CKME136 - CAPSTONE

Dinesafe Exploration & Analysis

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Step 1. Data Load

Process Dinesafe is an open dataset from City of Toronto Food Hygiene Inspection Report for the year 2015 and 2016. Address is a full address dataset extracted from google map for the Dinesafe food premises using google geocode. Load Dinesafe and Address Datasets, convert NULL values to NA.

```
Dinesafe = read.csv("D:/CAPSTONE/data/DineSafe_02162017.csv",
na.strings='NULL')
Address  = read.csv("D:/CAPSTONE/data/ADDRESS_02262017.csv",
na.strings='NULL')
```

Step 2. Dataset Exploration Process

2.1 - Identify the column names for each datasets

```
## List Column names
colnames(Dinesafe)
cat("\n")
colnames(Address)
```

2.2 - Identify database dimensions, Address has 7 columns and Dinesafe has 17 columns

```
## Review dimension of dataset (Row by column)
dim(Dinesafe)
cat("\n")
dim(Address)
```

2.3 - Summarise the datasets. Find the min, max, median for quartile quantitative values, as well as identify word category counts for the categorical values.

```
## Review dataset summary
summary(Dinesafe)
cat("\n")
summary(Address)
```

2.4 - Identify the dataset structure such as int, factor, num for both datasets

```
## Review dataset structure
str(Dinesafe)
cat("\n")
str(Address)
```

2.5 - Display top 5 sample data

```
head(Dinesafe,5)
head(Address,5)
```

Step 3 – Merge Datasets

Merge Dinesafe and Address datasets based on establishment id column

```
Dinesafe <- merge(Dinesafe,Address,by="ESTABLISHMENT_ID")
```

3.1 - Analyise merged dataset

```
dim(Dinesafe)     ## Identify dimension
cat("\n")
str(Dinesafe)     ## Identify structure
cat("\n")
table(Dinesafe$CUISINE_TYPE, useNA = "always")      ## Identify Cuisine Type
cat("\n")
table(Dinesafe$ESTABLISHMENT_STATUS, useNA = "always")## Identify Review
Rating
cat("\n")
table(Dinesafe$DISTRICT, useNA = "always")           ## Identify Districts
cat("\n")
table(Dinesafe$SEVERITY)                            ## Identify Severity Type
```

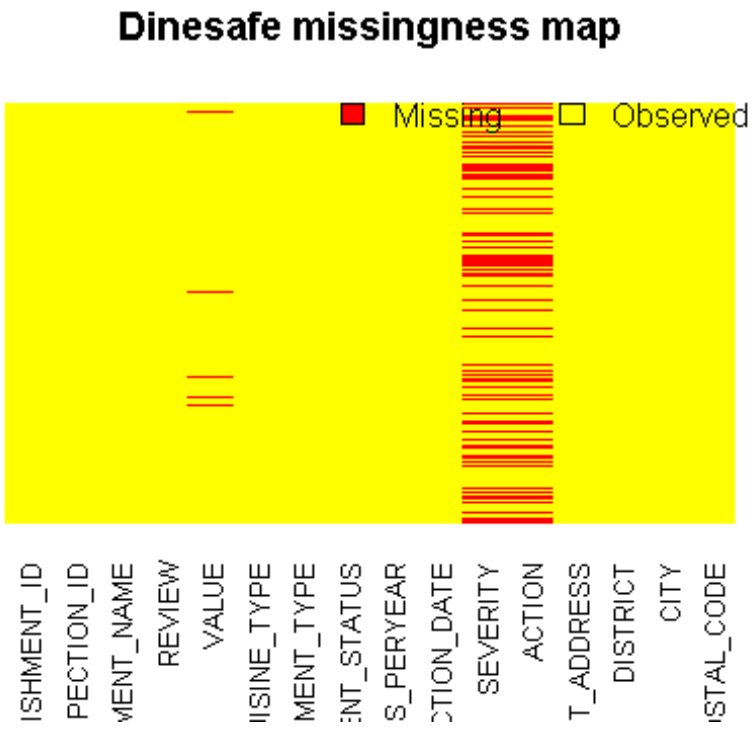
Step 4 - Data Munging Step

4.1 - Data Cleaning and Transforming raw data into usable dataset.

```
### Remove COURT_OUTCOME, AMOUNT_FINED & INFRACTION_DETAILS Columns from
Dinesafe dataset
Dinesafe <- subset(Dinesafe, select = -c(ROW_ID,
COURT_OUTCOME,AMOUNT_FINED,LONG_ADDRESS, INFRACTION_DETAILS) )
cat("\n")
### Remove doublicate Establishement Name and Address from dataset
Dinesafe <- subset(Dinesafe, select = -c(ESTABLISHMENT_NAME.y,
ESTABLISHMENT_ADDRESS) )
cat("\n")
## Rename ESTABLISHMENT_NAME.x column name to ESTABLISHMENT_NAME
colnames(Dinesafe)[colnames(Dinesafe) == 'ESTABLISHMENT_NAME.x'] <-
'ESTABLISHMENT_NAME'
```

Plot missingness map using Amelia package

```
#Quantify missing values
apply(Dinesafe, 2, function(x) sum(is.na(x)))
cat("\n")

# Plot missingness map using Amelia package
library(Amelia)

## Loading required package: Rcpp

## ##
## ## Amelia II: Multiple Imputation
## ## (Version 1.7.4, built: 2015-12-05)
## ## Copyright (C) 2005-2017 James Honaker, Gary King and Matthew Blackwell
## ## Refer to http://gking.harvard.edu/amelia/ for more information
## ##

missmap(Dinesafe, col = c("Red","Yellow"), y.cex = 0.8, x.cex = 0.8, legend =
TRUE, rank.order = "False" ,main = "Dinesafe missingness map", y.labels =
NULL,y.at = NULL)
```



4.3 - Change ACTION from factor to character to avoid error during imputation.

```
## Convert Action column from factor to character type
Dinesafe$ACTION = as.character(Dinesafe$ACTION)
```

4.4 - Set catagorical level for Establishment status and Sevrity columns

```
## Set Categorical Data Type Level for Establishment Status column
Dinesafe$ESTABLISHMENT_STATUS =
factor(Dinesafe$ESTABLISHMENT_STATUS,levels=c("Closed","Conditional Pass",
"Pass"))
cat("\n")

## Set Categorical Data Type Level for Severity column
Dinesafe$SEVERITY <- factor(Dinesafe$SEVERITY, levels = c("NA - Not
Applicable", "N - No Action", "M - Minor", "S - Significant", "C - Crucial"))
```

4.5 - Describe quantitative values in Reveiw and Rate columns

```
library(Hmisc)

## Loading required package: lattice

## Loading required package: survival

## Loading required package: Formula

## Loading required package: ggplot2

##
## Attaching package: 'Hmisc'

## The following objects are masked from 'package:base':
##
##     format.pval, round.POSIXt, trunc.POSIXt, units

## Describe Review data
describe(Dinesafe$REVIEW)
cat("\n")

## Describe Value data
describe(Dinesafe$VALUE)
cat("\n")
```

