UE20CS312 - Data Analytics - Worksheet 1a - Part 2 - EDA with R | ANOVA

PES University

'SUNDEEP A, Dept. of CSE - PES1UG20CS445'

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Part I. Exploratory Data Analysis with R

Book Club Marketing Dataset

Problems

Problem 1 (1 point)

```
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.3.6      v purrr   0.3.4
## v tibble  3.1.8      v dplyr   1.0.9
## v tidyr   1.2.0      v stringr 1.4.0
## v readr   2.1.2      v forcats 0.5.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
cbc_df <- read_csv("C:\\Users\\HP\\Desktop\\PESU\\SEM - 5\\PES1UG20CS445\\DA\\1_b\\CharlesBookClubDatas
```

```
## New names:
## Rows: 4000 Columns: 26
## -- Column specification
## ---------------------------------------------------------- Delimiter: "," chr
## (4): Name, Phone_No., Address, Job dbl (22): ...1, Seq#, ID#, Gender, M, R, F,
## FirstPurch, ChildBks, YouthBks, ...
## i Use `spec()` to retrieve the full column specification for this data. i
## Specify the column types or set `show_col_types = FALSE` to quiet this message.
## * `` -> `...1`
```

```
head(cbc_df)
```

```
## # A tibble: 6 x 26
##     ...1 `Seq#` `ID#` Gender     M     R     F FirstPurch Child~1 Youth~2 CookBks
##    <dbl>  <dbl> <dbl>  <dbl> <dbl> <dbl> <dbl>      <dbl>   <dbl>   <dbl>   <dbl>
## 1      0      1    25      1   297    14     2         22       0       1       1
## 2      1      2    29      0   128     8     2         10       0       0       0
## 3      2      3    46      1   138    22     7         56       2       1       2
## 4      3      4    47      1   228     2     1          2       0       0       0
## 5      4      5    51      1   257    10     1         10       0       0       0
```

```
## 6      5      6     60      1    145      6      2     12      0      0      0
## # ... with 15 more variables: DoItYBks <dbl>, RefBks <dbl>, ArtBks <dbl>,
## #   GeogBks <dbl>, ItalCook <dbl>, ItalAtlas <dbl>, ItalArt <dbl>,
## #   Florence <dbl>, `Related Purchase` <dbl>, Yes_Florence <dbl>,
## #   No_Florence <dbl>, Name <chr>, Phone_No. <chr>, Address <chr>, Job <chr>,
## #   and abbreviated variable names 1: ChildBks, 2: YouthBks
## # i Use `colnames()` to see all variable names
```

```r
summary(cbc_df[c("M","F","R","FirstPurch","ChildBks","YouthBks","CookBks","DoItYBks","RefBks","ArtBks",
```

```
##        M                F                R             FirstPurch
##  Min.   : 15.0    Min.   : 1.000   Min.   : 2.00    Min.   : 2.00
##  1st Qu.:130.0    1st Qu.: 1.000   1st Qu.: 8.00    1st Qu.:12.00
##  Median :208.0    Median : 2.000   Median :12.00    Median :20.00
##  Mean   :208.2    Mean   : 3.831   Mean   :13.43    Mean   :26.51
##  3rd Qu.:283.0    3rd Qu.: 6.000   3rd Qu.:16.00    3rd Qu.:36.00
##  Max.   :479.0    Max.   :12.000   Max.   :36.00    Max.   :99.00
##  NA's   :93       NA's   :218      NA's   :342
##     ChildBks         YouthBks          CookBks          DoItYBks
##  Min.   :0.0000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000
##  Median :0.0000   Median :0.0000   Median :0.0000   Median :0.0000
##  Mean   :0.6398   Mean   :0.3048   Mean   :0.7312   Mean   :0.3508
##  3rd Qu.:1.0000   3rd Qu.:0.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   :7.0000   Max.   :5.0000   Max.   :7.0000   Max.   :5.0000
##
##      RefBks           ArtBks          GeogBks          ItalCook
##  Min.   :0.0000   Min.   :0.000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.0000   1st Qu.:0.000   1st Qu.:0.0000   1st Qu.:0.0000
##  Median :0.0000   Median :0.000   Median :0.0000   Median :0.0000
##  Mean   :0.2562   Mean   :0.289   Mean   :0.3875   Mean   :0.1252
##  3rd Qu.:0.0000   3rd Qu.:0.000   3rd Qu.:1.0000   3rd Qu.:0.0000
##  Max.   :4.0000   Max.   :5.000   Max.   :6.0000   Max.   :3.0000
##
##     ItalAtlas         ItalArt          Florence       Related Purchase
##  Min.   :0.0000   Min.   :0.00000   Min.   :0.0000   Min.   :0.000
##  1st Qu.:0.0000   1st Qu.:0.00000   1st Qu.:0.0000   1st Qu.:0.000
##  Median :0.0000   Median :0.00000   Median :0.0000   Median :0.000
##  Mean   :0.0375   Mean   :0.04575   Mean   :0.0845   Mean   :0.885
##  3rd Qu.:0.0000   3rd Qu.:0.00000   3rd Qu.:0.0000   3rd Qu.:1.000
##  Max.   :2.0000   Max.   :2.00000   Max.   :1.0000   Max.   :8.000
##
##   Yes_Florence      No_Florence
##  Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.0000   1st Qu.:1.0000
##  Median :0.0000   Median :1.0000
##  Mean   :0.0845   Mean   :0.9155
##  3rd Qu.:0.0000   3rd Qu.:1.0000
##  Max.   :1.0000   Max.   :1.0000
##
```

```r
sprintf("The standard Deviation of M data : %f",sd(cbc_df$M,na.rm = T))
```

```
## [1] "The standard Deviation of M data : 100.926278"
```

```r
sprintf("The standard Deviation of F data : %f",sd(cbc_df$F,na.rm = T))
```

[1] "The standard Deviation of F data : 3.455656"

```r
sprintf("The standard Deviation of R data : %f",sd(cbc_df$R,na.rm = T))
```

[1] "The standard Deviation of R data : 8.090016"

```r
sprintf("The standard Deviation of FirstPurch data : %f",sd(cbc_df$FirstPurch))
```

[1] "The standard Deviation of FirstPurch data : 18.351380"

```r
sprintf("The standard Deviation of ChildBks data : %f",sd(cbc_df$ChildBks))
```

[1] "The standard Deviation of ChildBks data : 0.994343"

```r
sprintf("The standard Deviation of YouthBks data : %f",sd(cbc_df$YouthBks))
```

[1] "The standard Deviation of YouthBks data : 0.611940"

```r
sprintf("The standard Deviation of CookBks data : %f",sd(cbc_df$CookBks))
```

[1] "The standard Deviation of CookBks data : 1.089413"

```r
sprintf("The standard Deviation of DoItYBks data : %f",sd(cbc_df$DoItYBks))
```

[1] "The standard Deviation of DoItYBks data : 0.687999"

```r
sprintf("The standard Deviation of RefBks data : %f",sd(cbc_df$RefBks))
```

[1] "The standard Deviation of RefBks data : 0.558269"

```r
sprintf("The standard Deviation of ArtBks data : %f",sd(cbc_df$ArtBks))
```

[1] "The standard Deviation of ArtBks data : 0.600890"

```r
sprintf("The standard Deviation of GeogBks data : %f",sd(cbc_df$GeogBks))
```

[1] "The standard Deviation of GeogBks data : 0.750656"

```r
sprintf("The standard Deviation of ItalCook data : %f",sd(cbc_df$ItalCook))
```

[1] "The standard Deviation of ItalCook data : 0.385486"

```r
sprintf("The standard Deviation of ItalAtlas data : %f",sd(cbc_df$ItalAtlas))
```

[1] "The standard Deviation of ItalAtlas data : 0.214721"

```r
sprintf("The standard Deviation of ItalArt data : %f",sd(cbc_df$ItalArt))
```

[1] "The standard Deviation of ItalArt data : 0.220611"

```r
sprintf("The standard Deviation of Florence data : %f",sd(cbc_df$Florence))
```

[1] "The standard Deviation of Florence data : 0.278171"

```r
sprintf("The standard Deviation of Related Purchase data : %f",sd(cbc_df$`Related Purchase`))
```

[1] "The standard Deviation of Related Purchase data : 1.226234"

```r
sprintf("The standard Deviation of Yes_Florence data : %f",sd(cbc_df$Yes_Florence))
```

[1] "The standard Deviation of Yes_Florence data : 0.278171"

```r
sprintf("The standard Deviation of NO_Florence data : %f",sd(cbc_df$No_Florence))
```

```
## [1] "The standard Deviation of NO_Florence data : 0.278171"
```

```r
print("Count per each column : ")
```

```
## [1] "Count per each column : "
```

```r
print(colSums(!is.na(cbc_df)))
```

```
##            ...1         Seq#          ID#        Gender
##            4000         4000         4000          4000
##               M            R            F     FirstPurch
##            3907         3658         3782          4000
##         ChildBks      YouthBks      CookBks       DoItYBks
##            4000         4000         4000          4000
##           RefBks       ArtBks      GeogBks       ItalCook
##            4000         4000         4000          4000
##        ItalAtlas      ItalArt Florence Related Purchase
##            4000         4000         4000          4000
##     Yes_Florence  No_Florence         Name     Phone_No.
##            4000         4000         4000          4000
##          Address          Job
##            4000         4000
```

```r
print("Number of missing Values per column :")
```

```
## [1] "Number of missing Values per column :"
```

```r
colSums(is.na(cbc_df))
```
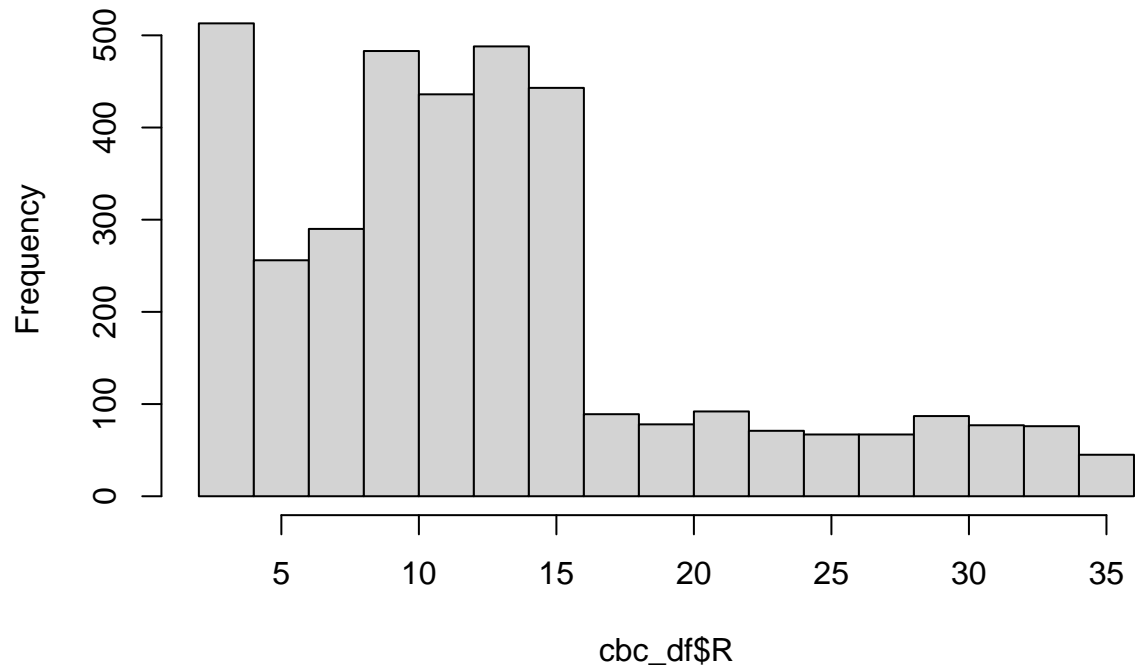
```
##            ...1         Seq#          ID#        Gender
##               0            0            0             0
##               M            R            F     FirstPurch
##              93          342          218             0
##         ChildBks      YouthBks      CookBks       DoItYBks
##               0            0            0             0
##           RefBks       ArtBks      GeogBks       ItalCook
##               0            0            0             0
##        ItalAtlas      ItalArt Florence Related Purchase
##               0            0            0             0
##     Yes_Florence  No_Florence         Name     Phone_No.
##               0            0            0             0
##          Address          Job
##               0            0
```

Problem 2 (2 points)

```r
hist(cbc_df$R)
```

Histogram of cbc_df$R


```r
cbc_df$R[is.na(cbc_df$R)] <- median(cbc_df$R, na.rm = T)
hist(cbc_df$R)
```

