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

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I. Executive Summary:

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

II. Problem statement & questions to be answered:

```
## Assuming I work for Motor Trend, a magazine about the automobile industry. Looking at the data se
## They are interested in exploring the relationship between a set of variables and the miles per ga
## They are particularly interested in the following two questions:
       ## Q1 "Is an automatic or manual transmission better for 'mpg'"
       ## Q2 "Quantify the MPG difference between automatic and manual transmissions"
```

Grading - Criteria (remove on completion)

Did the student interpret the coefficients correctly?

Did the student do some exploratory data analyses?

Did the student fit multiple models and detail their strategy for model selection?

Did the student answer the questions of interest or detail why the question(s) is (are) not answerable?

Did the student do a residual plot and some diagnostics?

Did the student quantify the uncertainty in their conclusions and/or perform an inference correctly?

Was the report brief (about 2 pages long) for the main body of the report and no longer than 5 with supporting appendix of figures?

Did the report include an executive summary?

YES Was the report done in Rmd (knitr) with pdf output?

III. Analysis considerations:

A.

```
Descriptive
        any(is.na)
        head(data)
        str(data)
        summary(data)
Exploratory
        Pairs
        Histograms
        Boxplots
        Heatmap
        K-Means
        Dimension Reduction
                PCA
                SVD
```

B.

```
OLS Ordinary least squares
        General least squares for linear equations
```

C.

```
Regression to the mean - Simple linear regression
```

D.

```
Statistical linear regression
        Basic - w additive Gaussian error
        Interpretation of regression coefficients (intercept, slope)
        Regression - prediction
```

E.

```
Residuals
        Residual variation
        Influence
        Leverage
        Estimate residual variation
        R squared
```

F.

```
Regression inference
        Parameters
        Confidence intervals
        Prediction
```

G.

```
Multivariate regression analysis
        Linear models
        Two variable simple linear regression (additive) / (multiplicative)
        Summary coefficients
        Fitted values, residuals and residual variation
        Summary coefficients
        Model Adjustment
```

H.

```
GLMs
        Linear
        Logistic
        Poisson
        Binary GLMs
                Odds
                Fitting
        VIF
```

I.

```
QQ plots
```

J.

```
Predictive ~ NA
Causal ~ NA
Mechanistic ~ NA
```

IV. Software environment:

```
System - session Info:
```

```
sessionInfo()
```

```
## R version 3.3.1 (2016-06-21)
## Platform: x86_64-apple-darwin13.4.0 (64-bit)
## Running under: OS X 10.11.6 (El Capitan)
## 
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
## 
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base     
## 
## loaded via a namespace (and not attached):
##  [1] magrittr_1.5    formatR_1.4     tools_3.3.1     htmltools_0.3.5
##  [5] yaml_2.1.13     Rcpp_0.12.7     stringi_1.1.1   rmarkdown_1.0  
##  [9] knitr_1.14      stringr_1.1.0   digest_0.6.10   evaluate_0.9
```

V. Accessing data:

```
    Getting the data:
```

VI. Raw data overview:

```
    Motor Trend 'mtcars' data set:
```

```
any(is.na(mtcars)); colnames(mtcars)
```

```
## [1] FALSE
```

```
##  [1] "mpg"  "cyl"  "disp" "hp"   "drat" "wt"   "qsec" "vs"   "am"   "gear"
## [11] "carb"
```

VII. Processing data:

```
    Transformations;
            1 factor variables 8:11;
            2 change variable labels in columns 8 & 9;
                    a Note; for column header 8 = vs; variable names = V-block, & S-block;
                    b Note; for column header 9 = am; variable names = Automatic = A, & Manual = M;
```

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

VIII. Exploratory Analysis:

```
Pairs plot: Appendix A, Figure 1
Histograms: Appendix A, Figure 2
Boxplots: Appendix A, Figure 3
Barplots - na
Scatterplots ?
Multiple plots ?
```

IX. Statistical Modeling, Regression & Model Fit:

```
Assumptions:
        A Possible that significant multivarite intercorrelation exists
        B
        C
Simple Linear Regression
Statistical linear regression
        Basic - w additive Gaussian error
        Interpretation of regression coefficients (intercept, slope)
        Regression - prediction
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
GLMs
```

X.Preliminary findings: quesions of interest: & interpretation of results:

```
A
B
C
```

XII. Conclusions / recommendations:

```
A
B
C
        1 Challenge the results ?
        2 Measures of uncertainty 'e'
```