4.6 - Show complete rows from dataset

```
## Complete Case Rows with no missing (NA) value
Complete_Dinesafe  <- Dinesafe[complete.cases(Dinesafe),]
nrow(Complete_Dinesafe)
```

4.7 - Impute NA values in REVIEW column based on mean value of each cuisine type

```
## Impute Dinesafe$REVIEW with Mean Review Value for each missing review
value based cuisine type
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="African"] =
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="African"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Bakeries"] =
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Bakeries"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Bar"] =
```

```
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Bar"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Cafe"] =
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Cafe"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Caribbean"]
= mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Caribbean"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Deli"] =
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Deli"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Dessert"] =
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Dessert"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="European"] =
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="European"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Far
Eastern"] = mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Far Eastern"],
na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Pastries"] =
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Pastries"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="South
Asian"] = mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="South Asian"],
na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="South East
Asian"] = mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="South East Asian"],
na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Latin
American"] = mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Latin American"],
na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) &
Dinesafe$CUISINE_TYPE=="Mediterranean"] =
mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Mediterranean"], na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Middle
Eastern"] = mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Middle Eastern"],
na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="North
American"] = mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="North American"],
na.rm=TRUE)
Dinesafe$REVIEW[is.na(Dinesafe$REVIEW) & Dinesafe$CUISINE_TYPE=="Juicery &
Smoothies"] = mean(Dinesafe$REVIEW[Dinesafe$CUISINE_TYPE=="Juicery &
Smoothies"], na.rm=TRUE)
```

4.7 - Impute NA values in VALUE column based on mean value of each cuisine type

```
## Impute Dinesafe$VALUE with Mean Value for each missing value based cuisine
type
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="African"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="African"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Bakeries"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Bakeries"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Bar"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Bar"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Cafe"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Cafe"], na.rm=TRUE)
```

```
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Caribbean"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Caribbean"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Deli"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Deli"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Dessert"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Dessert"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="European"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="European"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Far Eastern"]
= mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Far Eastern"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Pastries"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Pastries"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="South Asian"]
= mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="South Asian"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="South East
Asian"] = mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="South East Asian"],
na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Latin
American"] = mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Latin American"],
na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) &
Dinesafe$CUISINE_TYPE=="Mediterranean"] =
mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Mediterranean"], na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Middle
Eastern"] = mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Middle Eastern"],
na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="North
American"] = mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="North American"],
na.rm=TRUE)
Dinesafe$VALUE[is.na(Dinesafe$VALUE) & Dinesafe$CUISINE_TYPE=="Juicery &
Smoothies"] = mean(Dinesafe$VALUE[Dinesafe$CUISINE_TYPE=="Juicery &
Smoothies"], na.rm=TRUE)
```

4.8 - Impute missing severity and action columns where establishment status is PASS

```
## Impute Severity column if it is NA and Establishment Status is PASS
Dinesafe$SEVERITY[is.na(Dinesafe$SEVERITY) & Dinesafe$ESTABLISHMENT_STATUS ==
"Pass"] = "NA - Not Applicable"
cat("\n")
## Impute Action column if it is NA and Establishment Status is PASS &
Severity is No Action
Dinesafe$ACTION[is.na(Dinesafe$ACTION) & Dinesafe$ESTABLISHMENT_STATUS ==
"Pass" & Dinesafe$SEVERITY == "NA - Not Applicable"] = "No Action Required"
```

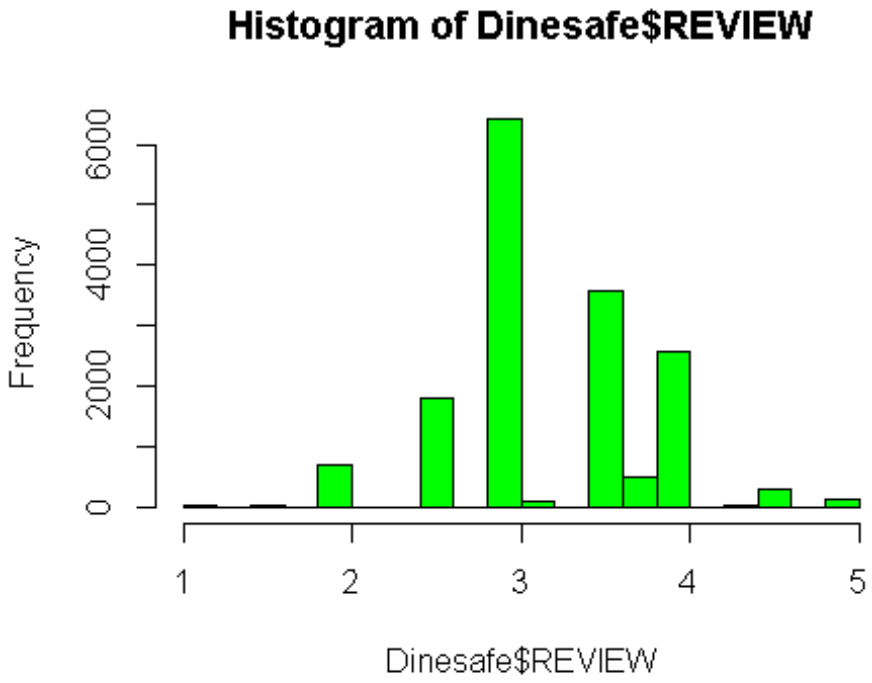
4.9 - Check for incomplete rows

```
## Check for non complete case
Dinesafe_NA  <- Dinesafe[!complete.cases(Dinesafe),]
cat("\n")
nrow(Dinesafe_NA)
```

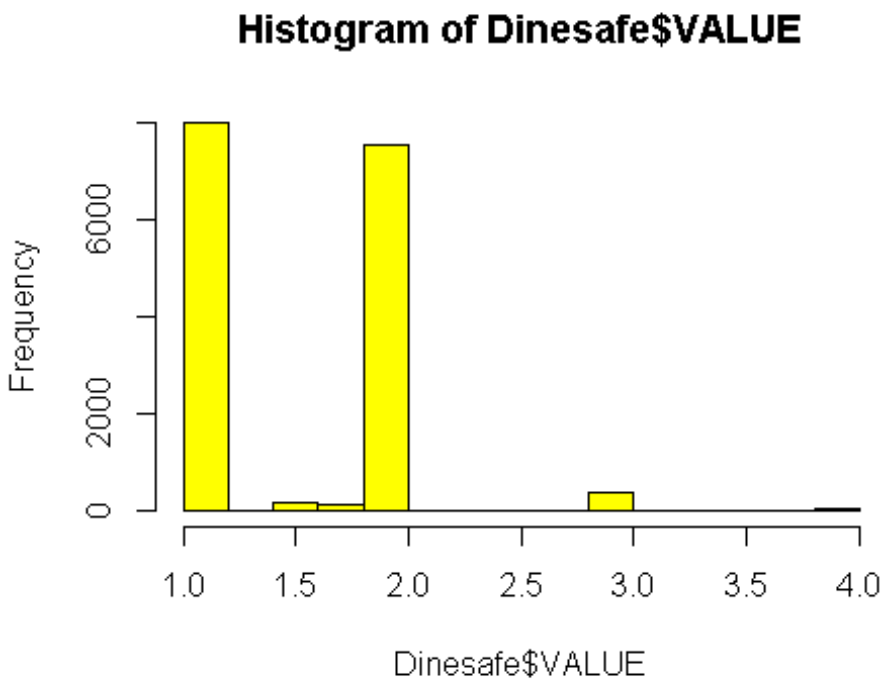
Step 5 - Data Exploratory Analysis and Visualization