Histogram of cbc_df$R


```
hist(cbc_df$F)
```
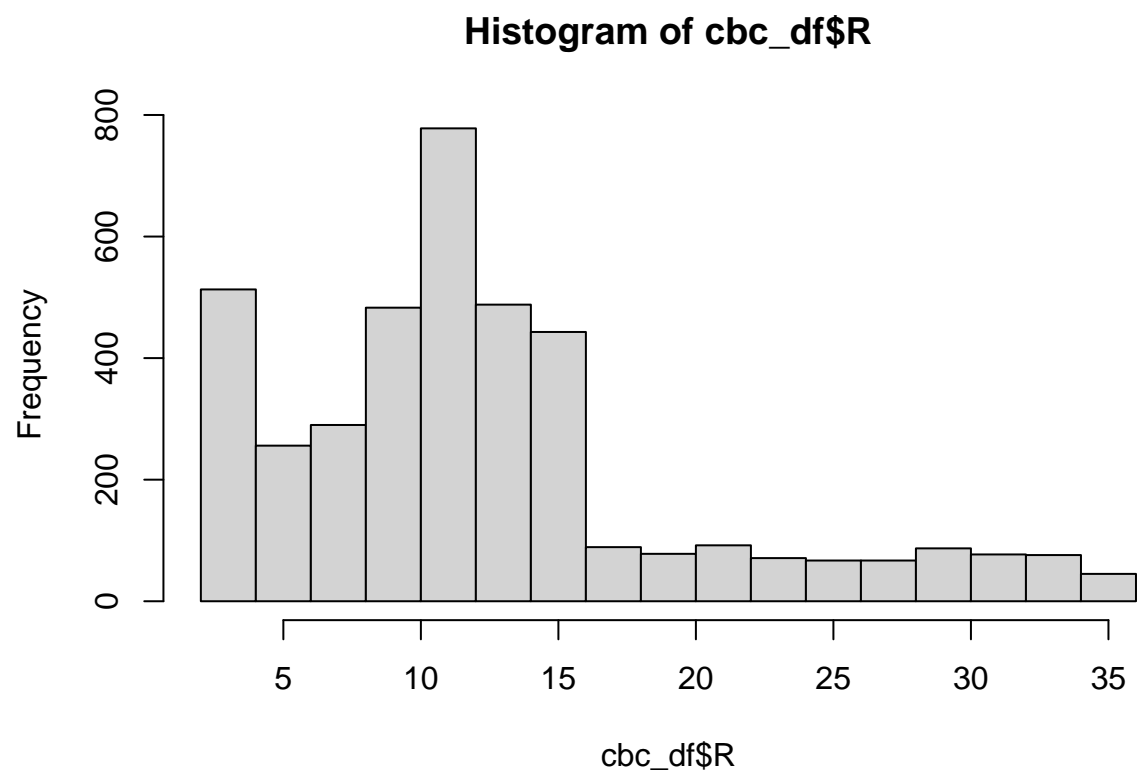
Histogram of cbc_df$F
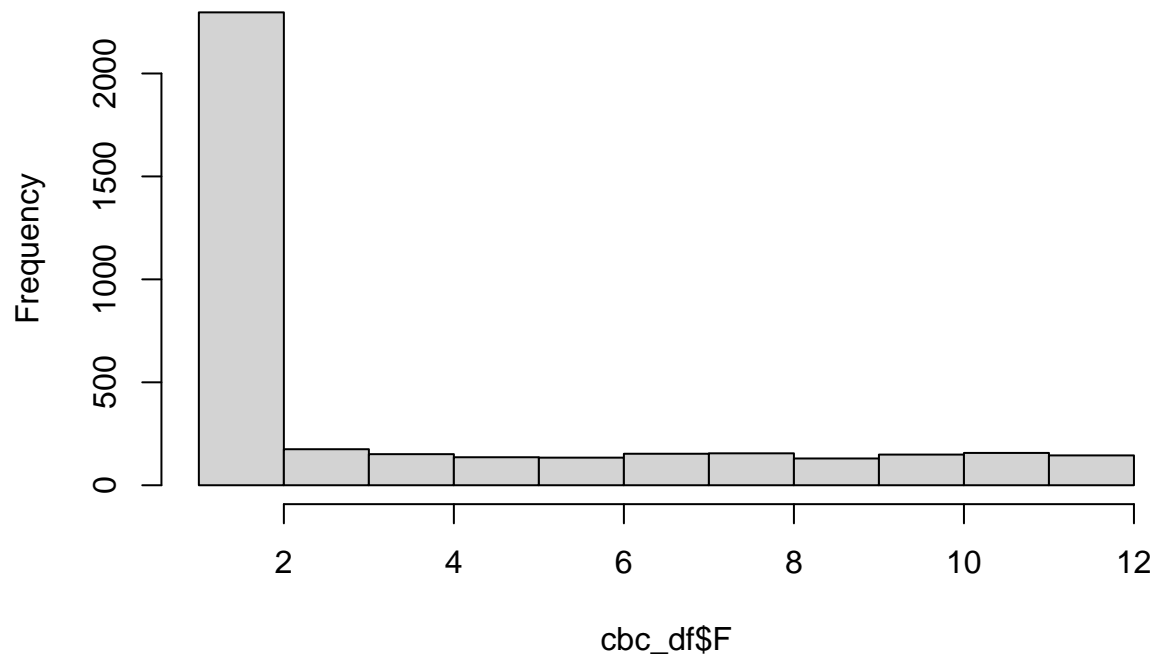

```
cbc_df$F[is.na(cbc_df$F)] <- median(cbc_df$F, na.rm = T)
hist(cbc_df$F)
```

Histogram of cbc_df$F

```
hist(cbc_df$M)
```
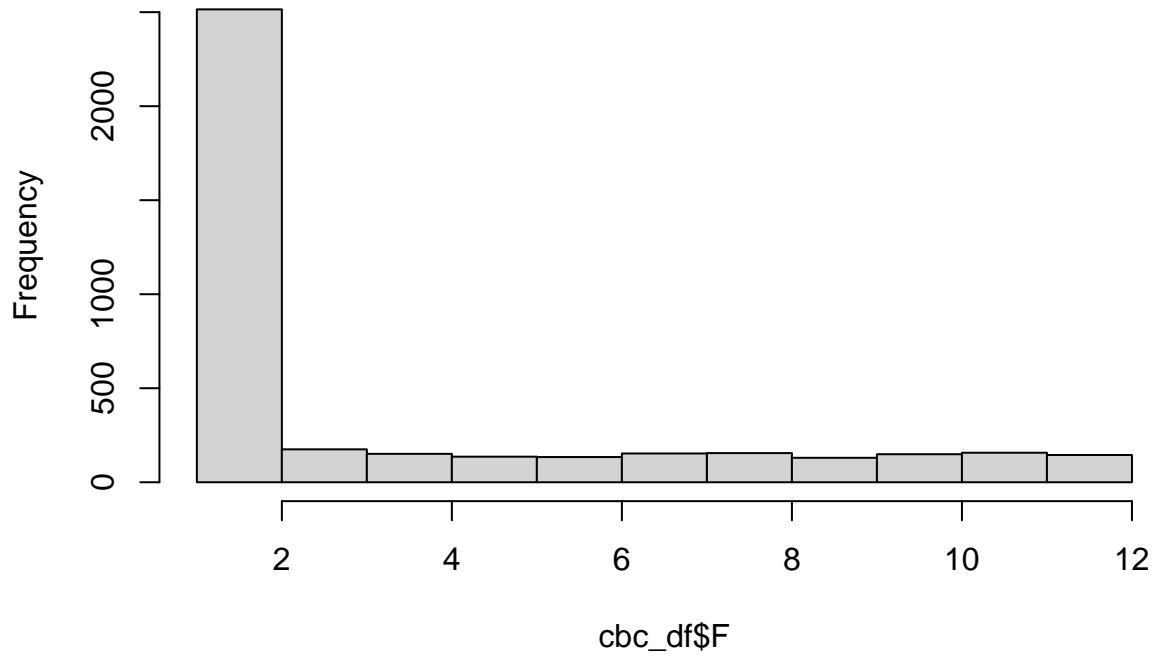
Histogram of cbc_df$M
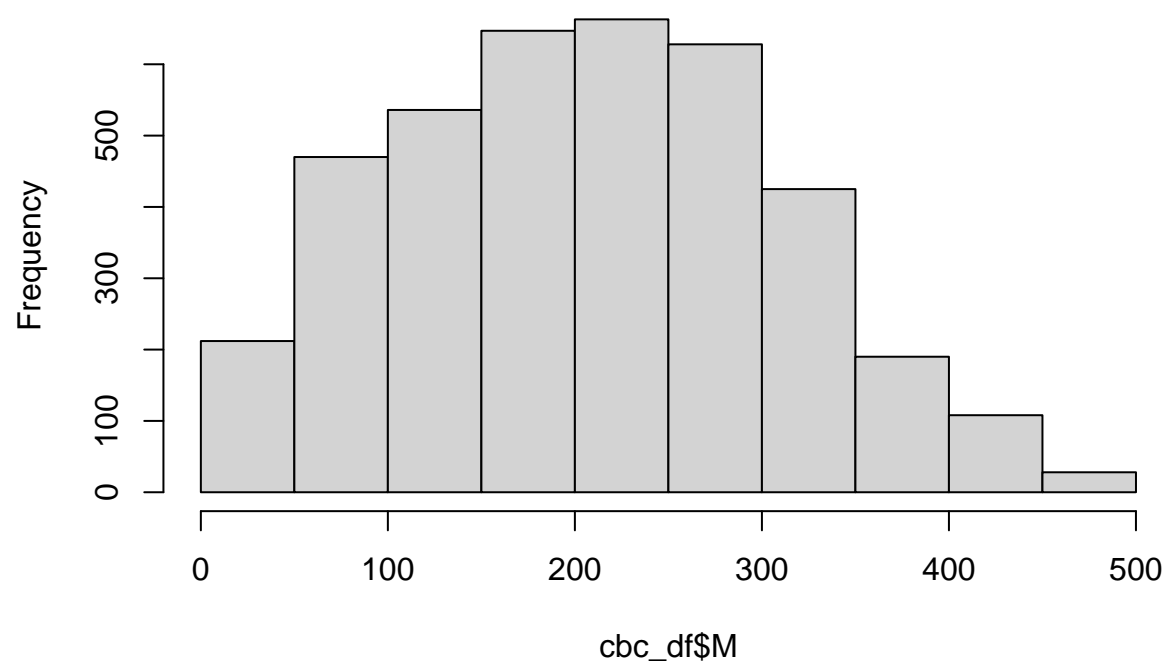

```r
cbc_df$M[is.na(cbc_df$M)] <- mean(cbc_df$M, na.rm = T)
hist(cbc_df$M)
```

Histogram of cbc_df$M
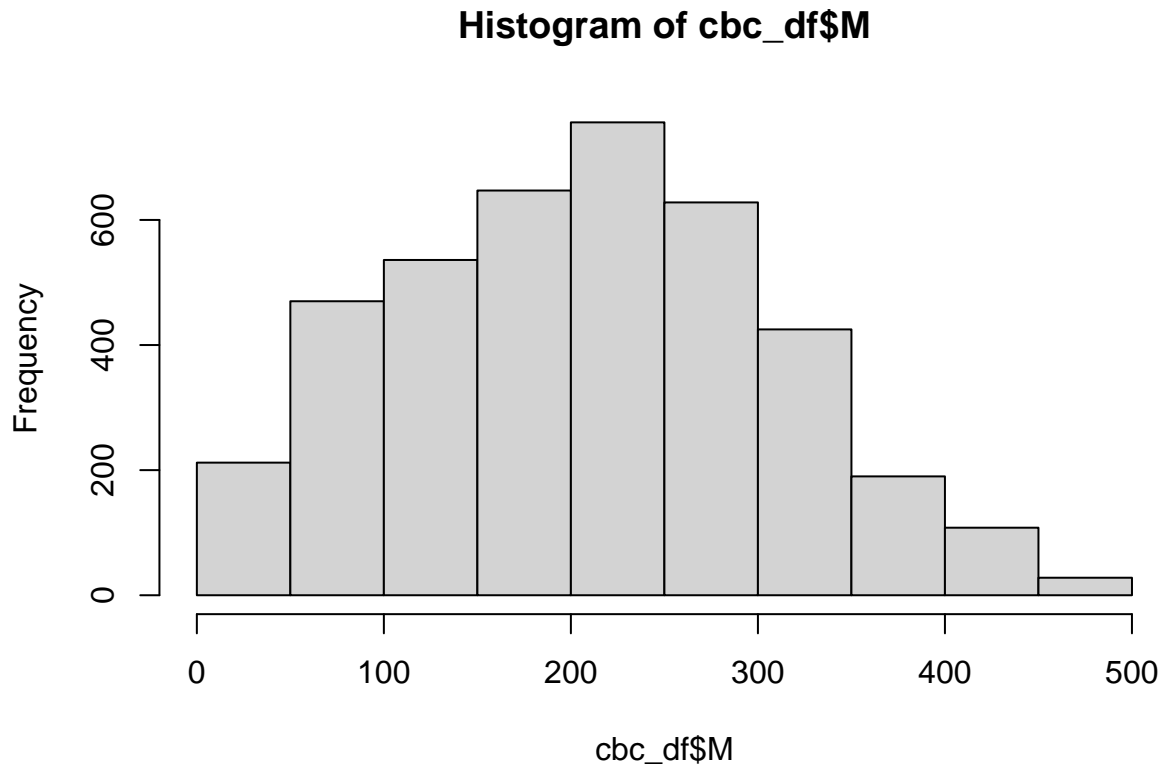

```r
print("So we can observe that there are no missing values")
```

```
## [1] "So we can observe that there are no missing values"
```

```r
colSums(is.na(cbc_df))
```

```
##              ...1             Seq#              ID#            Gender
##                 0                0                0                 0
##                 M                R                F         FirstPurch
##                 0                0                0                 0
##          ChildBks          YouthBks          CookBks          DoItYBks
##                 0                0                0                 0
##            RefBks            ArtBks          GeogBks          ItalCook
##                 0                0                0                 0
##          ItalAtlas          ItalArt  Florence Related Purchase
##                 0                0                0                 0
##      Yes_Florence       No_Florence             Name         Phone_No.
##                 0                0                0                 0
##           Address              Job
##                 0                0
```

Analysis:

Since the Histogram of R dataset is Right Skewed, So we can replace the missing values with the **median** of the R data

Similarly the Histogram of F dataset is Right Skewed, So we can replace the missing values with the **median** of the F data

Finally the Histogram of the M dataset is normally distributed,So we can replace the missing Values with **mean** of the M data

Problem 3 (2 points)

```
cbc_df$Mcode <- cut(cbc_df$M, breaks = 5)
cbc_df$Rcode <- cut(cbc_df$R, breaks = 5)
cbc_df$Fcode <- cut(cbc_df$F, breaks = 5)

summary(cbc_df[c("Mcode","Rcode","Fcode")])
```

```
##        Mcode              Rcode               Fcode
##  (14.5,108]: 753   (1.97,8.8] :1059   (0.989,3.2]:2690
##  (108,201] :1112   (8.8,15.6] :1749   (3.2,5.4]  : 287
##  (201,293] :1295   (15.6,22.4]: 702   (5.4,7.6]  : 287
##  (293,386] : 660   (22.4,29.2]: 205   (7.6,9.8]  : 285
##  (386,479] : 180   (29.2,36]  : 285   (9.8,12]   : 451
```

