Residuals
Hatvalues
dfbetas
Influence Measures
Anova
        Chisq
Ancova
GLM
```

Inference:

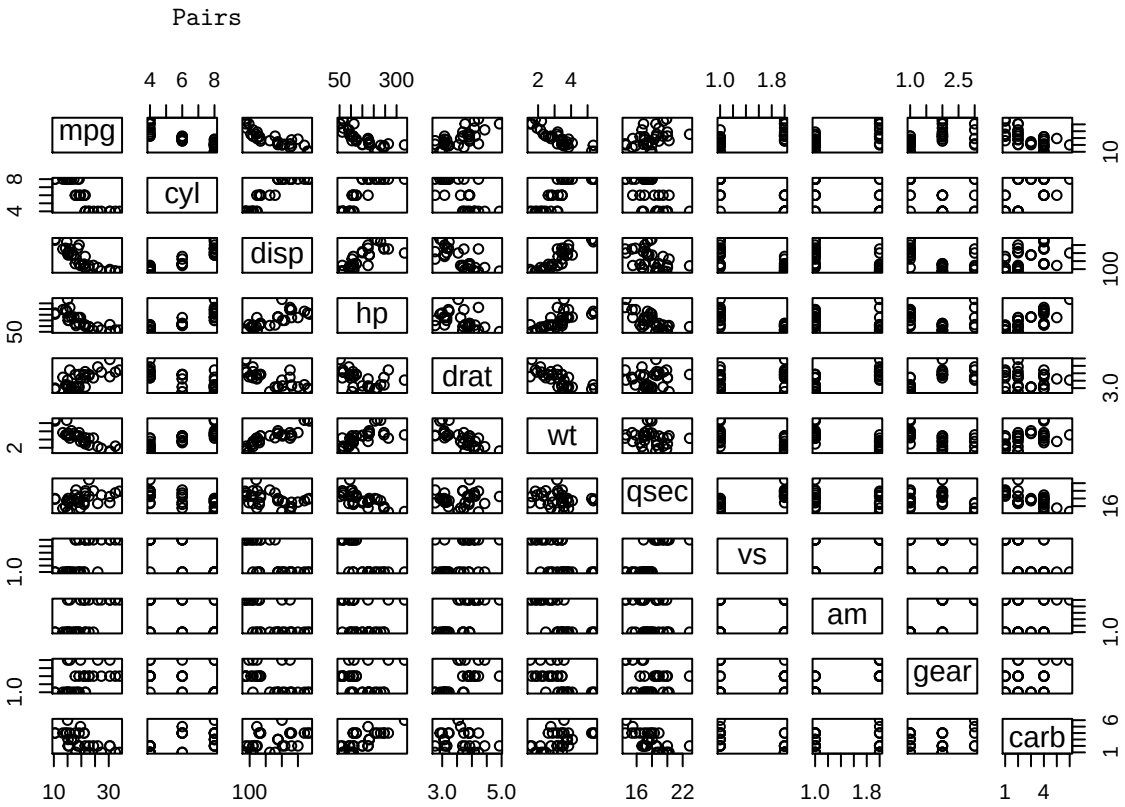
```
Assumptions:
        A
        B
        C
State H0 & Ha hypothesis'here
Set Seed, if required
One or Two Sided Test
Power / Alpha
Beta = (1 - Alpha)
Confidence Intervals (.95 one sided, .975 two sided)
Standard Error
```

```
Variance
student's T-score
Z-score
p-Values
Residual Plots with diagnostics see Appendix
```

What are some possible alternative analyses?:

```
A
B
```

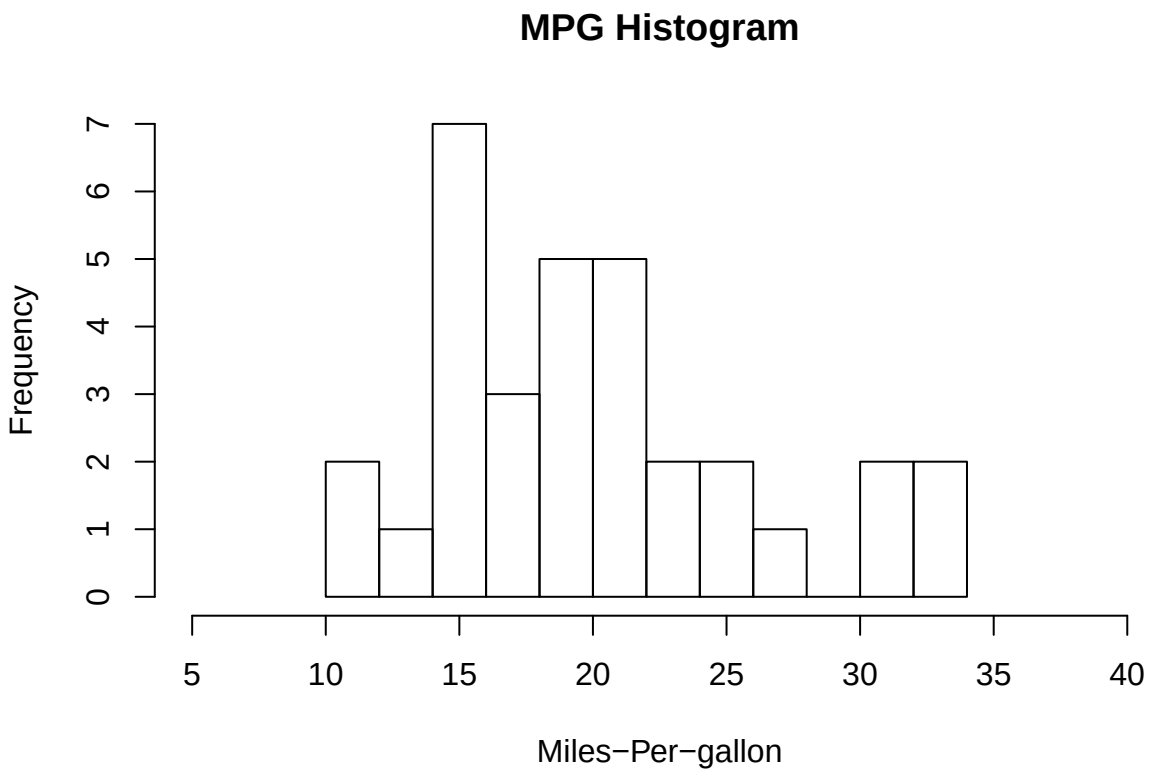
Appendix A



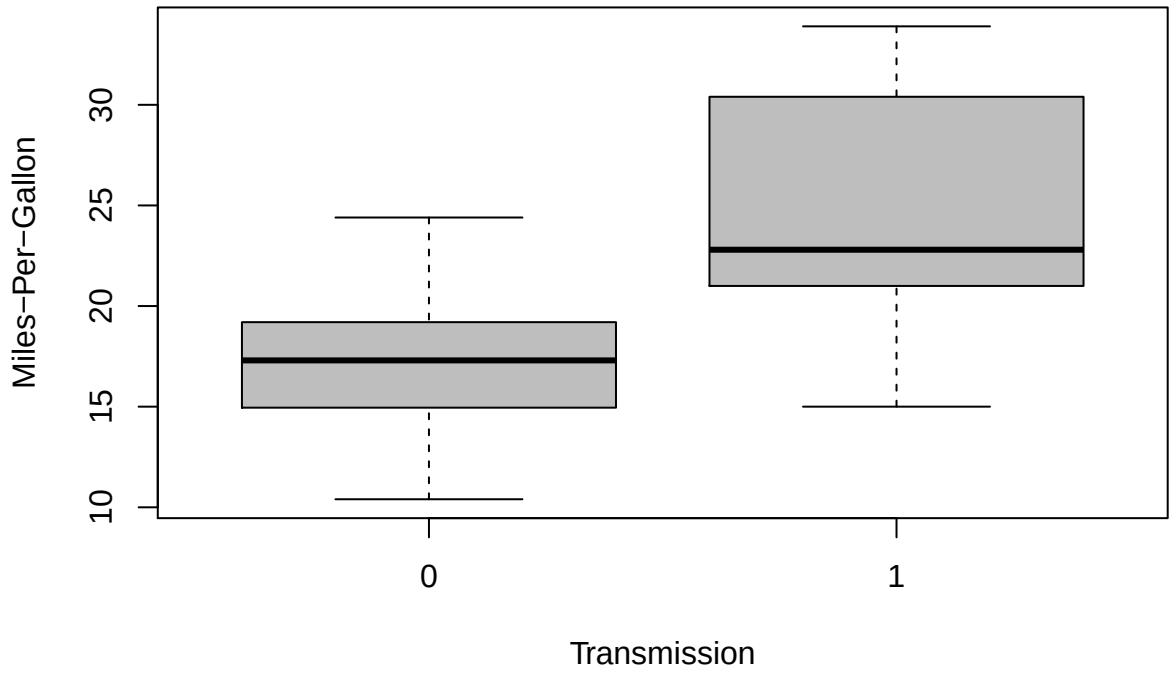
Histograms

```
## Loading required package: ggplot2

## Loading required package: dplyr

##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```



Box



Plots
QQ Plots

```
Fitted

Residuals

Residuals vs Fitted
```

=== END ===