5.1 Univarient Data Analysis

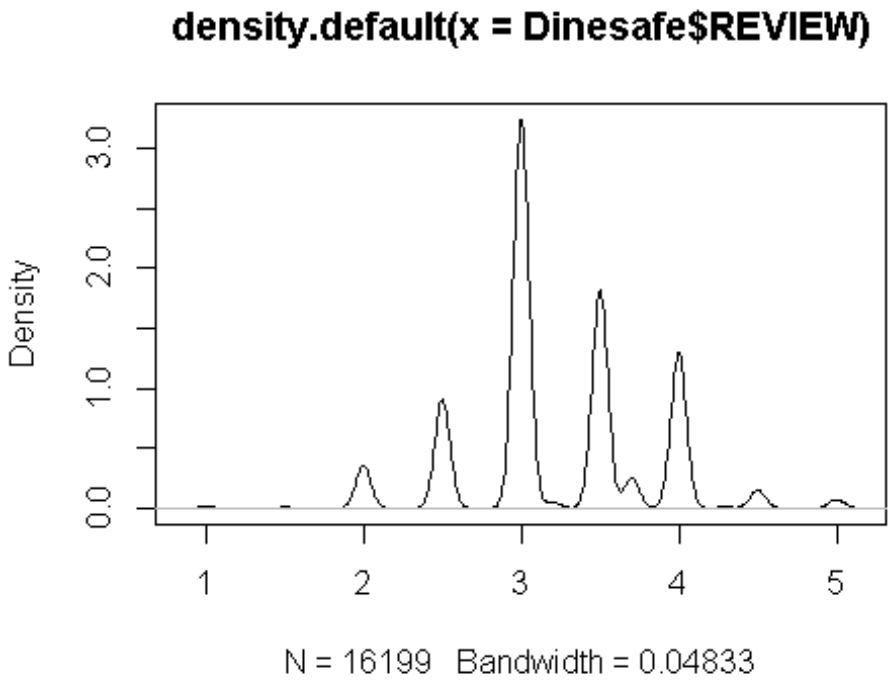
```
## The histogram graph of quantitative data in Dinesafe$Review shows that the
data is normally distrubuted skewed to the left, where as Dinesafe$value
shows that the data is not normally distrubuted.

## Histogram graph
hist(Dinesafe$REVIEW, col="GREEN")
```



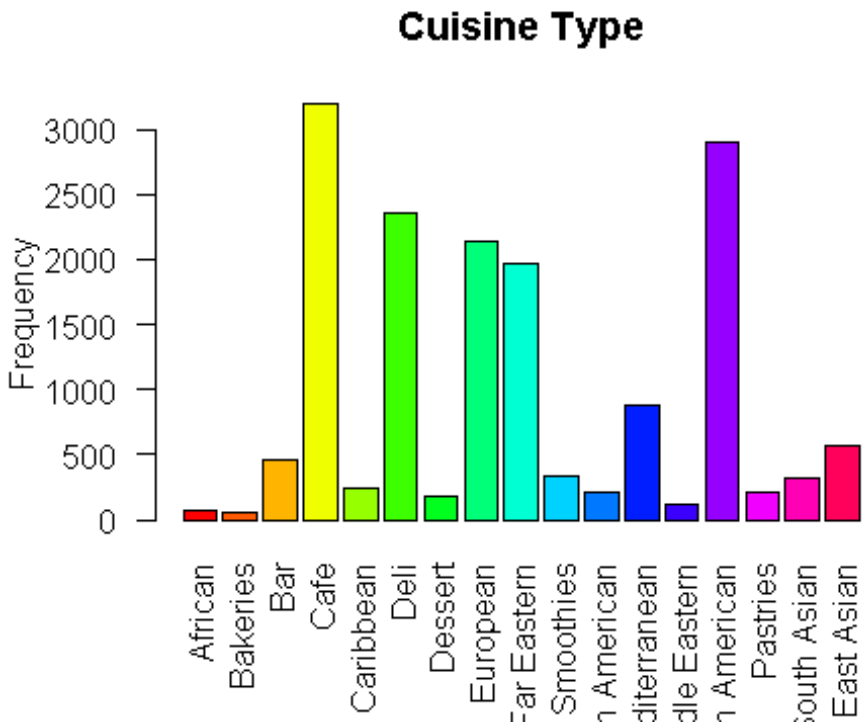

```
hist(Dinesafe$VALUE,col="YELLOW")
```



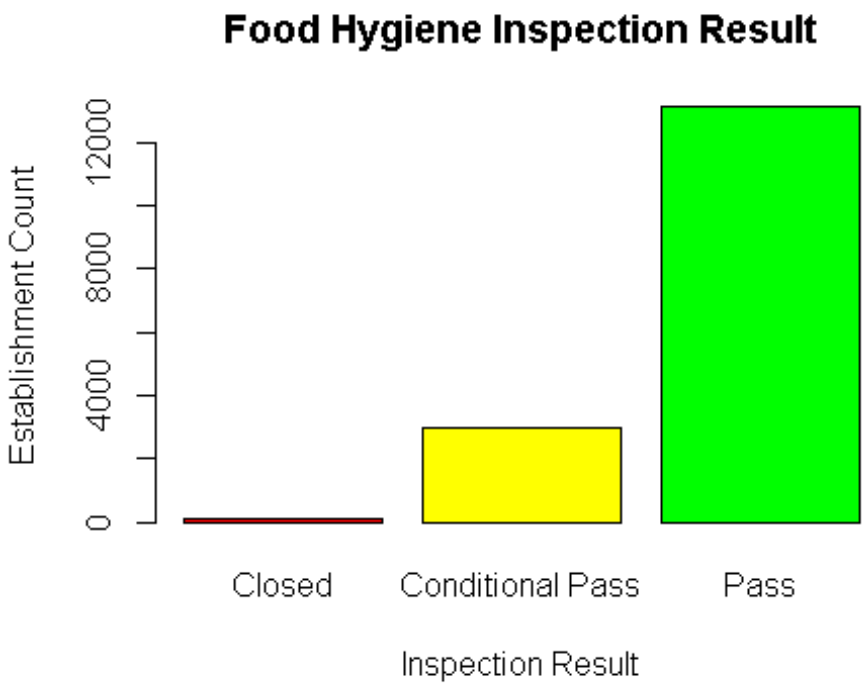

```
## Kernel Density Plots
Review <- density(Dinesafe$REVIEW)
plot(Review)
```