Problem 4

```
hist(cbc_df$FirstPurch)
```


Histogram of cbc_df$FirstPurch
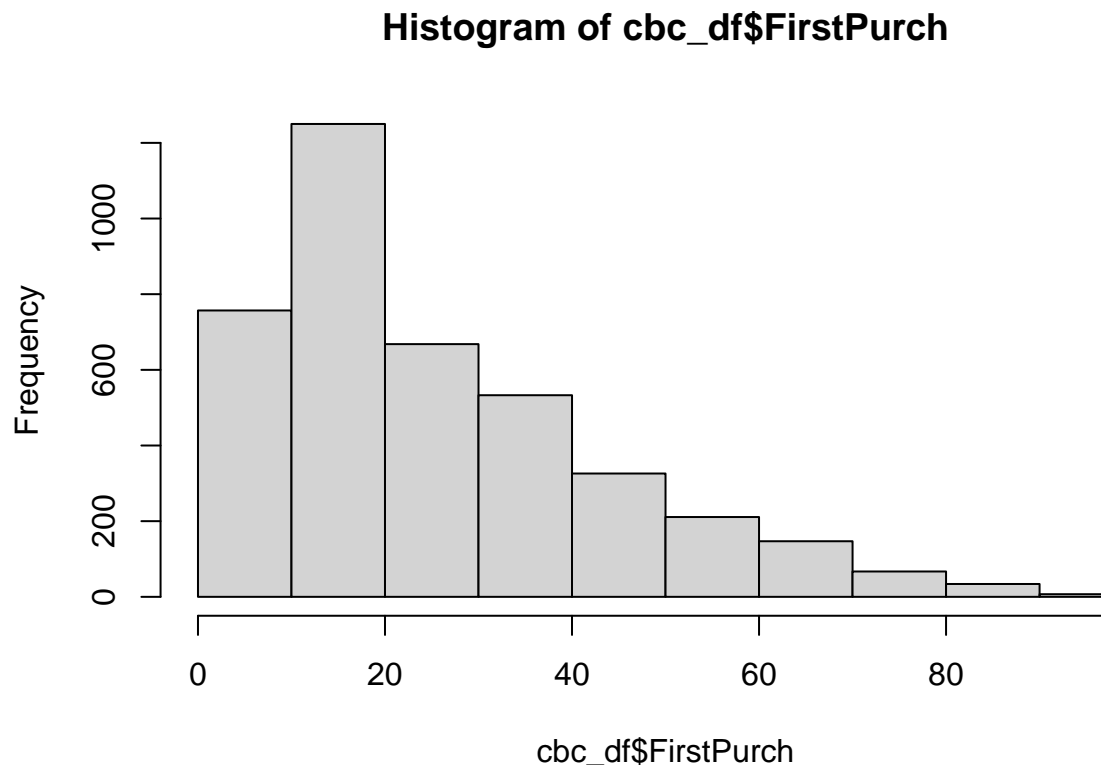
4.1 Bar Graphs (1 point)

```
numeric_Mcode=as.numeric(cbc_df$Mcode)
numeric_Rcode=as.numeric(cbc_df$Rcode)
numeric_Fcode=as.numeric(cbc_df$Fcode)
hist(numeric_Mcode)
```

Histogram of numeric_Mcode
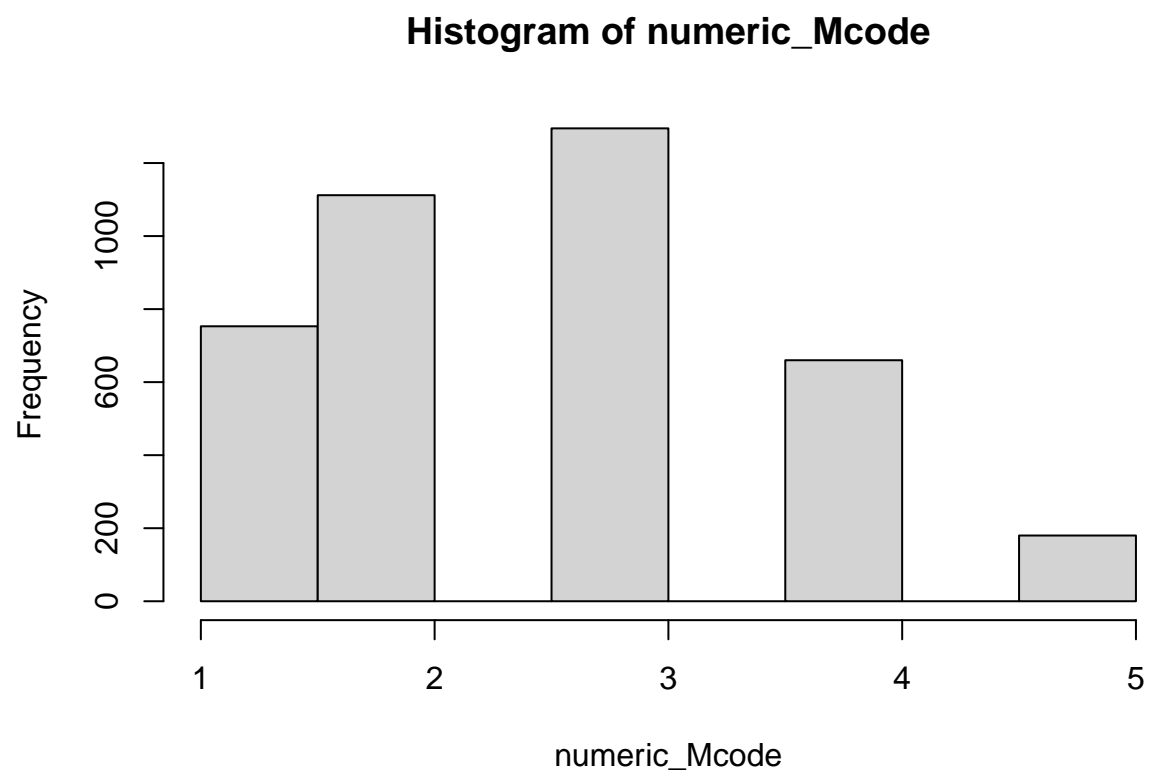

```
hist(numeric_Fcode)
```

Histogram of numeric_Fcode


```
hist(numeric_Rcode)
```
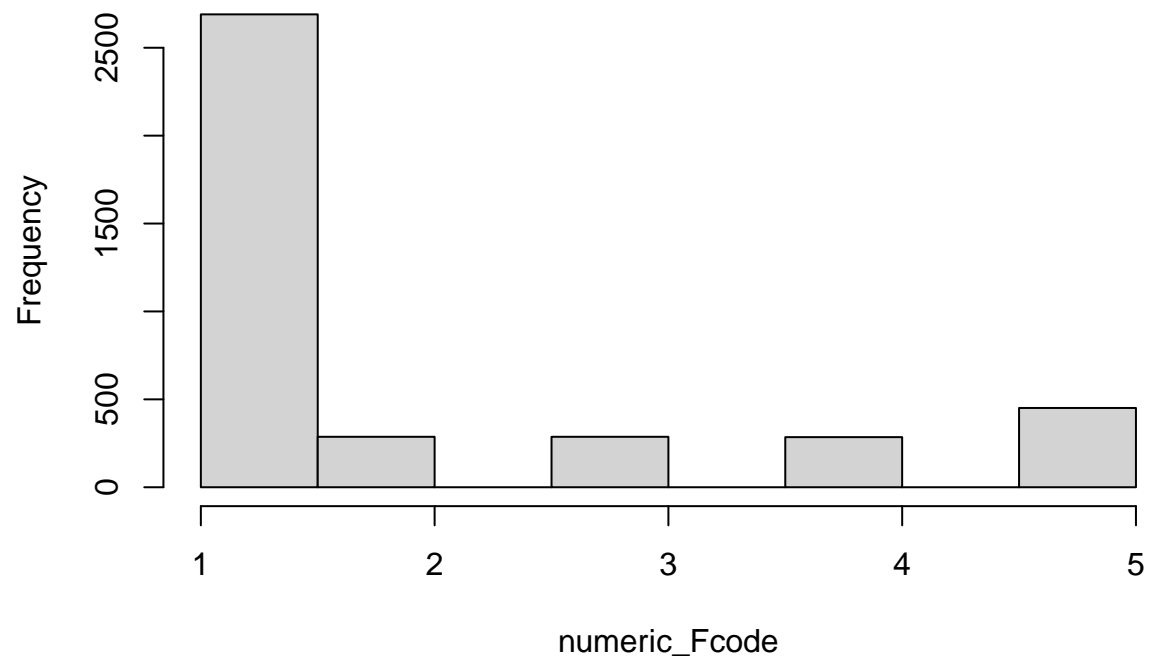
Histogram of numeric_Rcode
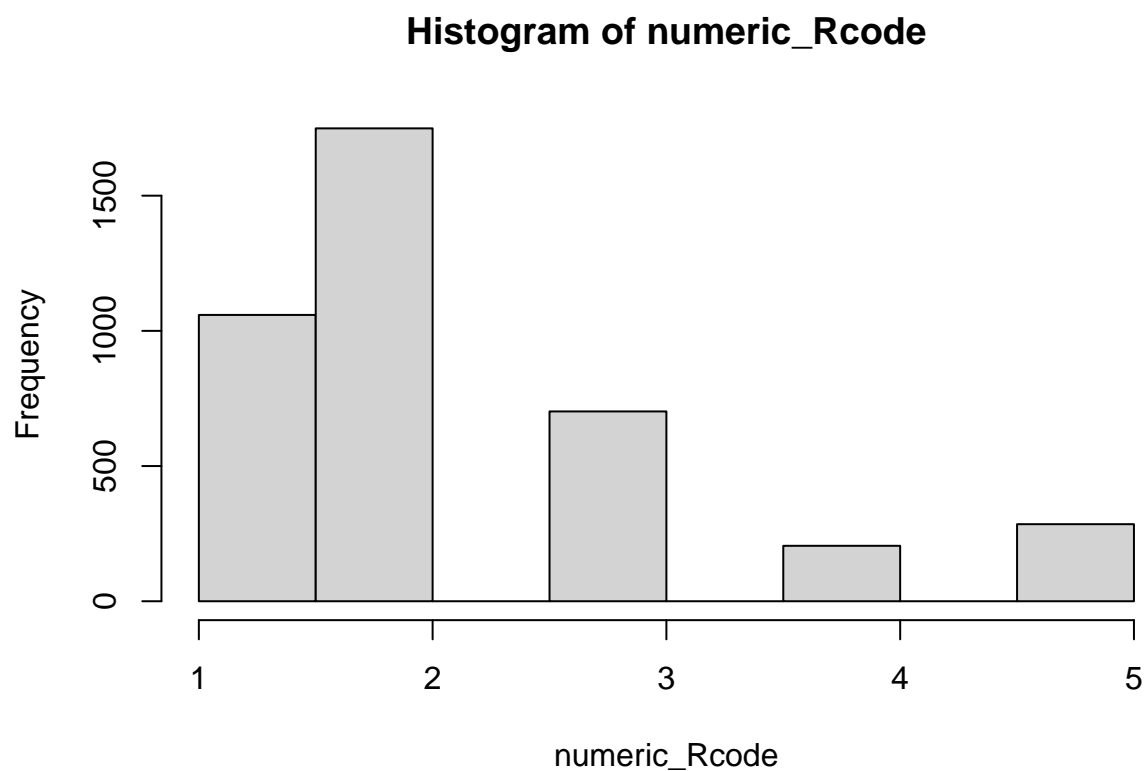

```
cbc_df$Florence=factor(cbc_df$Florence, labels=c("TRUE","FALSE"))
F_R_T=cbc_df$R[which(cbc_df$Florence=="TRUE")]
F_R_F=cbc_df$R[which(cbc_df$Florence=="FALSE")]
boxplot(F_R_T,F_R_F,horizontal = TRUE,xlab="R",ylab="Florence",names = c("TRUE","FALSE"))
```
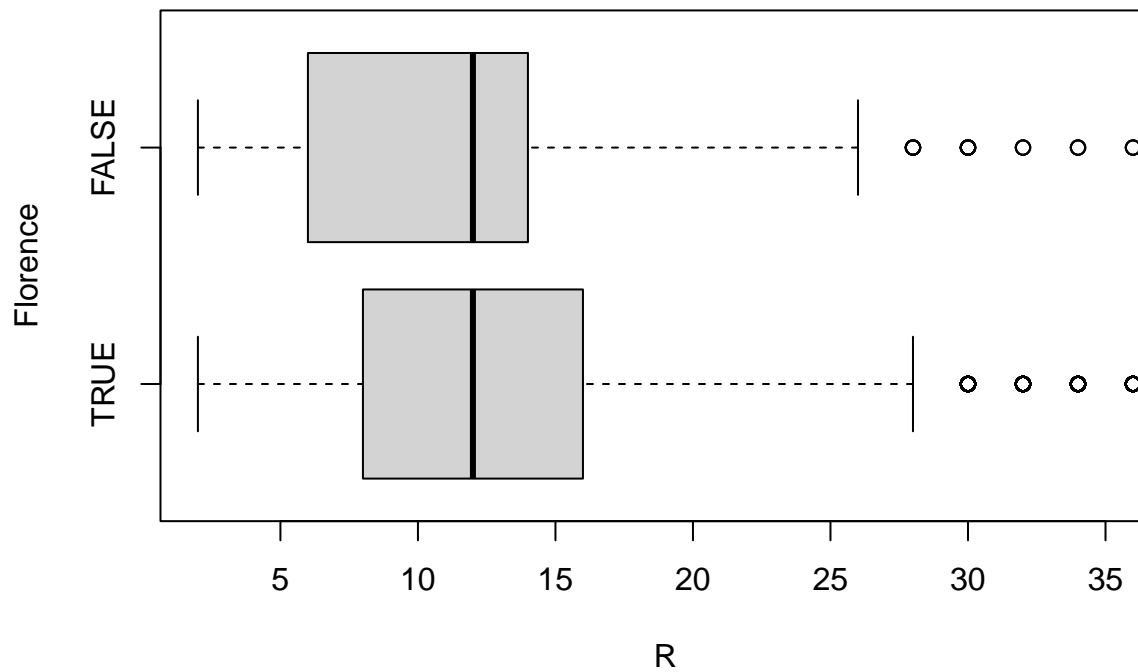
4.2 Box Plot (1 point)

```
F_M_T=cbc_df$M[which(cbc_df$Florence=="TRUE")]
F_M_F=cbc_df$M[which(cbc_df$Florence=="FALSE")]
boxplot(F_M_T,F_M_F,horizontal = TRUE,xlab="M",ylab="Florence",names = c("TRUE","FALSE"))
```