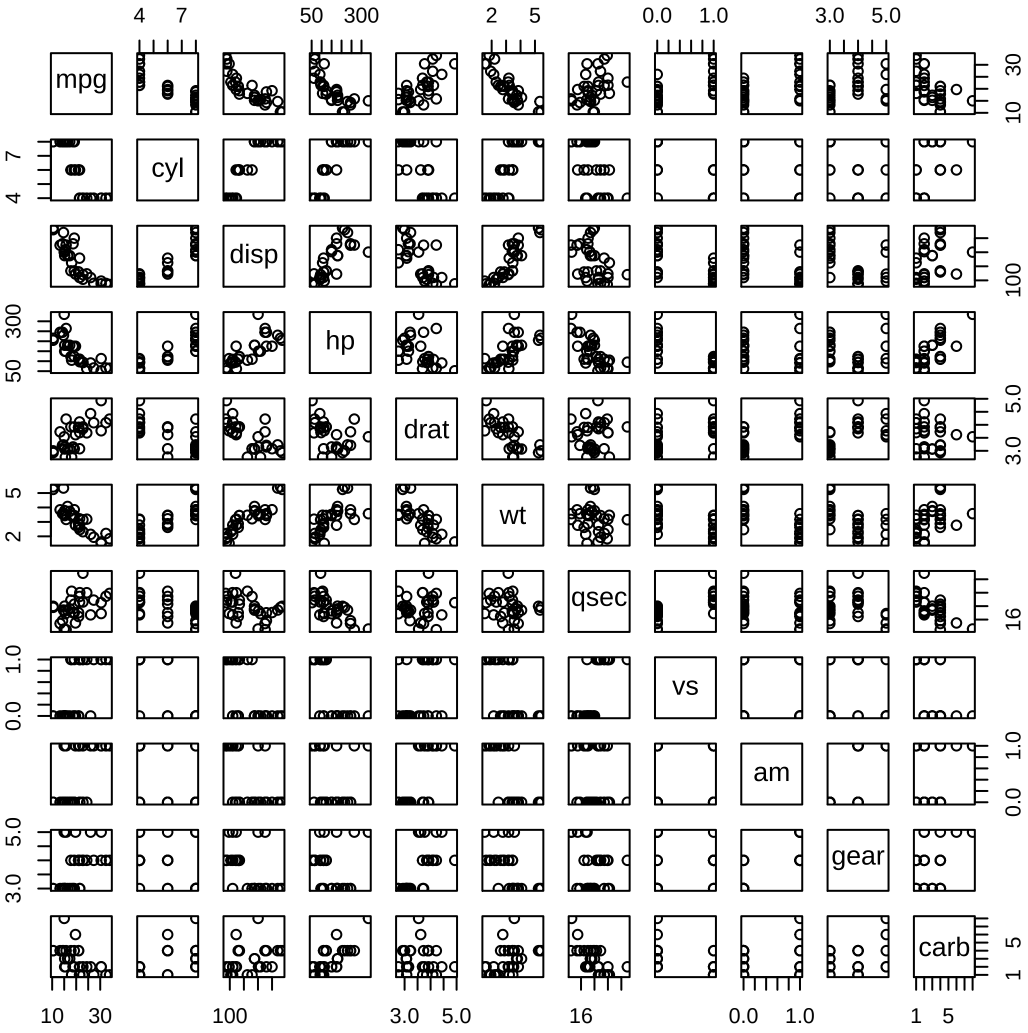
XIII. Are there any possible viable alternative analyses?

```
A
B
```

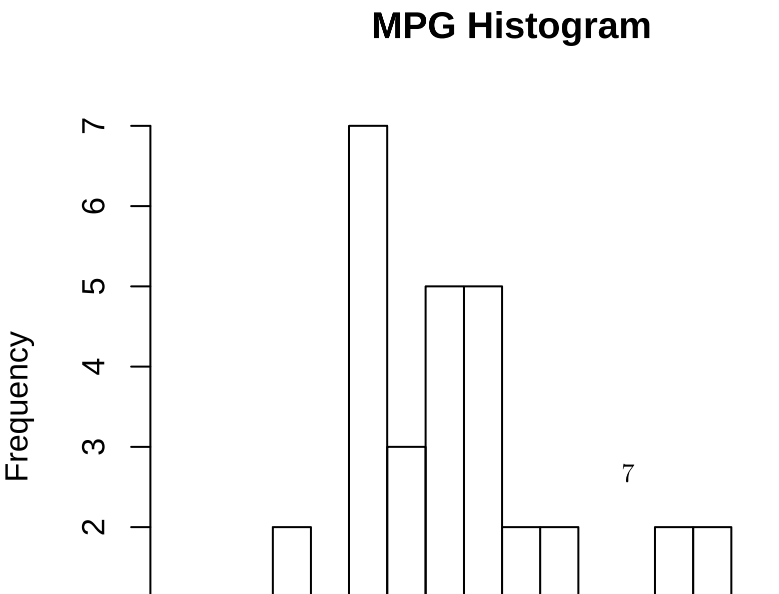
XIV. Appendix A,

Exploratory Analysis Visual Analysis

# Figure 1, Pairs



# Figure 2, Histograms



# Figure 4, QQ Plot

```
# Figure 5, Single Variable Linear Model Regression plot
```

```
##               Estimate Std. Error   t value     Pr(>|t|)
## (Intercept) 17.147368   1.124603 15.247492 1.133983e-15
## factor(am)1  7.244939   1.764422  4.106127 2.850207e-04
```

```
#To be inserted
```

```
#To be inserted
```

```
# Figure 8, Residuals plot
```

```
# Figure 9, Residuals vs Fitted
```

```
# Figure 10, GLM
```

=== END ===