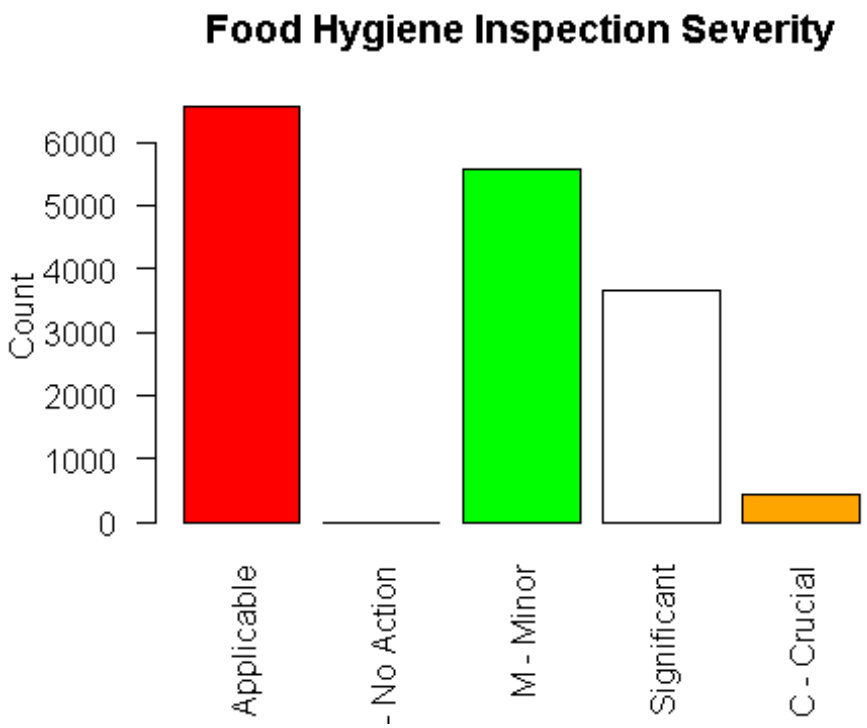
```
## Bar chart representation of a categorical values in Cusine Typek
Inspection Result and Severity columns.

## CUISINE TYPE FREQUECY
Cuisin <- table(Dinesafe$CUISINE_TYPE)
barplot(Cuisin, main="Cuisine Type", ylab="Frequency", beside=TRUE, col =
rainbow(17),las=2, horiz=FALSE)
```



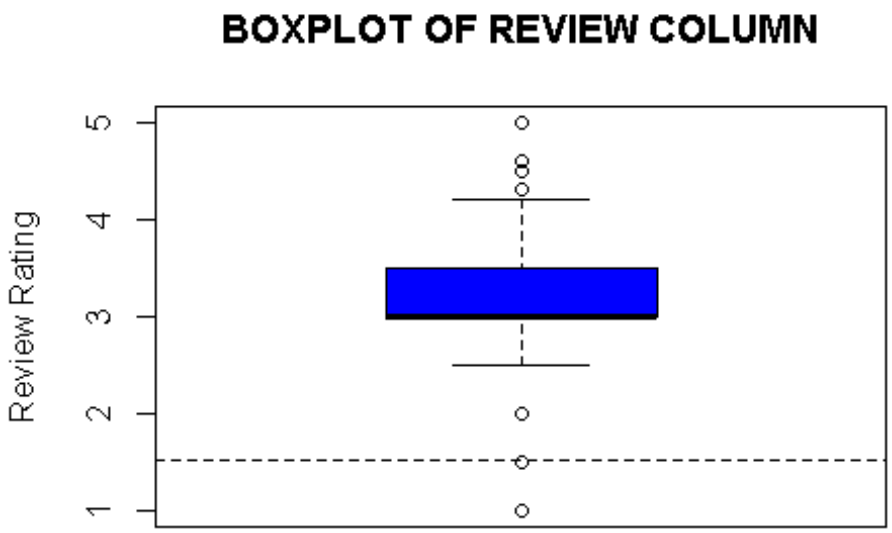

```
## Food Hygiene Inspection Result
Inspection <- table(Dinesafe$ESTABLISHMENT_STATUS)
barplot(Inspection, main="Food Hygiene Inspection Result", xlab="Inspection
Result", ylab="Establishment Count", col=c("red","yellow","green"),
beside=TRUE)
```



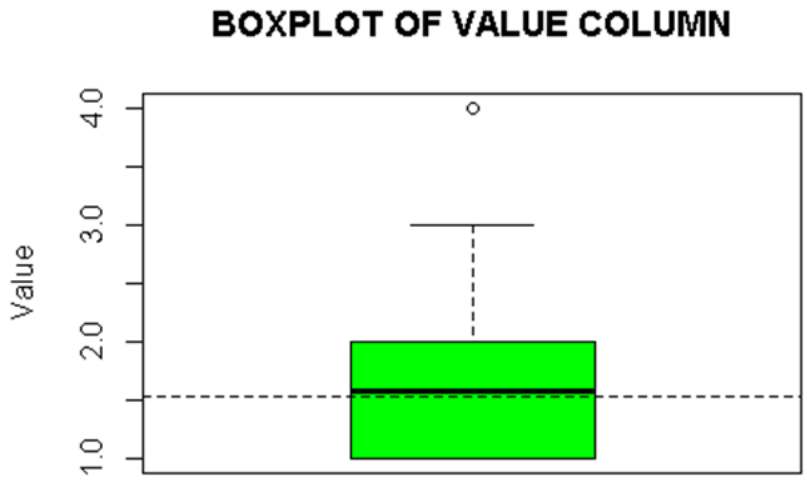

```
## Food Hygiene Inspection Severity
Severity <- table(Dinesafe$SEVERITY)
barplot(Severity, main="Food Hygiene Inspection Severity", xlab="",
ylab="Count", col=c("red","yellow","green","White","Orange"),
beside=TRUE,las=2)
```




```
## Boxplot of data distribution representation of Review and Value columns
with its minimum, maximum, median, 1st quartile, 3rd quartile as well as
outliers.

## The Review boxplot shows that the rating value range is quite close, ie
between 2.5 and 4 with most of the data is concertrated above the median
value of 3. Outlier data are above 4 and below 2.5 and mean value is 1.5
boxplot(Dinesafe$REVIEW,main = toupper("Boxplot of Review Column"),ylab =
"Review Rating",col = "blue")
abline(h=mean(Dinesafe$VALUE, na.rm = T), lty=2)
```




```
## The Value boxplot shows that it has one outlier and the data distriubtion
is between 1 and 2 and the median and mean values are close to each other
around 1.5
boxplot(Dinesafe$VALUE,main = toupper("Boxplot of VALUE Column"),ylab =
"Value",col = "green")
abline(h=mean(Dinesafe$VALUE, na.rm = T), lty=2)
```



5.2 Bivarient Data Analysis

5.2.1 - Mean & Standard deviation of Review and Value data against Estalishment status.