Florence

M
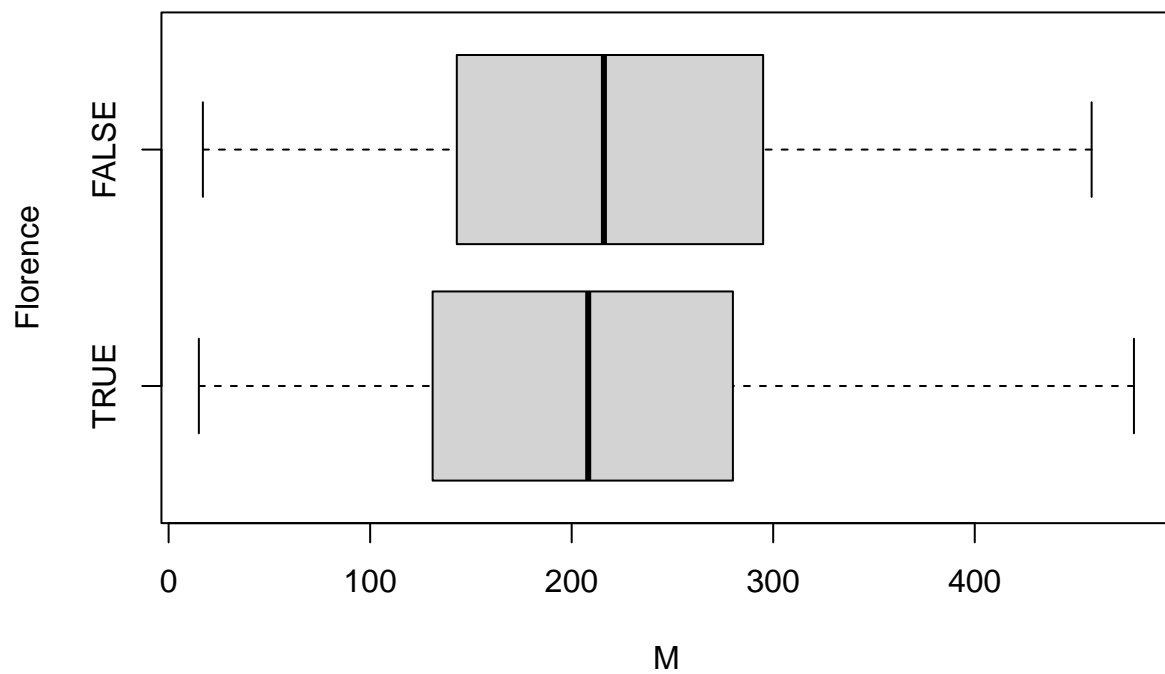
```
F_First_T=cbc_df$FirstPurch[which(cbc_df$Florence=="TRUE")]
F_First_F=cbc_df$FirstPurch[which(cbc_df$Florence=="FALSE")]
boxplot(F_First_T,F_First_F,horizontal = TRUE,xlab="FirstPurch",ylab="Florence",names = c("TRUE","FALSE
```
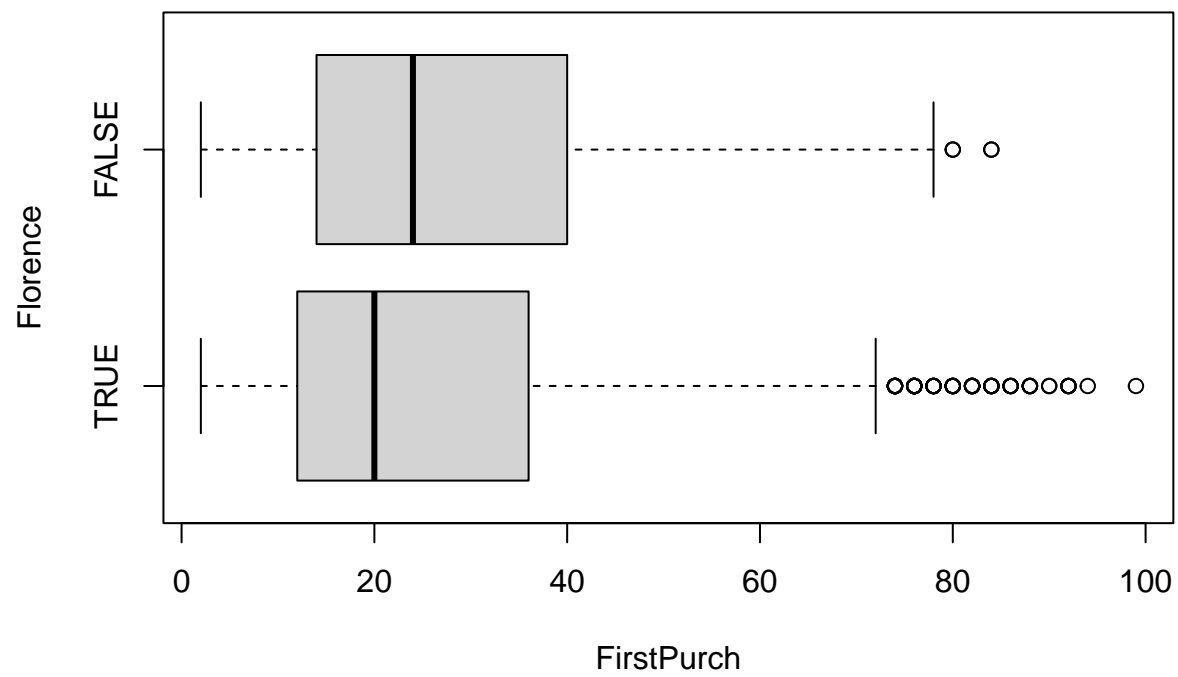
```
plot(density(cbc_df$R),main="Recency")
```

Recency

N = 4000   Bandwidth = 1.023
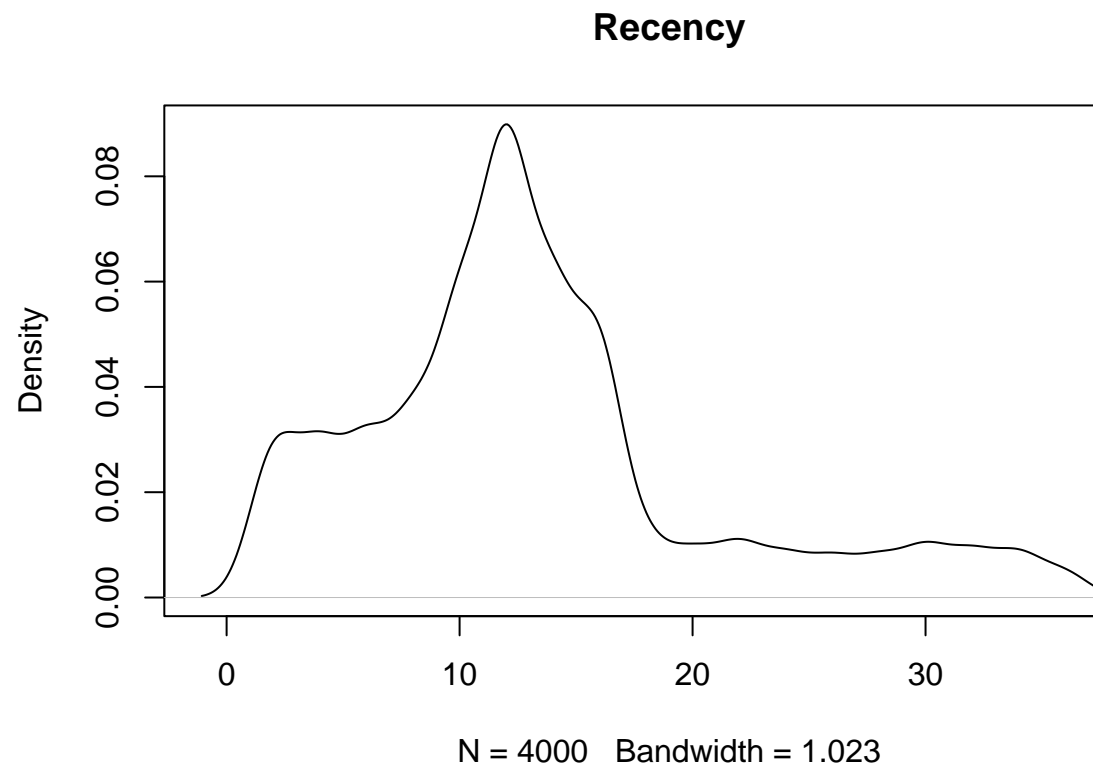
4.3 Density Plot (1 point)

```
plot(density(cbc_df$F),main="Frequency")
```

Frequency

N = 4000   Bandwidth = 0.5801
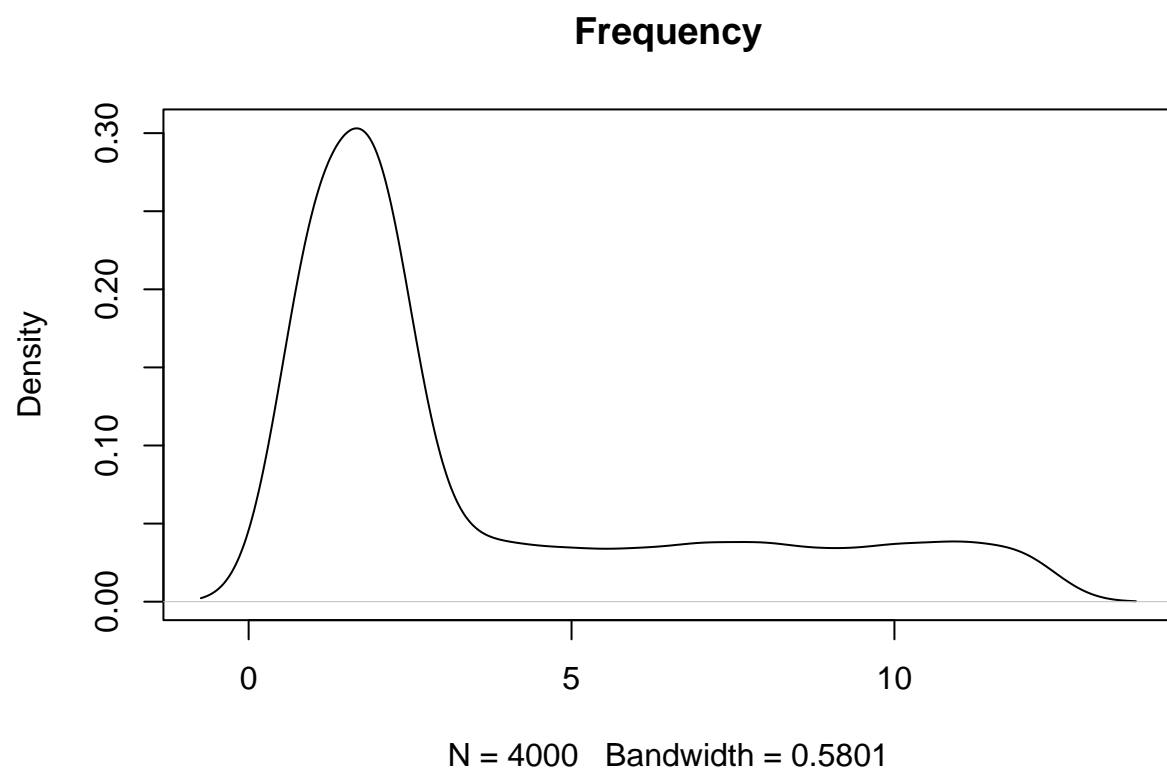
```
plot(density(cbc_df$M),main="Monetary")
```

Monetary

Density

N = 4000   Bandwidth = 17.09
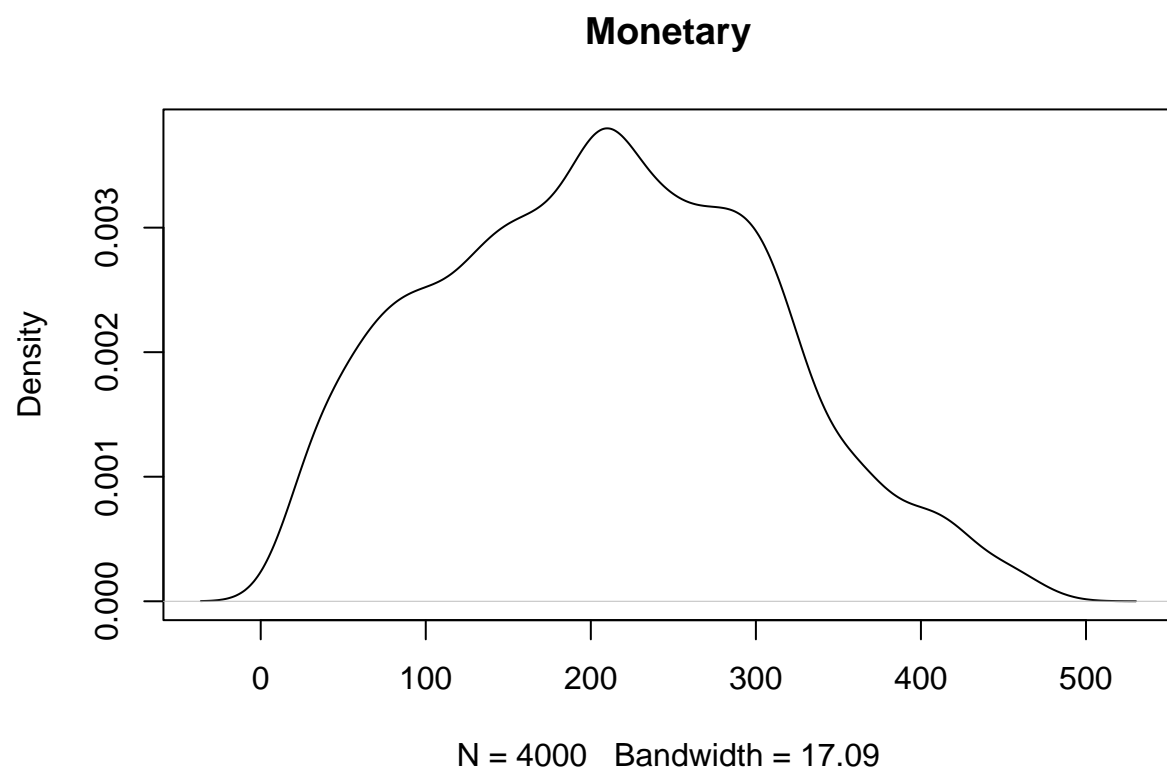
```
plot(density(cbc_df$FirstPurch),main="FirstPurch")
```

FirstPurch

N = 4000   Bandwidth = 3.069
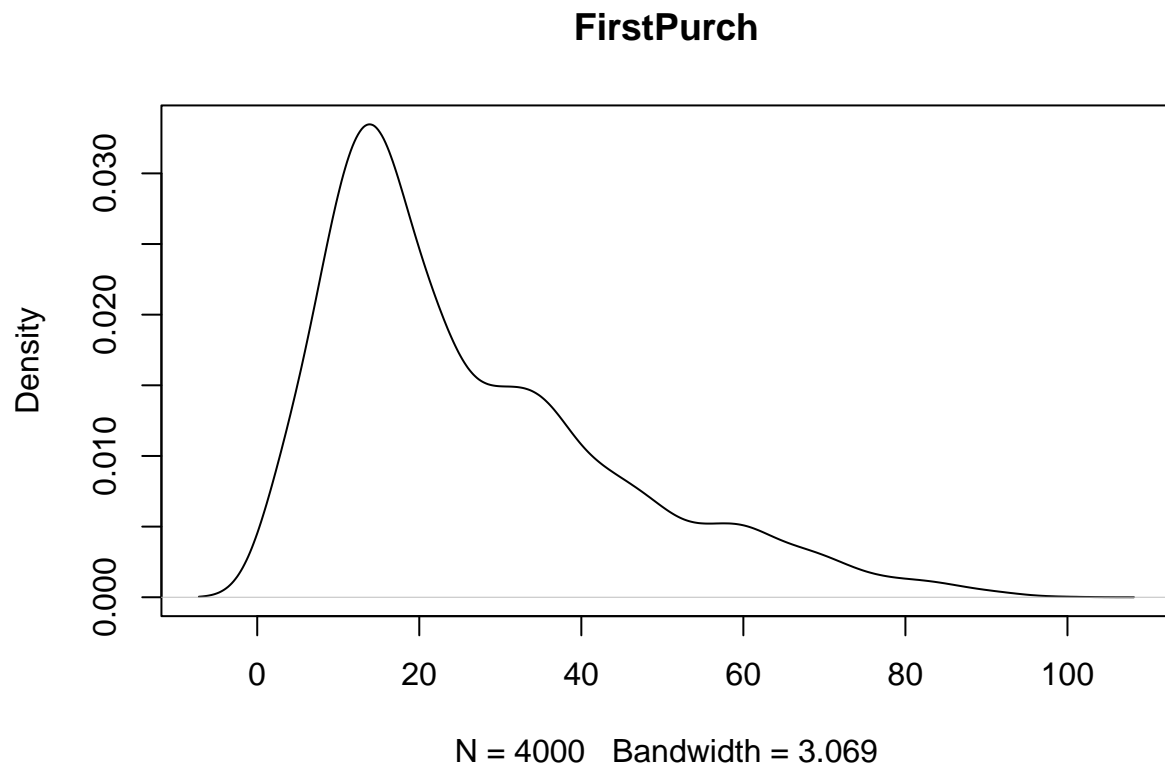
Part II. ANOVA

Problems

Problem 1 (2 points)

```r
library(ggpubr)
library(dplyr)
library(ggplot2)
library(ggpubr)
library(broom)
library(car)
```

```
## Loading required package: carData
```

```
##
## Attaching package: 'car'
```

```
## The following object is masked from 'package:dplyr':
##
##     recode
```

```
## The following object is masked from 'package:purrr':
##
##     some
```

```
data <- read.csv('C:\\Users\\HP\\Desktop\\PESU\\SEM - 5\\PES1UG20CS445\\DA\\1_b\\Scenario 1.csv')
anova_1 <- aov(No.of.items ~ POI, data = data)
summary(anova_1)
```

```
##              Df Sum Sq Mean Sq F value Pr(>F)
## POI           4    127   31.75   1.025  0.393
## Residuals   995  30827   30.98
```

Analysis:

1.. Scully can use one-way ANOVA Test, because we are analyzing a single independent variable.

2.. aov() is a function used by Scully for ANOVA in R programming

3..NULL HYPOTHESIS : It states that the means are the same.

ALTERNATE HYPOTHESIS : It states that the means of every group is different.

Output: Since the P-Vaue is greater than alpha(5%).We accept the NULL Hypothesis, which means that there is no difference between the means .

Problem 2 (3 points)

```
data=read.csv('C:\\Users\\HP\\Desktop\\PESU\\SEM - 5\\PES1UG20CS445\\DA\\1_b\\Scenario 2.csv')
anova_2=aov(No.of.items ~ POI*Priority,data=data)
summary(anova_2)
```

```
##               Df Sum Sq Mean Sq F value   Pr(>F)
## POI            4    317   79.29   2.880   0.0218 *
## Priority       4    690  172.53   6.268 5.57e-05 ***
## POI:Priority  16    347   21.66   0.787   0.7019
## Residuals    975  26839   27.53
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Analysis:

1.. We choose two-way ANOVA because there are two independent variables 2.. aov() function is used in R programming to find the AVOVA 3.. NULL HYPOTHESIS: the means are the same ALTERNATE HYPOTHESIS : the means are different ouput : Since the P-value is very less then the alpha(5%) value, we reject the NULL Hypothesis. 4..Global mean is not considered

Problem 3 (1 point)

```
HSD=TukeyHSD(anova_2)
HSD
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = No.of.items ~ POI * Priority, data = data)
##
## $POI
##                          diff         lwr       upr      p adj
## Fredo-Apollonia    -1.16541489 -3.527882256 1.1970525 0.6610398
## Micheal-Apollonia   0.97971301 -2.046113871 4.0055399 0.9025238
```

```
## Sonny-Apollonia    -0.07537018 -2.350096344 2.1993560 0.9999848
## Vito-Apollonia     -0.74221825 -3.264671502 1.7802350 0.9293713
## Micheal-Fredo       2.14512791 -0.129588606 4.4198444 0.0753886
## Sonny-Fredo         1.09004471 -0.002240047 2.1823295 0.0507698
## Vito-Fredo          0.42319665 -1.120006939 1.9664002 0.9446478
## Sonny-Micheal      -1.05508319 -3.238535117 1.1283687 0.6784431
## Vito-Micheal       -1.72193126 -4.162393022 0.7185305 0.3029361
## Vito-Sonny         -0.66684807 -2.072054240 0.7383581 0.6932090
##
## $Priority
##                       diff        lwr        upr     p adj
## high-critical  -3.4375139 -5.6024538 -1.2725741 0.0001534
## low-critical   -1.9212087 -3.2006497 -0.6417676 0.0004230
## med-critical   -1.5518320 -2.9759071 -0.1277569 0.0247330
## None-critical  -1.7809723 -4.1230935  0.5611489 0.2303819
## low-high        1.5163053 -0.4634213  3.4960319 0.2237743
## med-high        1.8856819 -0.1904534  3.9618172 0.0954896
## None-high       1.6565416 -1.1305500  4.4436332 0.4820853
## med-low         0.3693766 -0.7532733  1.4920265 0.8972243
## None-low        0.1402363 -2.0318328  2.3123055 0.9997831
## None-med       -0.2291403 -2.4894290  2.0311484 0.9987096
##
## $`POI:Priority`
##                                          diff         lwr         upr
## Fredo:critical-Apollonia:critical  -1.8571428571 -10.257712   6.5434260
## Micheal:critical-Apollonia:critical -1.0333333333 -12.688650  10.6219830
## Sonny:critical-Apollonia:critical   -0.9251700680  -9.020161   7.1698207
## Vito:critical-Apollonia:critical    -1.1333333333 -10.092846   7.8261796
## Apollonia:high-Apollonia:critical   -8.8333333333 -29.623681  11.9570139
## Fredo:high-Apollonia:critical       -4.9583333333 -13.743859   3.8271919
## Micheal:high-Apollonia:critical     -4.8333333333 -20.549359  10.8826920
## Sonny:high-Apollonia:critical       -4.4487179487 -13.166400   4.2689644
## Vito:high-Apollonia:critical        -4.5000000000 -15.612908   6.6129081
## Apollonia:low-Apollonia:critical    -3.8333333333 -12.792846   5.1261796
## Fredo:low-Apollonia:critical        -3.7655367232 -11.820852   4.2897789
## Micheal:low-Apollonia:critical      -0.9242424242  -9.789276   7.9407914
## Sonny:low-Apollonia:critical        -2.7088353414 -10.660959   5.2432886
## Vito:low-Apollonia:critical         -3.6770833333 -11.895190   4.5410230
## Apollonia:med-Apollonia:critical     0.0952380952  -9.296883   9.4873596
## Fredo:med-Apollonia:critical        -3.6236559140 -11.853116   4.6058040
## Micheal:med-Apollonia:critical      -0.8333333333 -10.131059   8.4643926
## Sonny:med-Apollonia:critical        -2.5613333333 -10.605728   5.4830613
## Vito:med-Apollonia:critical         -3.3787878788 -11.921348   5.1637725
## Apollonia:None-Apollonia:critical   -8.3333333333 -24.049359   7.3826920
## Fredo:None-Apollonia:critical       -3.2878787879 -13.056670   6.4809127
## Micheal:None-Apollonia:critical     -5.5000000000 -19.110477   8.1104772
## Sonny:None-Apollonia:critical       -2.5933333333 -11.343646   6.1569792
## Vito:None-Apollonia:critical        -0.6904761905 -11.399142  10.0181900
## Micheal:critical-Fredo:critical      0.8238095238  -8.282190   9.9298092
## Sonny:critical-Fredo:critical        0.9319727891  -2.617915   4.4818611
## Vito:critical-Fredo:critical         0.7238095238  -4.505502   5.9531215
## Apollonia:high-Fredo:critical       -6.9761904762 -26.452108  12.4997273
## Fredo:high-Fredo:critical           -3.1011904762  -8.026461   1.8240796
## Micheal:high-Fredo:critical         -2.9761904762 -16.906958  10.9545770
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23