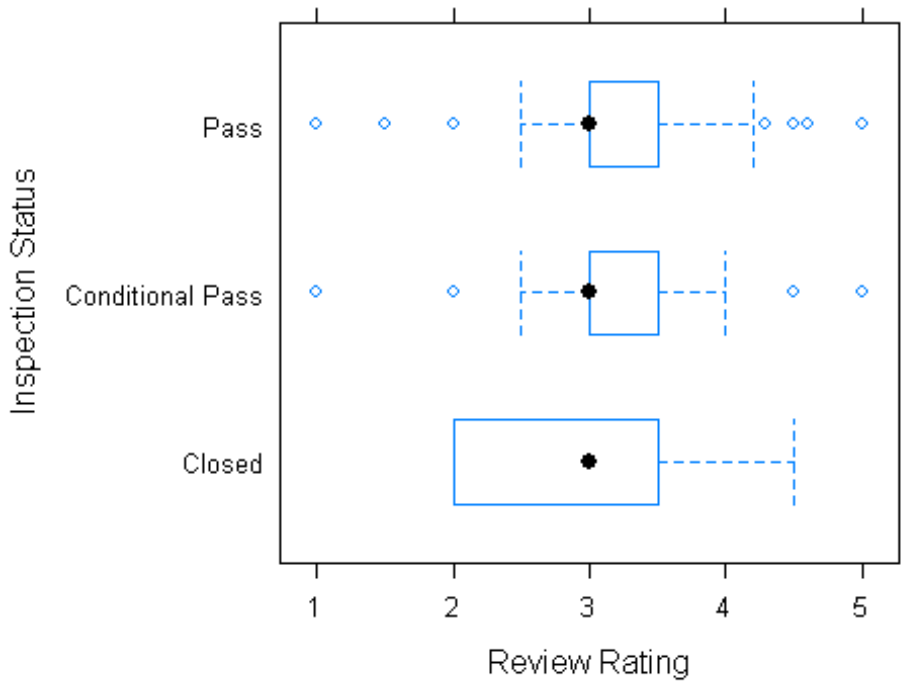
Based on the mean and standard deviation value of the review rating food premises that failed inspection had a mean review ratnig below the passed premises. Also failed food premises has a higher standard deviation value as compared to those who passed.

On the other hand the relationship between mean/standard deviation value and inspection outcome is not observer due to consistent result across all three values.

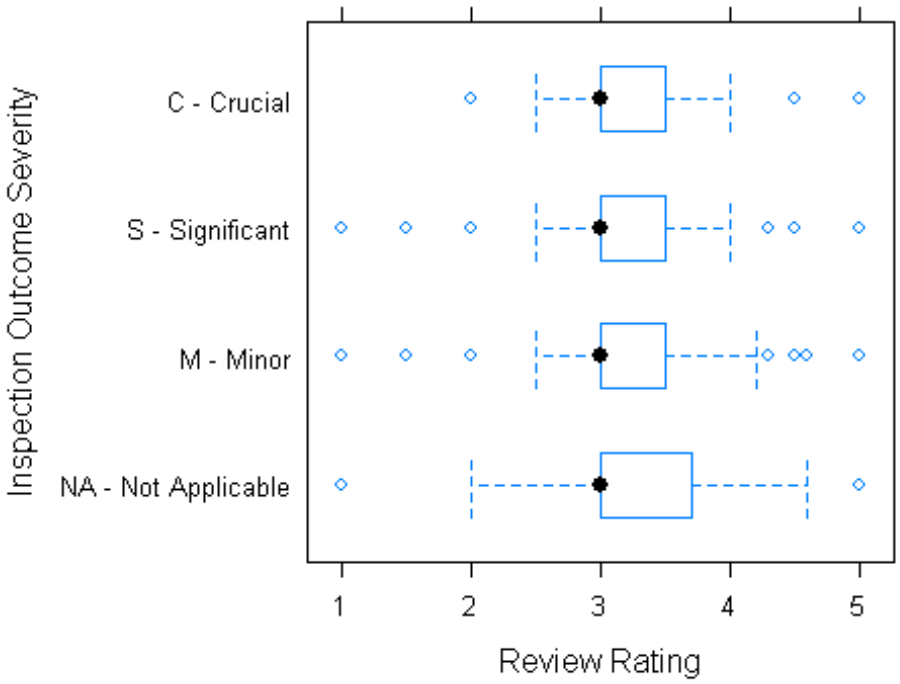
```
## Mean Review data against establishment inspection status
tapply(Dinesafe$REVIEW , Dinesafe$ESTABLISHMENT_STATUS, mean)
cat("\n")
## Standard Deviation of Review data against establishment inspection status
tapply(Dinesafe$REVIEW , Dinesafe$ESTABLISHMENT_STATUS, sd)
cat("\n")
## Mean value data against establishment inspection status
tapply(Dinesafe$VALUE , Dinesafe$ESTABLISHMENT_STATUS, mean)
cat("\n")
## Standard Deviation of Value data against establishment inspection status
tapply(Dinesafe$VALUE , Dinesafe$ESTABLISHMENT_STATUS, sd)
```

5.2.2 - Categorical data analysis against the numerical Review Rating column using bwplot

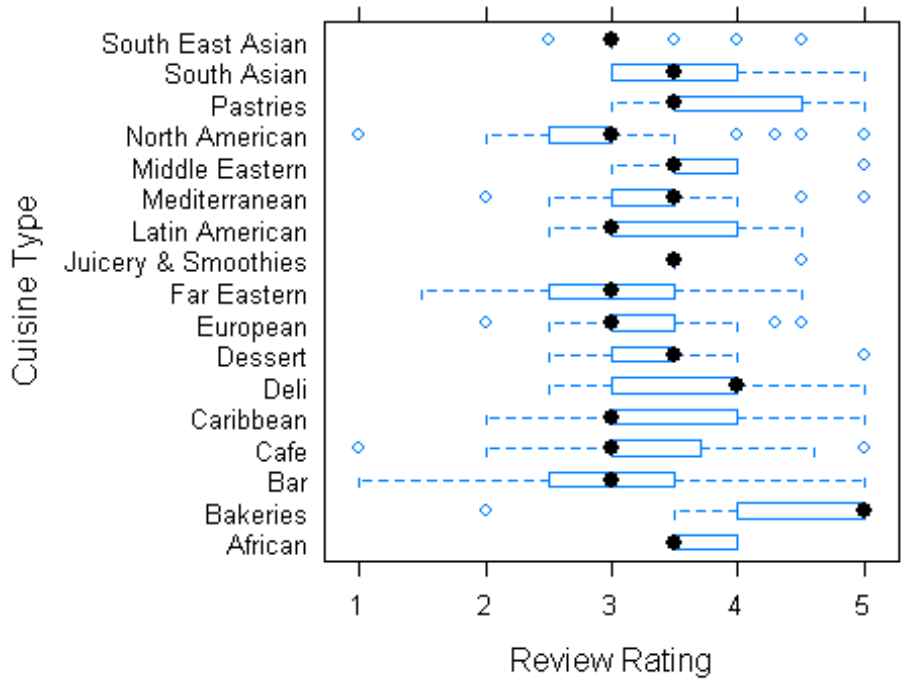
```
library(lattice)
bwplot(ESTABLISHMENT_STATUS ~ REVIEW, data = Dinesafe, ylab = "Inspection
Status", xlab = "Review Rating")
```



```
bwplot(SEVERITY ~ REVIEW, data = Dinesafe, ylab = "Inspection Outcome
Severity", xlab = "Review Rating")
```

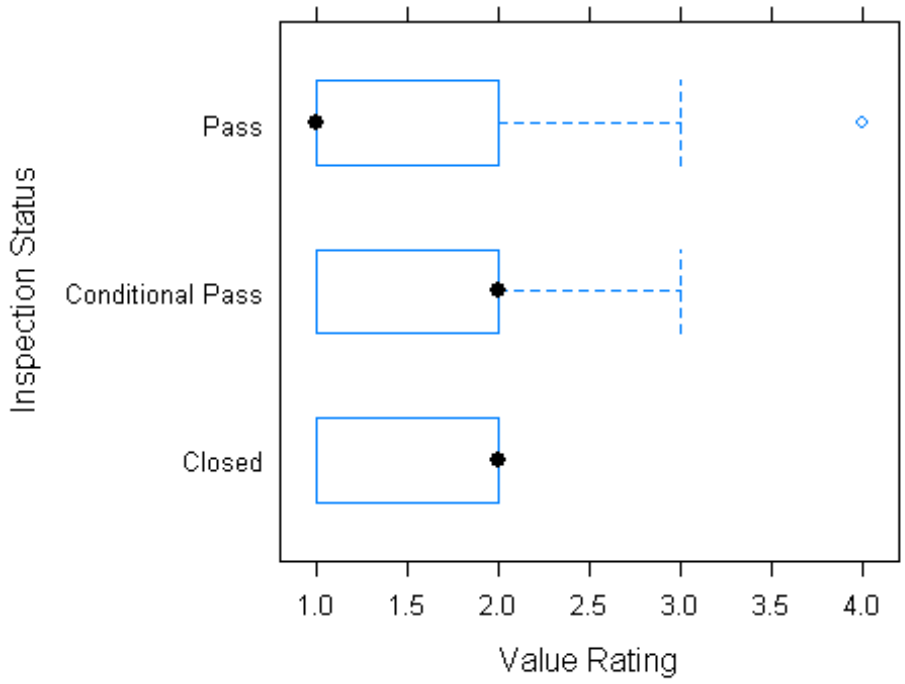



```
bwplot(CUISINE_TYPE ~ REVIEW, data = Dinesafe, ylab = "Cuisine Type", xlab =
"Review Rating")
```

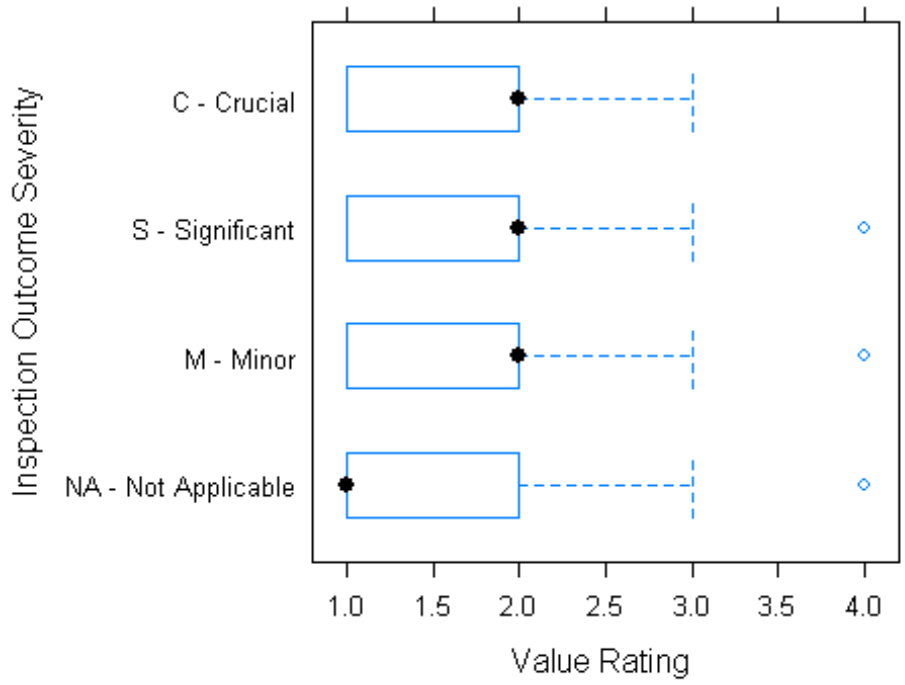


5.2.3 - Categorical data analysis against the numerical Value Rating column using bwplot

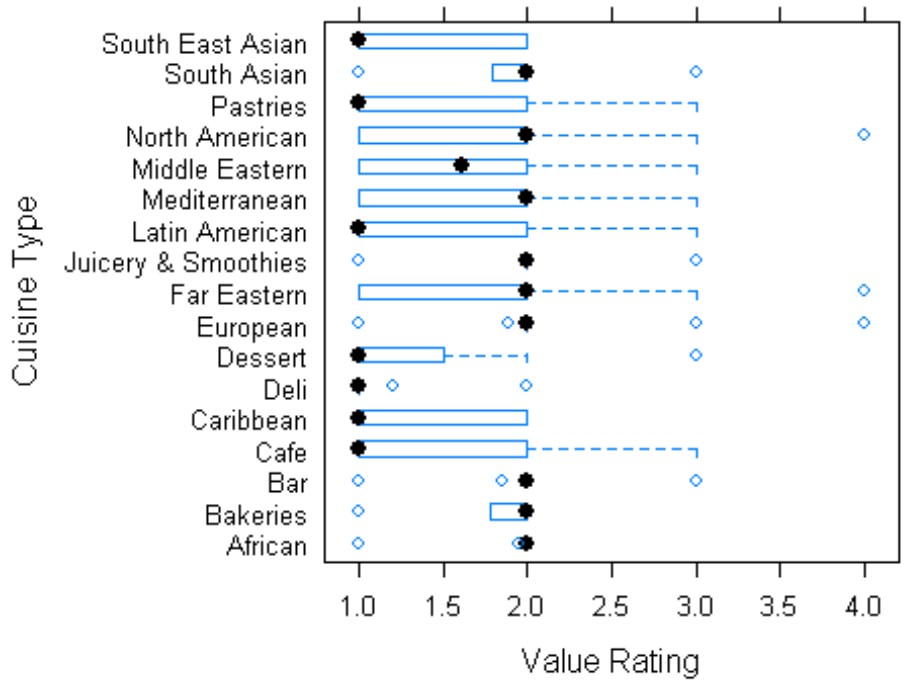
```
## Categorical data analysis
bwplot(ESTABLISHMENT_STATUS ~ VALUE, data = Dinesafe, ylab = "Inspection
Status", xlab = "Value Rating")
```




```
bwplot(SEVERITY ~ VALUE, data = Dinesafe, ylab = "Inspection Outcome
Severity", xlab = "Value Rating ")
```