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## Sonny:high-Fredo:critical       -2.5915750916  -7.394784   2.2116339
## Vito:high-Fredo:critical         -2.6428571429 -11.043426   5.7577117
## Apollonia:low-Fredo:critical     -1.9761904762  -7.205502   3.2531215
## Fredo:low-Fredo:critical         -1.9083938660  -5.366853   1.5500656
## Micheal:low-Fredo:critical        0.9329004329  -4.132833   5.9986341
## Sonny:low-Fredo:critical         -0.8516924842  -4.062472   2.3590873
## Vito:low-Fredo:critical          -1.8199404762  -5.642257   2.0023761
## Apollonia:med-Fredo:critical      1.9523809524  -3.987718   7.8924802
## Fredo:med-Fredo:critical         -1.7665130568  -5.613179   2.0801534
## Micheal:med-Fredo:critical        1.0238095238  -4.765883   6.8135021
## Sonny:med-Fredo:critical         -0.7041904762  -4.137136   2.7287552
## Vito:med-Fredo:critical          -1.5216450216  -5.999163   2.9558732
## Apollonia:None-Fredo:critical    -6.4761904762 -20.406958   7.4545770
## Fredo:None-Fredo:critical        -1.4307359307  -7.950101   5.0886291
## Micheal:None-Fredo:critical      -3.6428571429 -15.145810   7.8600955
## Sonny:None-Fredo:critical        -0.7361904762  -5.598371   4.1259903
## Vito:None-Fredo:critical          1.1666666667  -6.691346   9.0246793
## Sonny:critical-Micheal:critical   0.1081632653  -8.716719   8.9330456
## Vito:critical-Micheal:critical   -0.1000000000  -9.724061   9.5240607
## Apollonia:high-Micheal:critical  -7.8000000000 -28.885261  13.2852605
## Fredo:high-Micheal:critical      -3.9250000000 -13.387300   5.5373003
## Micheal:high-Micheal:critical    -3.8000000000 -19.904134  12.3041338
## Sonny:high-Micheal:critical      -3.4153846154 -12.814728   5.9839589
## Vito:high-Micheal:critical       -3.4666666667 -15.121983   8.1886496
## Apollonia:low-Micheal:critical   -2.8000000000 -12.424061   6.8240607
## Fredo:low-Micheal:critical       -2.7322033898 -11.520706   6.0562995
## Micheal:low-Micheal:critical      0.1090909091  -9.427077   9.6452588
## Sonny:low-Micheal:critical       -1.6755020080 -10.369520   7.0185159
## Vito:low-Micheal:critical        -2.6437500000 -11.581700   6.2941997
## Apollonia:med-Micheal:critical    1.1285714286  -8.899470  11.1566131
## Fredo:med-Micheal:critical       -2.5903225806 -11.538713   6.3580674
## Micheal:med-Micheal:critical      0.2000000000  -9.739687  10.1396871
## Sonny:med-Micheal:critical       -1.5280000000 -10.306494   7.2504940
## Vito:med-Micheal:critical        -2.3454545455 -11.582608   6.8916993
## Apollonia:None-Micheal:critical  -7.3000000000 -23.404134   8.8041338
## Fredo:None-Micheal:critical      -2.2545454545 -12.636210   8.1271192
## Micheal:None-Micheal:critical    -4.4666666667 -18.523507   9.5901737
## Sonny:None-Micheal:critical      -1.5600000000 -10.989615   7.8696152
## Vito:None-Micheal:critical        0.3428571429 -10.927689  11.6134030
## Vito:critical-Sonny:critical     -0.2081632653  -4.930982   4.5146559
## Apollonia:high-Sonny:critical    -7.9081632653 -27.254240  11.4379136
## Fredo:high-Sonny:critical        -4.0331632653  -8.416952   0.3506254
## Micheal:high-Sonny:critical      -3.9081632653 -17.656821   9.8404949
## Sonny:high-Sonny:critical        -3.5235478807  -7.769738   0.7226427
## Vito:high-Sonny:critical         -3.5748299320 -11.669821   4.5201608
## Apollonia:low-Sonny:critical     -2.9081632653  -7.630982   1.8146559
## Fredo:low-Sonny:critical         -2.8403666551  -5.471005  -0.2097281
## Micheal:low-Sonny:critical        0.0009276438  -4.540105   4.5419600
## Sonny:low-Sonny:critical         -1.7836652733  -4.078970   0.5116396
## Vito:low-Sonny:critical          -2.7519132653  -5.845361   0.3415348
## Apollonia:med-Sonny:critical      1.0204081633  -4.479055   6.5198714
## Fredo:med-Sonny:critical         -2.6984858460  -5.821971   0.4249994
## Micheal:med-Sonny:critical        0.0918367347  -5.244816   5.4284890
## Sonny:med-Sonny:critical         -1.6361632653  -4.233168   0.9608414
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## Vito:med-Sonny:critical           -2.4536178108  -6.327568   1.4203320
## Apollonia:None-Sonny:critical      -7.4081632653 -21.156821   6.3404949
## Fredo:None-Sonny:critical          -2.3627087199  -8.483284   3.7578662
## Micheal:None-Sonny:critical        -4.5748299320 -15.856551   6.7068915
## Sonny:None-Sonny:critical          -1.6681632653  -5.980949   2.6446223
## Vito:None-Sonny:critical            0.2346938776  -7.295756   7.7651441
## Apollonia:high-Vito:critical       -7.7000000000 -27.423455  12.0234552
## Fredo:high-Vito:critical           -3.8250000000  -9.652658   2.0026582
## Micheal:high-Vito:critical         -3.7000000000 -17.974789  10.5747889
## Sonny:high-Vito:critical           -3.3153846154  -9.040254   2.4094849
## Vito:high-Vito:critical            -3.3666666667 -12.326180   5.5928462
## Apollonia:low-Vito:critical        -2.7000000000  -8.786790   3.3867904
## Fredo:low-Vito:critical            -2.6322033898  -7.286691   2.0222843
## Micheal:low-Vito:critical           0.2090909091  -5.737755   6.1559364
## Sonny:low-Vito:critical            -1.5755020080  -6.049026   2.8980225
## Vito:low-Vito:critical             -2.5437500000  -7.474614   2.3871138
## Apollonia:med-Vito:critical         1.2285714286  -5.478745   7.9358878
## Fredo:med-Vito:critical            -2.4903225806  -7.440086   2.4594407
## Micheal:med-Vito:critical           0.3000000000  -6.274485   6.8744851
## Sonny:med-Vito:critical            -1.4280000000  -6.063561   3.2075615
## Vito:med-Vito:critical             -2.2454545455  -7.699947   3.2090375
## Apollonia:None-Vito:critical       -7.2000000000 -21.474789   7.0747889
## Fredo:None-Vito:critical           -2.1545454545  -9.379878   5.0707873
## Micheal:None-Vito:critical         -4.3666666667 -16.283933   7.5505996
## Sonny:None-Vito:critical           -1.4600000000  -7.234436   4.3144364
## Vito:None-Vito:critical             0.4428571429  -8.010052   8.8957665
## Fredo:high-Apollonia:high           3.8750000000 -15.770032  23.5200316
## Micheal:high-Apollonia:high         4.0000000000 -19.574038  27.5740380
## Sonny:high-Apollonia:high           4.3846153846 -15.230170  23.9994006
## Vito:high-Apollonia:high            4.3333333333 -16.457014  25.1236806
## Apollonia:low-Apollonia:high        5.0000000000 -14.723455  24.7234552
## Fredo:low-Apollonia:high            5.0677966102 -14.261713  24.3973058
## Micheal:low-Apollonia:high          7.9090909091 -11.771627  27.5898084
## Sonny:low-Apollonia:high            6.1244979920 -13.162236  25.4112315
## Vito:low-Apollonia:high             5.1562500000 -14.241664  24.5541645
## Apollonia:med-Apollonia:high        8.9285714286 -10.995127  28.8522699
## Fredo:med-Apollonia:high            5.2096774194 -14.193050  24.6124047
## Micheal:med-Apollonia:high          8.0000000000 -11.879374  27.8793743
## Sonny:med-Apollonia:high            6.2720000000 -13.052961  25.5969605
## Vito:med-Apollonia:high             5.4545454545 -14.083038  24.9921285
## Apollonia:None-Apollonia:high       0.5000000000 -23.074038  24.0740380
## Fredo:None-Apollonia:high           5.5454545455 -14.558553  25.6494617
## Micheal:None-Apollonia:high         3.3333333333 -18.892483  25.5591495
## Sonny:None-Apollonia:high           6.2400000000 -13.389309  25.8693093
## Vito:None-Apollonia:high            8.1428571429 -12.434250  28.7199645
## Micheal:high-Fredo:high             0.1250000000 -14.041234  14.2912338
## Sonny:high-Fredo:high               0.5096153846  -4.938936   5.9581668
## Vito:high-Fredo:high                0.4583333333  -8.327192   9.2438586
## Apollonia:low-Fredo:high            1.1250000000  -4.702658   6.9526582
## Fredo:low-Fredo:high                1.1927966102  -3.117289   5.5028822
## Micheal:low-Fredo:high              4.0340909091  -1.647243   9.7154247
## Sonny:low-Fredo:high                2.2494979920  -1.864503   6.3634989
## Vito:low-Fredo:high                 1.2812500000  -3.325918   5.8884183
## Apollonia:med-Fredo:high            5.0535714286  -1.419502  11.5266445
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## Fredo:med-Fredo:high            1.3346774194  -3.292713  5.9620675
## Micheal:med-Fredo:high          4.1250000000  -2.210332 10.4603323
## Sonny:med-Fredo:high            2.3970000000  -1.892640  6.6866401
## Vito:med-Fredo:high             1.5795454545  -3.584181  6.7432714
## Apollonia:None-Fredo:high      -3.3750000000 -17.541234 10.7912338
## Fredo:None-Fredo:high           1.6704545455  -5.337970  8.6788792
## Micheal:None-Fredo:high        -0.5416666667 -12.328686 11.2453523
## Sonny:None-Fredo:high           2.3650000000  -3.135609  7.8656089
## Vito:None-Fredo:high            4.2678571429  -4.000411 12.5361253
## Sonny:high-Micheal:high         0.3846153846 -13.739644 14.5088750
## Vito:high-Micheal:high          0.3333333333 -15.382692 16.0493586
## Apollonia:low-Micheal:high      1.0000000000 -13.274789 15.2747889
## Fredo:low-Micheal:high          1.0677966102 -12.657539 14.7931322
## Micheal:low-Micheal:high        3.9090909091 -10.306589 18.1247707
## Sonny:low-Micheal:high          2.1244979920 -11.540530 15.7895264
## Vito:low-Micheal:high           1.1562500000 -12.665255 14.9777549
## Apollonia:med-Micheal:high      4.9285714286  -9.621641 19.4787835
## Fredo:med-Micheal:high          1.2096774194 -12.618581 15.0379360
## Micheal:med-Micheal:high        4.0000000000 -10.489459 18.4894594
## Sonny:med-Micheal:high          2.2720000000 -11.446929 15.9909289
## Vito:med-Micheal:high           1.4545454545 -12.562304 15.4713947
## Apollonia:None-Micheal:high    -3.5000000000 -22.748121 15.7481214
## Fredo:None-Micheal:high         1.5454545455 -13.250694 16.3416032
## Micheal:None-Micheal:high      -0.6666666667 -18.237717 16.9043838
## Sonny:None-Micheal:high         2.2400000000 -11.904423 16.3844228
## Vito:None-Micheal:high          4.1428571429 -11.289973 19.5756876
## Vito:high-Sonny:high           -0.0512820513  -8.768964  8.6664003
## Apollonia:low-Sonny:high        0.6153846154  -5.109485  6.3402541
## Fredo:low-Sonny:high            0.6831812256  -3.486875  4.8532375
## Micheal:low-Sonny:high          3.5244755245  -2.051373  9.1003239
## Sonny:low-Sonny:high            1.7398826074  -2.227174  5.7069388
## Vito:low-Sonny:high             0.7716346154  -3.704807  5.2480764
## Apollonia:med-Sonny:high        4.5439560440  -1.836734 10.9246462
## Fredo:med-Sonny:high            0.8250620347  -3.672189  5.3223134
## Micheal:med-Sonny:high          3.6153846154  -2.625526  9.8562954
## Sonny:med-Sonny:high            1.8873846154  -2.261536  6.0363054
## Vito:med-Sonny:high             1.0699300699  -3.977505  6.1173648
## Apollonia:None-Sonny:high      -3.8846153846 -18.008875 10.2396443
## Fredo:None-Sonny:high           1.1608391608  -5.762350  8.0840283
## Micheal:None-Sonny:high        -1.0512820513 -12.787821 10.6852570
## Sonny:None-Sonny:high           1.8553846154  -3.536204  7.2469734
## Vito:None-Sonny:high            3.7582417582  -4.437903 11.9543866
## Apollonia:low-Vito:high         0.6666666667  -8.292846  9.6261796
## Fredo:low-Vito:high             0.7344632768  -7.320852  8.7897789
## Micheal:low-Vito:high           3.5757575758  -5.289276 12.4407914
## Sonny:low-Vito:high             1.7911646586  -6.160959  9.7432886
## Vito:low-Vito:high              0.8229166667  -7.395190  9.0410230
## Apollonia:med-Vito:high         4.5952380952  -4.796883 13.9873596
## Fredo:med-Vito:high             0.8763440860  -7.353116  9.1058040
## Micheal:med-Vito:high           3.6666666667  -5.631059 12.9643926
## Sonny:med-Vito:high             1.9386666667  -6.105728  9.9830613
## Vito:med-Vito:high              1.1212121212  -7.421348  9.6637725
## Apollonia:None-Vito:high       -3.8333333333 -19.549359 11.8826920
## Fredo:None-Vito:high            1.2121212121  -8.556670 10.9809127
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## Micheal:None-Vito:high            -1.0000000000 -14.610477 12.6104772
## Sonny:None-Vito:high               1.9066666667  -6.843646 10.6569792
## Vito:None-Vito:high                3.8095238095  -6.899142 14.5181900
## Fredo:low-Apollonia:low            0.0677966102  -4.586691  4.7222843
## Micheal:low-Apollonia:low          2.9090909091  -3.037755  8.8559364
## Sonny:low-Apollonia:low            1.1244979920  -3.349026  5.5980225
## Vito:low-Apollonia:low             0.1562500000  -4.774614  5.0871138
## Apollonia:med-Apollonia:low        3.9285714286  -2.778745 10.6358878
## Fredo:med-Apollonia:low            0.2096774194  -4.740086  5.1594407
## Micheal:med-Apollonia:low          3.0000000000  -3.574485  9.5744851
## Sonny:med-Apollonia:low            1.2720000000  -3.363561  5.9075615
## Vito:med-Apollonia:low             0.4545454545  -4.999947  5.9090375
## Apollonia:None-Apollonia:low       -4.5000000000 -18.774789  9.7747889
## Fredo:None-Apollonia:low           0.5454545455  -6.679878  7.7707873
## Micheal:None-Apollonia:low         -1.6666666667 -13.583933 10.2505996
## Sonny:None-Apollonia:low           1.2400000000  -4.534436  7.0144364
## Vito:None-Apollonia:low            3.1428571429  -5.310052 11.5957665
## Micheal:low-Fredo:low              2.8412942989  -1.628629  7.3112171
## Sonny:low-Fredo:low                1.0567013818  -1.094498  3.2079010
## Vito:low-Fredo:low                 0.0884533898  -2.899632  3.0765391
## Apollonia:med-Fredo:low            3.8607748184  -1.580120  9.3016692
## Fredo:med-Fredo:low                0.1418808092  -2.877290  3.1610521
## Micheal:med-Fredo:low              2.9322033898  -2.344073  8.2084798
## Sonny:med-Fredo:low                1.2042033898  -1.266357  3.6747638
## Vito:med-Fredo:low                 0.3867488444  -3.403597  4.1770948
## Apollonia:None-Fredo:low           -4.5677966102 -18.293132  9.1575389
## Fredo:None-Fredo:low               0.4776579353  -5.590346  6.5456619
## Micheal:None-Fredo:low             -1.7344632768 -12.987750  9.5188239
## Sonny:None-Fredo:low               1.1722033898  -3.065644  5.4100512
## Vito:None-Fredo:low                3.0750605327  -4.412724 10.5628449
## Sonny:low-Micheal:low              -1.7845929171  -6.065758  2.4965722
## Vito:low-Micheal:low               -2.7528409091  -7.509875  2.0041930
## Apollonia:med-Micheal:low          1.0194805195  -5.561101  7.6000615
## Fredo:med-Micheal:low              -2.6994134897  -7.476035  2.0772078
## Micheal:med-Micheal:low            0.0909090909  -6.354229  6.5360474
## Sonny:med-Micheal:low              -1.6370909091  -6.087303  2.8131208
## Vito:med-Micheal:low               -2.4545454545  -7.752417  2.8433256
## Apollonia:None-Micheal:low         -7.4090909091 -21.624771  6.8065889
## Fredo:None-Micheal:low             -2.3636363636  -9.471476  4.7442035
## Micheal:None-Micheal:low           -4.5757575758 -16.422157  7.2706422
## Sonny:None-Micheal:low             -1.6690909091  -7.295819  3.9576372
## Vito:None-Micheal:low              0.2337662338  -8.118936  8.5864682
## Vito:low-Sonny:low                 -0.9682479920  -3.665806  1.7293104
## Apollonia:med-Sonny:low            2.8040734366  -2.482844  8.0909909
## Fredo:med-Sonny:low                -0.9148205726  -3.646772  1.8171312
## Micheal:med-Sonny:low              1.8755020080  -3.241847  6.9928507
## Sonny:med-Sonny:low                0.1475020080  -1.962435  2.2574389
## Vito:med-Sonny:low                 -0.6699525374  -4.235747  2.8958415
## Apollonia:None-Sonny:low           -5.6244979920 -19.289526  8.0405304
## Fredo:None-Sonny:low               -0.5790434465  -6.509375  5.3512885
## Micheal:None-Sonny:low             -2.7911646586 -13.970818  8.3884882
## Sonny:None-Sonny:low               0.1155020080  -3.922755  4.1537590
## Vito:None-Sonny:low                2.0183591509  -5.358299  9.3950170
## Apollonia:med-Vito:low             3.7723214286  -1.906806  9.4514493
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## Fredo:med-Vito:low               0.0534274194  -3.376523   3.4833774
## Micheal:med-Vito:low             2.8437500000  -2.677867   8.3653670
## Sonny:med-Vito:low               1.1157500000  -1.842768   4.0742683
## Vito:med-Vito:low                0.2982954545  -3.826736   4.4233269
## Apollonia:None-Vito:low         -4.6562500000 -18.477755   9.1652549
## Fredo:None-Vito:low              0.3892045455  -5.893298   6.6717068
## Micheal:None-Vito:low           -1.8229166667 -13.193301   9.5474674
## Sonny:None-Vito:low              1.0837500000  -3.455910   5.6234104
## Vito:None-Vito:low               2.9866071429  -4.676035  10.6492488
## Fredo:med-Apollonia:med         -3.7188940092  -9.414439   1.9766509
## Micheal:med-Apollonia:med       -0.9285714286  -8.081398   6.2242552
## Sonny:med-Apollonia:med         -2.6565714286  -8.081284   2.7681411
## Vito:med-Apollonia:med          -3.4740259740  -9.613290   2.6652378
## Apollonia:None-Apollonia:med    -8.4285714286 -22.978784   6.1216407
## Fredo:None-Apollonia:med        -3.3831168831 -11.138406   4.3721722
## Micheal:None-Apollonia:med      -5.5952380952 -17.841066   6.6505902
## Sonny:None-Apollonia:med        -2.6885714286  -9.113771   3.7366283
## Vito:None-Apollonia:med         -0.7857142857  -9.695863   8.1244345
## Micheal:med-Fredo:med            2.7903225806  -2.748178   8.3288236
## Sonny:med-Fredo:med              1.0623225806  -1.927589   4.0522339
## Vito:med-Fredo:med               0.2448680352  -3.902736   4.3924725
## Apollonia:None-Fredo:med        -4.7096774194 -18.537936   9.1185812
## Fredo:None-Fredo:med             0.3357771261  -5.961569   6.6331236
## Micheal:None-Fredo:med          -1.8763440860 -13.254937   9.5022487
## Sonny:None-Fredo:med             1.0303225806  -3.529859   5.5905041
## Vito:None-Fredo:med              2.9331797235  -4.741637  10.6079967
## Sonny:med-Micheal:med           -1.7280000000  -6.987588   3.5315881
## Vito:med-Micheal:med            -2.5454545455  -8.539311   3.4484023
## Apollonia:None-Micheal:med      -7.5000000000 -21.989459   6.9894594
## Fredo:None-Micheal:med          -2.4545454545 -10.095244   5.1861528
## Micheal:None-Micheal:med        -4.6666666667 -16.840248   7.5069142
## Sonny:None-Micheal:med          -1.7600000000  -8.046410   4.5264101
## Vito:None-Micheal:med            0.1428571429  -8.667734   8.9534481
## Vito:med-Sonny:med              -0.8174545455  -4.584535   2.9496261
## Apollonia:None-Sonny:med        -5.7720000000 -19.490929   7.9469289
## Fredo:None-Sonny:med            -0.7265454545  -6.780044   5.3269533
## Micheal:None-Sonny:med          -2.9386666667 -14.184139   8.3068056
## Sonny:None-Sonny:med            -0.0320000000  -4.249052   4.1850521
## Vito:None-Sonny:med              1.8708571429  -5.605177   9.3468915
## Apollonia:None-Vito:med         -4.9545454545 -18.971395   9.0623038
## Fredo:None-Vito:med              0.0909090909  -6.610427   6.7922448
## Micheal:None-Vito:med           -2.1212121212 -13.728266   9.4858418
## Sonny:None-Vito:med              0.7854545455  -4.318131   5.8890398
## Vito:None-Vito:med               2.6883116883  -5.321316  10.6979398
## Fredo:None-Apollonia:None        5.0454545455  -9.750694  19.8416032
## Micheal:None-Apollonia:None      2.8333333333 -14.737717  20.4043838
## Sonny:None-Apollonia:None        5.7400000000  -8.404423  19.8844228
## Vito:None-Apollonia:None         7.6428571429  -7.789973  23.0756876
## Micheal:None-Fredo:None         -2.2121212121 -14.749172  10.3249299
## Sonny:None-Fredo:None            0.6945454545  -6.269687   7.6587778
## Vito:None-Fredo:None             2.5974025974  -6.708944  11.9037495
## Sonny:None-Micheal:None          2.9066666667  -8.854130  14.6674631
## Vito:None-Micheal:None           4.8095238095  -8.472942  18.0919895
## Vito:None-Sonny:None             1.9028571429  -6.327986  10.1337001
```

```
##                                         p adj
## Fredo:critical-Apollonia:critical     1.0000000
## Micheal:critical-Apollonia:critical   1.0000000
## Sonny:critical-Apollonia:critical     1.0000000
## Vito:critical-Apollonia:critical      1.0000000
## Apollonia:high-Apollonia:critical     0.9981321
## Fredo:high-Apollonia:critical         0.9338284
## Micheal:high-Apollonia:critical       0.9999924
## Sonny:high-Apollonia:critical         0.9780080
## Vito:high-Apollonia:critical          0.9991044
## Apollonia:low-Apollonia:critical      0.9979278
## Fredo:low-Apollonia:critical          0.9927551
## Micheal:low-Apollonia:critical        1.0000000
## Sonny:low-Apollonia:critical          0.9999507
## Vito:low-Apollonia:critical           0.9960368
## Apollonia:med-Apollonia:critical      1.0000000
## Fredo:med-Apollonia:critical          0.9968462
## Micheal:med-Apollonia:critical        1.0000000
## Sonny:med-Apollonia:critical          0.9999855
## Vito:med-Apollonia:critical           0.9993823
## Apollonia:None-Apollonia:critical     0.9657925
## Fredo:None-Apollonia:critical         0.9999602
## Micheal:None-Apollonia:critical       0.9991328
## Sonny:None-Apollonia:critical         0.9999963
## Vito:None-Apollonia:critical          1.0000000
## Micheal:critical-Fredo:critical       1.0000000
## Sonny:critical-Fredo:critical         0.9999997
## Vito:critical-Fredo:critical          1.0000000
## Apollonia:high-Fredo:critical         0.9998810
## Fredo:high-Fredo:critical             0.8249665
## Micheal:high-Fredo:critical           1.0000000
## Sonny:high-Fredo:critical             0.9585717
## Vito:high-Fredo:critical              0.9999884
## Apollonia:low-Fredo:critical          0.9997057
## Fredo:low-Fredo:critical              0.9474043
## Micheal:low-Fredo:critical            1.0000000
## Sonny:low-Fredo:critical              0.9999996
## Vito:low-Fredo:critical               0.9907540
## Apollonia:med-Fredo:critical          0.9999741
## Fredo:med-Fredo:critical              0.9943061
## Micheal:med-Fredo:critical            1.0000000
## Sonny:med-Fredo:critical              1.0000000
## Vito:med-Fredo:critical               0.9999527
## Apollonia:None-Fredo:critical         0.9932746
## Fredo:None-Fredo:critical             1.0000000
## Micheal:None-Fredo:critical           0.9999869
## Sonny:None-Fredo:critical             1.0000000
## Vito:None-Fredo:critical              1.0000000
## Sonny:critical-Micheal:critical       1.0000000
## Vito:critical-Micheal:critical        1.0000000
## Apollonia:high-Micheal:critical       0.9997940
## Fredo:high-Micheal:critical           0.9987003
## Micheal:high-Micheal:critical         1.0000000
## Sonny:high-Micheal:critical           0.9998479
```

```
## Vito:high-Micheal:critical           0.9999960
## Apollonia:low-Micheal:critical        0.9999974
## Fredo:low-Micheal:critical            0.9999907
## Micheal:low-Micheal:critical          1.0000000
## Sonny:low-Micheal:critical            1.0000000
## Vito:low-Micheal:critical             0.9999964
## Apollonia:med-Micheal:critical        1.0000000
## Fredo:med-Micheal:critical            0.9999976
## Micheal:med-Micheal:critical          1.0000000
## Sonny:med-Micheal:critical            1.0000000
## Vito:med-Micheal:critical             0.9999998
## Apollonia:None-Micheal:critical       0.9952426
## Fredo:None-Micheal:critical           1.0000000
## Micheal:None-Micheal:critical         0.9999861
## Sonny:None-Micheal:critical           1.0000000
## Vito:None-Micheal:critical            1.0000000
## Vito:critical-Sonny:critical          1.0000000
## Apollonia:high-Sonny:critical         0.9989627
## Fredo:high-Sonny:critical             0.1229204
## Micheal:high-Sonny:critical           0.9999983
## Sonny:high-Sonny:critical             0.2831871
## Vito:high-Sonny:critical              0.9967116
## Apollonia:low-Sonny:critical          0.8536035
## Fredo:low-Sonny:critical              0.0178781
## Micheal:low-Sonny:critical            1.0000000
## Sonny:low-Sonny:critical              0.4181876
## Vito:low-Sonny:critical               0.1665849
## Apollonia:med-Sonny:critical          1.0000000
## Fredo:med-Sonny:critical              0.2115316
## Micheal:med-Sonny:critical            1.0000000
## Sonny:med-Sonny:critical              0.8241631
## Vito:med-Sonny:critical               0.8168239
## Apollonia:None-Sonny:critical         0.9591701
## Fredo:None-Sonny:critical             0.9995826
## Micheal:None-Sonny:critical           0.9990844
## Sonny:None-Sonny:critical             0.9995689
## Vito:None-Sonny:critical              1.0000000
## Apollonia:high-Vito:critical          0.9994990
## Fredo:high-Vito:critical              0.7622721
## Micheal:high-Vito:critical            0.9999997
## Sonny:high-Vito:critical              0.9149740
## Vito:high-Vito:critical               0.9997322
## Apollonia:low-Vito:critical           0.9964949
## Fredo:low-Vito:critical               0.9324808
## Micheal:low-Vito:critical             1.0000000
## Sonny:low-Vito:critical               0.9999113
## Vito:low-Vito:critical                0.9750053
## Apollonia:med-Vito:critical           1.0000000
## Fredo:med-Vito:critical               0.9814541
## Micheal:med-Vito:critical             1.0000000
## Sonny:med-Vito:critical               0.9999922
## Vito:med-Vito:critical                0.9988431
## Apollonia:None-Vito:critical          0.9808806
## Fredo:None-Vito:critical              0.9999958
```
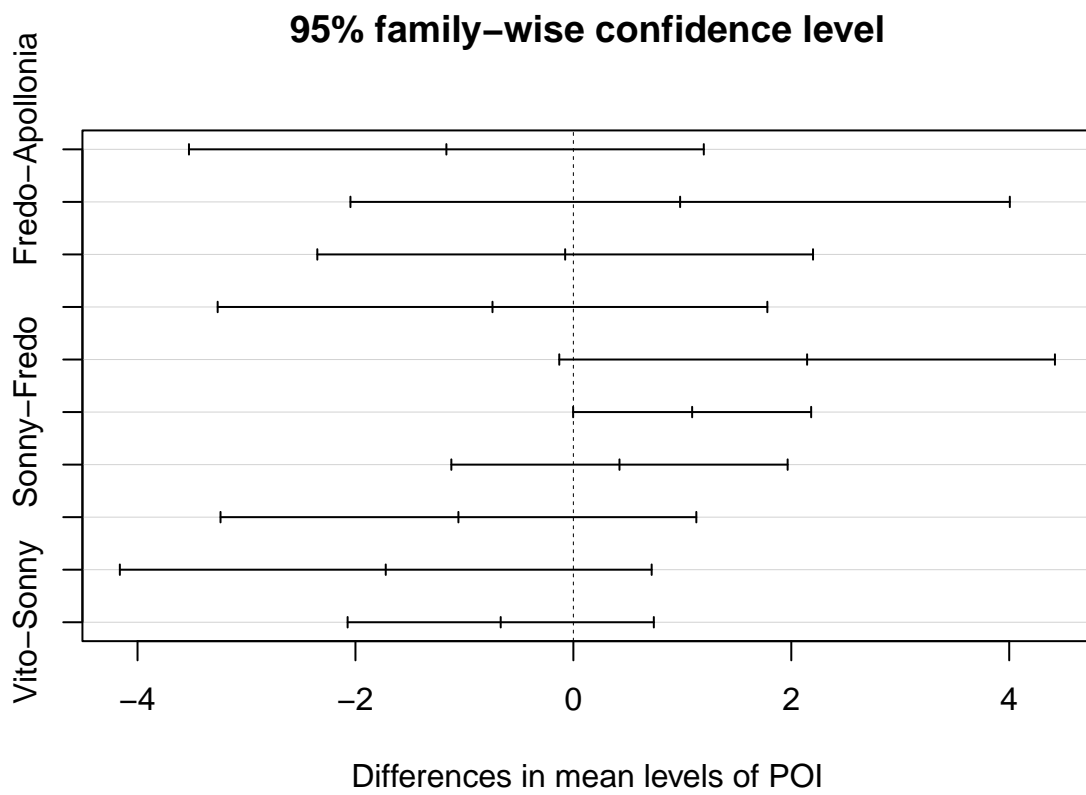
```
## Micheal:None-Vito:critical           0.9998246
## Sonny:None-Vito:critical             0.9999998
## Vito:None-Vito:critical              1.0000000
## Fredo:high-Apollonia:high            1.0000000
## Micheal:high-Apollonia:high          1.0000000
## Sonny:high-Apollonia:high            1.0000000
## Vito:high-Apollonia:high             1.0000000
## Apollonia:low-Apollonia:high         0.9999998
## Fredo:low-Apollonia:high             0.9999997
## Micheal:low-Apollonia:high           0.9992050
## Sonny:low-Apollonia:high             0.9999862
## Vito:low-Apollonia:high              0.9999996
## Apollonia:med-Apollonia:high         0.9959481
## Fredo:med-Apollonia:high             0.9999995
## Micheal:med-Apollonia:high           0.9991875
## Sonny:med-Apollonia:high             0.9999794
## Vito:med-Apollonia:high              0.9999988
## Apollonia:None-Apollonia:high        1.0000000
## Fredo:None-Apollonia:high            0.9999991
## Micheal:None-Apollonia:high          1.0000000
## Sonny:None-Apollonia:high            0.9999860
## Vito:None-Apollonia:high             0.9993773
## Micheal:high-Fredo:high              1.0000000
## Sonny:high-Fredo:high                1.0000000
## Vito:high-Fredo:high                 1.0000000
## Apollonia:low-Fredo:high             1.0000000
## Fredo:low-Fredo:high                 0.9999990
## Micheal:low-Fredo:high               0.6138533
## Sonny:low-Fredo:high                 0.9522111
## Vito:low-Fredo:high                  0.9999989
## Apollonia:med-Fredo:high             0.4081536
## Fredo:med-Fredo:high                 0.9999978
## Micheal:med-Fredo:high               0.7753085
## Sonny:med-Fredo:high                 0.9401375
## Vito:med-Fredo:high                  0.9999932
## Apollonia:None-Fredo:high            1.0000000
## Fredo:None-Fredo:high                1.0000000
## Micheal:None-Fredo:high              1.0000000
## Sonny:None-Fredo:high                0.9977719
## Vito:None-Fredo:high                 0.9748409
## Sonny:high-Micheal:high              1.0000000
## Vito:high-Micheal:high               1.0000000
## Apollonia:low-Micheal:high           1.0000000
## Fredo:low-Micheal:high               1.0000000
## Micheal:low-Micheal:high             0.9999991
## Sonny:low-Micheal:high               1.0000000
## Vito:low-Micheal:high                1.0000000
## Apollonia:med-Micheal:high           0.9999554
## Fredo:med-Micheal:high               1.0000000
## Micheal:med-Micheal:high             0.9999991
## Sonny:med-Micheal:high               1.0000000
## Vito:med-Micheal:high                1.0000000
## Apollonia:None-Micheal:high          1.0000000
## Fredo:None-Micheal:high              1.0000000
```