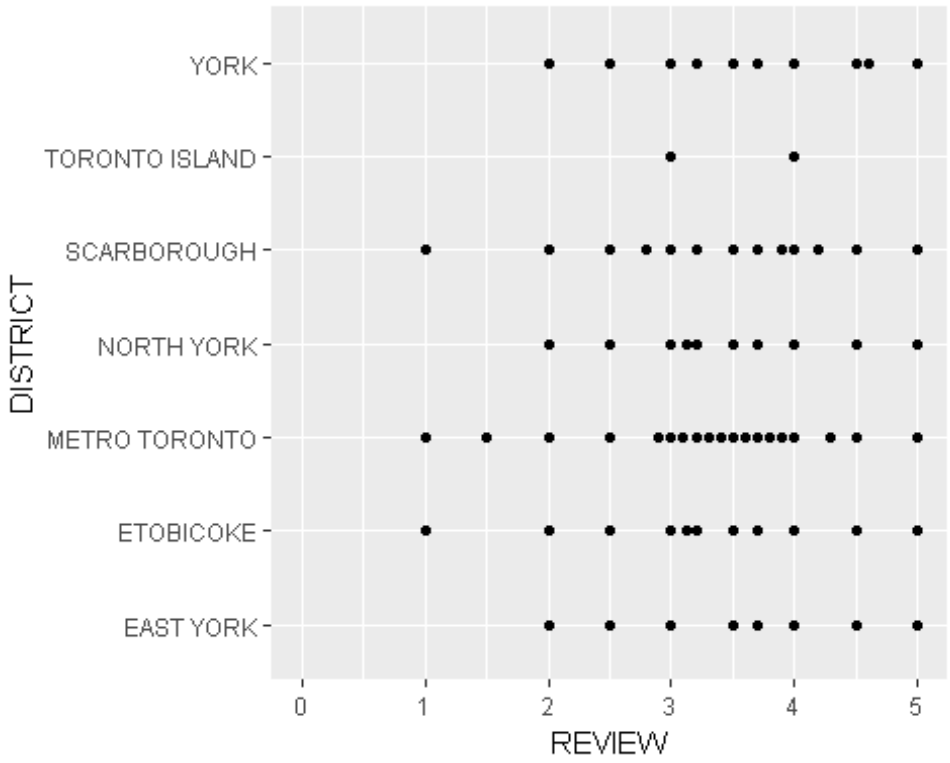


```
bwplot(CUISINE_TYPE ~ VALUE, data = Dinesafe, ylab = "Cuisine Type", xlab =
"Value Rating")
```



5.2.4 - Categorical data analysis of District against the numerical data of Review and Value Rating column using qplot

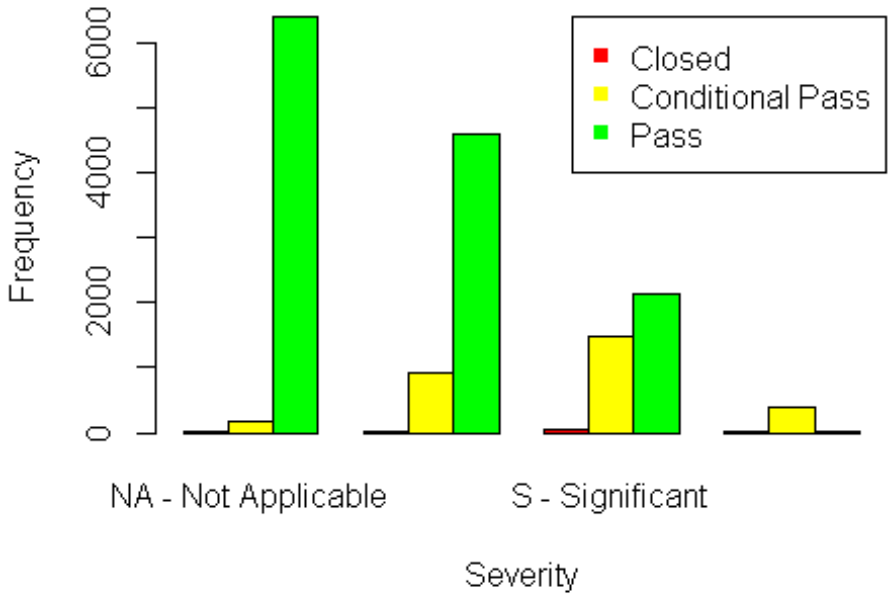
```
qplot(REVIEW, DISTRICT, data=Dinesafe) + xlim(0, 5)
```




```
qplot(VALUE, DISTRICT, data=Dinesafe) + xlim(0, 5)
```

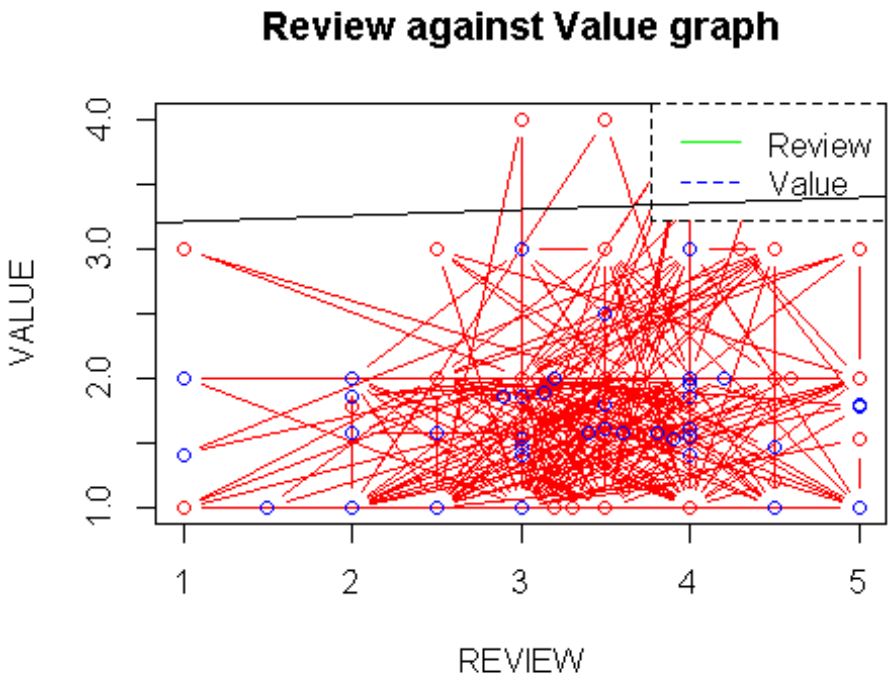
5.2.5 - Relationship graphy between two categorical columns (INSPECTION STATUS AND SEVERITY)

```
library(gmodels)
joint = CrossTable(Dinesafe$ESTABLISHMENT_STATUS, Dinesafe$SEVERITY)
joint$t
joint_count = joint$t
barplot(joint_count, beside = TRUE, col = c("Red","Yellow","Green"),ylab =
"Frequency", xlab = "Severity")
legend("topright", c("Closed","Conditional Pass","Pass"), pch=15, col =
c("Red","Yellow","Green"))
```