```
## Micheal:None-Micheal:high          1.0000000
## Sonny:None-Micheal:high            1.0000000
## Vito:None-Micheal:high             0.9999995
## Vito:high-Sonny:high               1.0000000
## Apollonia:low-Sonny:high           1.0000000
## Fredo:low-Sonny:high               1.0000000
## Micheal:low-Sonny:high             0.8196226
## Sonny:low-Sonny:high               0.9970216
## Vito:low-Sonny:high                1.0000000
## Apollonia:med-Sonny:high           0.6077425
## Fredo:med-Sonny:high               1.0000000
## Micheal:med-Sonny:high             0.9147176
## Sonny:med-Sonny:high               0.9950023
## Vito:med-Sonny:high                1.0000000
## Apollonia:None-Sonny:high          0.9999991
## Fredo:None-Sonny:high              1.0000000
## Micheal:None-Sonny:high            1.0000000
## Sonny:None-Sonny:high              0.9999409
## Vito:None-Sonny:high               0.9944231
## Apollonia:low-Vito:high            1.0000000
## Fredo:low-Vito:high                1.0000000
## Micheal:low-Vito:high              0.9991576
## Sonny:low-Vito:high                1.0000000
## Vito:low-Vito:high                 1.0000000
## Apollonia:med-Vito:high            0.9868774
## Fredo:med-Vito:high                1.0000000
## Micheal:med-Vito:high              0.9994107
## Sonny:med-Vito:high                0.9999999
## Vito:med-Vito:high                 1.0000000
## Apollonia:None-Vito:high           0.9999999
## Fredo:None-Vito:high               1.0000000
## Micheal:None-Vito:high             1.0000000
## Sonny:None-Vito:high               1.0000000
## Vito:None-Vito:high                0.9998943
## Fredo:low-Apollonia:low            1.0000000
## Micheal:low-Apollonia:low          0.9869055
## Sonny:low-Apollonia:low            0.9999999
## Vito:low-Apollonia:low             1.0000000
## Apollonia:med-Apollonia:low        0.9054736
## Fredo:med-Apollonia:low            1.0000000
## Micheal:med-Apollonia:low          0.9947852
## Sonny:med-Apollonia:low            0.9999992
## Vito:med-Apollonia:low             1.0000000
## Apollonia:None-Apollonia:low       0.9999880
## Fredo:None-Apollonia:low           1.0000000
## Micheal:None-Apollonia:low         1.0000000
## Sonny:None-Apollonia:low           1.0000000
## Vito:None-Apollonia:low            0.9997756
## Micheal:low-Fredo:low              0.8117201
## Sonny:low-Fredo:low                0.9862030
## Vito:low-Fredo:low                 1.0000000
## Apollonia:med-Fredo:low            0.6152487
## Fredo:med-Fredo:low                1.0000000
## Micheal:med-Fredo:low              0.9433994
```

```
## Sonny:med-Fredo:low                    0.9874904
## Vito:med-Fredo:low                     1.0000000
## Apollonia:None-Fredo:low               0.9999675
## Fredo:None-Fredo:low                   1.0000000
## Micheal:None-Fredo:low                 1.0000000
## Sonny:None-Fredo:low                   0.9999990
## Vito:None-Fredo:low                    0.9988854
## Sonny:low-Micheal:low                  0.9985991
## Vito:low-Micheal:low                   0.9155719
## Apollonia:med-Micheal:low              1.0000000
## Fredo:med-Micheal:low                  0.9329413
## Micheal:med-Micheal:low                1.0000000
## Sonny:med-Micheal:low                  0.9998125
## Vito:med-Micheal:low                   0.9935768
## Apollonia:None-Micheal:low             0.9718573
## Fredo:None-Micheal:low                 0.9999680
## Micheal:None-Micheal:low               0.9995786
## Sonny:None-Micheal:low                 0.9999962
## Vito:None-Micheal:low                  1.0000000
## Vito:low-Sonny:low                     0.9998767
## Apollonia:med-Sonny:low                0.9656949
## Fredo:med-Sonny:low                    0.9999637
## Micheal:med-Sonny:low                  0.9998239
## Sonny:med-Sonny:low                    1.0000000
## Vito:med-Sonny:low                     1.0000000
## Apollonia:None-Sonny:low               0.9988462
## Fredo:None-Sonny:low                   1.0000000
## Micheal:None-Sonny:low                 0.9999999
## Sonny:None-Sonny:low                   1.0000000
## Vito:None-Sonny:low                    0.9999992
## Apollonia:med-Vito:low                 0.7420503
## Fredo:med-Vito:low                     1.0000000
## Micheal:med-Vito:low                   0.9754895
## Sonny:med-Vito:low                     0.9997155
## Vito:med-Vito:low                      1.0000000
## Apollonia:None-Vito:low                0.9999595
## Fredo:None-Vito:low                    1.0000000
## Micheal:None-Vito:low                  1.0000000
## Sonny:None-Vito:low                    1.0000000
## Vito:None-Vito:low                     0.9995121
## Fredo:med-Apollonia:med                0.7707768
## Micheal:med-Apollonia:med              1.0000000
## Sonny:med-Apollonia:med                0.9867237
## Vito:med-Apollonia:med                 0.9320639
## Apollonia:None-Apollonia:med           0.9147582
## Fredo:None-Apollonia:med               0.9972447
## Micheal:None-Apollonia:med             0.9946896
## Sonny:None-Apollonia:med               0.9985154
## Vito:None-Apollonia:med                1.0000000
## Micheal:med-Fredo:med                  0.9811455
## Sonny:med-Fredo:med                    0.9998966
## Vito:med-Fredo:med                     1.0000000
## Apollonia:None-Fredo:med               0.9999508
## Fredo:None-Fredo:med                   1.0000000
```
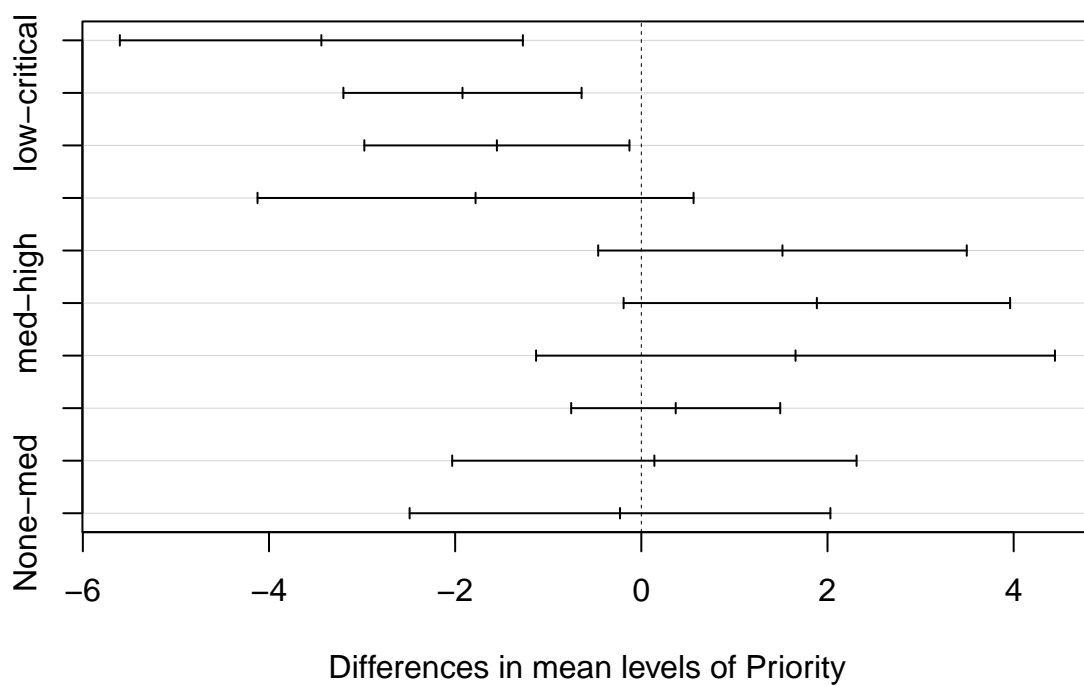
```
## Micheal:None-Fredo:med              1.0000000
## Sonny:None-Fredo:med                1.0000000
## Vito:None-Fredo:med                 0.9996457
## Sonny:med-Micheal:med               0.9999743
## Vito:med-Micheal:med                0.9981452
## Apollonia:None-Micheal:med          0.9740085
## Fredo:None-Micheal:med              0.9999829
## Micheal:None-Micheal:med            0.9996276
## Sonny:None-Micheal:med              0.9999988
## Vito:None-Micheal:med               1.0000000
## Vito:med-Sonny:med                  1.0000000
## Apollonia:None-Sonny:med            0.9983877
## Fredo:None-Sonny:med                1.0000000
## Micheal:None-Sonny:med              0.9999997
## Sonny:None-Sonny:med                1.0000000
## Vito:None-Sonny:med                 0.9999999
## Apollonia:None-Vito:med             0.9999054
## Fredo:None-Vito:med                 1.0000000
## Micheal:None-Vito:med               1.0000000
## Sonny:None-Vito:med                 1.0000000
## Vito:None-Vito:med                  0.9999621
## Fredo:None-Apollonia:None           0.9999497
## Micheal:None-Apollonia:None         1.0000000
## Sonny:None-Apollonia:None           0.9990735
## Vito:None-Apollonia:None            0.9847246
## Micheal:None-Fredo:None             1.0000000
## Sonny:None-Fredo:None               1.0000000
## Vito:None-Fredo:None                0.9999988
## Sonny:None-Micheal:None             0.9999999
## Vito:None-Micheal:None              0.9998567
## Vito:None-Sonny:None                1.0000000
```
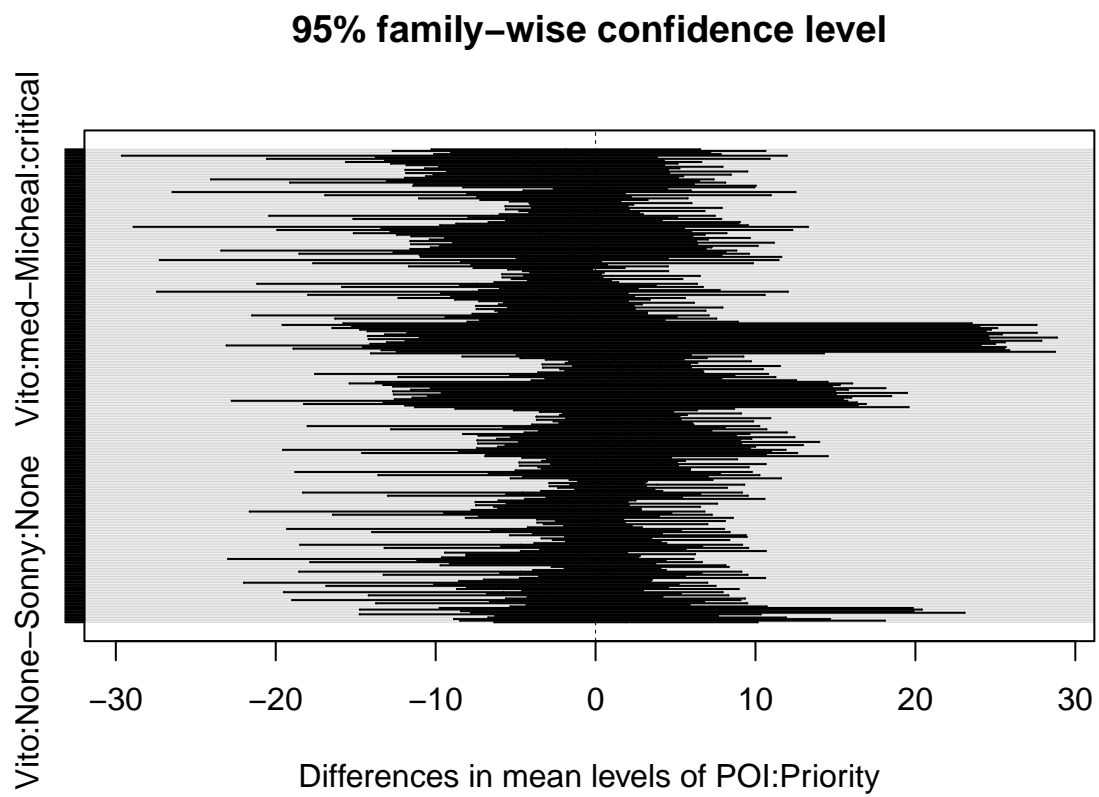
```
plot(HSD)
```

95% family−wise confidence level

Differences in mean levels of POI

95% family−wise confidence level

Differences in mean levels of Priority

95% family–wise confidence level

Differences in mean levels of POI:Priority

Analysis:

This test compares a set of means for the given category of data we observe that the pairs– high-critical,low-critical and med-critical are insignificant(i.e. have a p-value < 0.05)