5.2.6 - Scattered graph showing a relatship between two numerical values Based on the graph below there is no linear relationship between a restaurant review rating and value for money rating as the values are scattered all over the box and doesn't follow the simple linear regression model line.

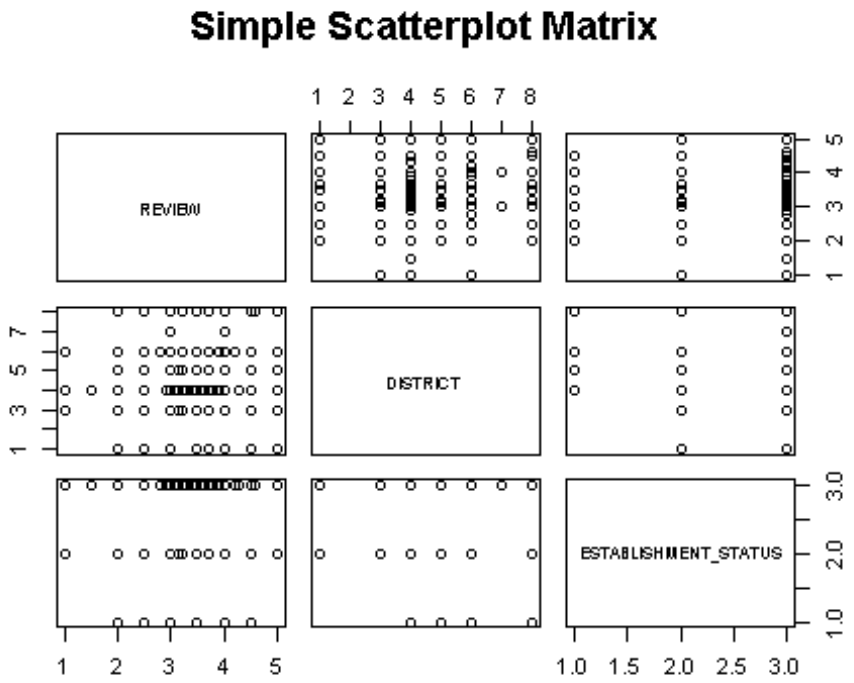
```
plot (Dinesafe$REVIEW, Dinesafe$VALUE,  col = c("RED", "BLUE"),
xlab="REVIEW", ylab="VALUE", main="Review against Value graph", type = "b")
legend("topright", legend=c("Review", "Value"), col=c("green", "blue"),
lty=1:2, cex=1, box.lty=2)
abline(lm(Dinesafe$REVIEW ~ Dinesafe$VALUE))
```



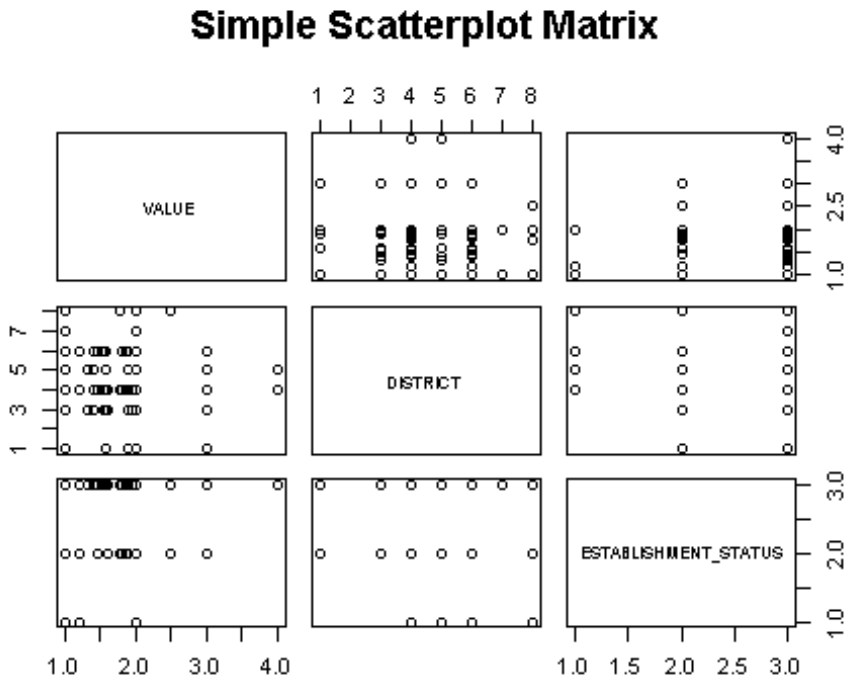
5.3 - Multivariant Data Analysis

5.3.1 - Plot of a simple scattered matrix between three columns (REVIEW, DISTRICT & ESTABLISHMENT TYPE) & (VALUE, DISTRICT & ESTABLISHMENT TYPE)

```
pairs(~REVIEW+DISTRICT+ESTABLISHMENT_STATUS,data=Dinesafe,  main="Simple
Scatterplot Matrix")
```




```
pairs( ~VALUE+DISTRICT+ESTABLISHMENT_STATUS,data=Dinesafe,  main="Simple
Scatterplot Matrix")
```



5.3.2- Aggregation between multiple columns categorical and numerical values.

```
head(aggregate(Dinesafe$REVIEW ~ Dinesafe$ESTABLISHMENT_STATUS +
Dinesafe$CUISINE_TYPE + Dinesafe$DISTRICT, FUN=mean),10)
head(aggregate(Dinesafe$REVIEW ~ Dinesafe$ESTABLISHMENT_STATUS +
Dinesafe$CUISINE_TYPE, FUN=length),10)
```

. Write final data frame to csv file.

```
write.csv(Dinesafe, file = "D:/CAPSTONE/CAPSTONE/DATASET/Final_Dinesafe.csv",
row.names= TRUE)
```