1. R AS CALCULATOR APPLICATION

(i) Without using R objects on console

> 25+32

Output:

[1] 57

> 36-15

Output:

[1] 21

> 145*8

[1] 1160

> 365/7

Output:

[1] 52.14

(ii) Using R objects on console:

>A=45

>B=2

>c=A+B

>c

Output:

[1]47

>A=5

>B=2

>c=A-B

>c

Output:

```
[1]3
>A=10
>B=2
>c=A*B
>c
Output:
[1]20

>A=4
>B=2
>c=A/B
>c
Output:
[1]2
```

(c) Program make a simple calculator that can add, subtract, multiply and divide using functions

```
add <- function(x, y) {
  return(x + y)
}
subtract <- function(x, y) {
  return(x - y)
}
multiply <- function(x, y) {
  return(x * y)
}
divide <- function(x, y) {
  return(x / y)
}
# take input from the user
```

```
print("Select operation.")

print("1.Add")

print("2.Subtract")

print("3.Multiply")

print("4.Divide")

choice = as.integer(readline(prompt="Enter choice[1/2/3/4]: "))

num1 = as.integer(readline(prompt="Enter first number: "))

num2 = as.integer(readline(prompt="Enter second number: "))

operator <- switch(choice,"+","-","*","/")

result <- switch(choice, add(num1, num2), subtract(num1, num2), multiply(num1, num2), divide(num1,
num2))

print(paste(num1, operator, num2, "=", result))
```

OUTPUT

```
> source("~/Documents/305.R")

[1] "Select operation."

[1] "1.Add"

[1] "2.Subtract"

[1] "3.Multiply"

[1] "4.Divide"

Enter choice[1/2/3/4]: 3

Enter first number: 3

Enter second number: 4

[1] "3 * 4 = 12"
```

2.DESCRIPTIVE STATISTICS IN R

a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.

load data mtcars:

```
data(mtcars)
```

structure of mtcars:

```
str(mtcars)
```

Output:

```
## '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  : num  0 0 1 1 0 1 0 1 1 1 ...
##  $ am  : num  1 1 1 0 0 0 0 0 0 0 ...
##  $ gear: num  4 4 4 3 3 3 3 4 4 4 ...
##  $ carb: num  4 4 1 1 2 1 4 2 2 4 ...
```

str( ) → This function compactly displays the internal structure of an R object, a diagnostic function and an alternative to summary. Ideally, only one line for each 'basic' structure is displayed. It is especially well suited to compactly display the (abbreviated) contents of (possibly nested) lists.

dimension of dataset:

```
dim(mtcars)
```

Output:

```
[1] 32 11
```

get names of each variables or columns:

```
names(mtcars)
```

Output:

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

Summaries of the datasets:

summary( )→ is a generic function used to produce summaries of the results of various model fitting functions. The function invokes particular methods which depend on the class of the first argument.

Usage:

>summary(mtcars)

Output:

```
     mpg             cyl             disp             hp             drat
 Min.   :10.40   Min.   :4.000   Min.   : 71.1   Min.   : 52.0   Min.   :2.760
 1st Qu.:15.43   1st Qu.:4.000   1st Qu.:120.8   1st Qu.: 96.5   1st Qu.:3.080
 Median :19.20   Median :6.000   Median :196.3   Median :123.0   Median :3.695
 Mean   :20.09   Mean   :6.188   Mean   :230.7   Mean   :146.7   Mean   :3.597
 3rd Qu.:22.80   3rd Qu.:8.000   3rd Qu.:326.0   3rd Qu.:180.0   3rd Qu.:3.920
 Max.   :33.90   Max.   :8.000   Max.   :472.0   Max.   :335.0   Max.   :4.930
       wt             qsec             vs               am              gear
 Min.   :1.513   Min.   :14.50   Min.   :0.0000   Min.   :0.0000   Min.   :3.000
 1st Qu.:2.581   1st Qu.:16.89   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:3.000
 Median :3.325   Median :17.71   Median :0.0000   Median :0.0000   Median :4.000
 Mean   :3.217   Mean   :17.85   Mean   :0.4375   Mean   :0.4062   Mean   :3.688
 3rd Qu.:3.610   3rd Qu.:18.90   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:4.000
 Max.   :5.424   Max.   :22.90   Max.   :1.0000   Max.   :1.0000   Max.   :5.000
     carb
 Min.   :1.000
 1st Qu.:2.000
 Median :2.000
 Mean   :2.812
 3rd Qu.:4.000
 Max.   :8.000
```

quantiles of dataset:

quantile()

The generic function quantile produces sample quantiles corresponding to the given probabilities. The smallest observation corresponds to a probability of 0 and the largest to a probability of 1.

Common quantiles have special names, such as quartiles (four groups), deciles (ten groups), and percentiles (100 groups). The groups created are termed halves, thirds, quarters, etc., though sometimes the terms for the quantile are used for the groups created, rather than for the cut points.

Ex:

x=1:10

> x

Output:

```
[1]  1  2  3  4  5  6  7  8  9 10
```

> quantile(x)

Output:

```
   0%   25%   50%   75%  100%
 1.00  3.25  5.50  7.75 10.00
```

> quantile(mtcars$mpg)

Output:

```
    0%    25%    50%    75%   100%
10.400 15.425 19.200 22.800 33.900
```

select quantiles by percent

quantile(mtcars$wt, c(.2, .4, .8))

Output:

```
 20%   40%   80%
 2.349 3.158 3.770
```

variance

variance of weight:

```
var(mtcars$wt)
```

Output:

```
[1] 0.957379
```

Covariance

get covariance between mpg and gear:

```
cov(mtcars$mpg, mtcars$gear)
```

Output:

```
[1] 2.135685
```

get covariance all variables:

```
cov(mtcars[,1:11])
```

Output:

```
  mpg         cyl        disp         hp         drat
## mpg    36.324103  -9.1723790  -633.09721 -320.732056   2.19506351
## cyl    -9.172379   3.1895161   199.66028  101.931452  -0.66836694
## disp -633.097208 199.6602823 15360.79983 6721.158669 -47.06401915
## hp   -320.732056 101.9314516  6721.15867 4700.866935 -16.45110887
## drat    2.195064  -0.6683669   -47.06402  -16.451109   0.28588135
## wt     -5.116685   1.3673710   107.68420   44.192661  -0.37272073
## qsec    4.509149  -1.8868548   -96.05168  -86.770081   0.08714073
## vs      2.017137  -0.7298387   -44.37762  -24.987903   0.11864919
## am      1.803931  -0.4657258   -36.56401   -8.320565   0.19015121
## gear    2.135685  -0.6491935   -50.80262   -6.358871   0.27598790
## carb   -5.363105   1.5201613    79.06875   83.036290  -0.07840726
##              wt        qsec          vs          am       gear
## mpg   -5.1166847   4.50914919   2.01713710   1.80393145   2.1356855
## cyl    1.3673710  -1.88685484  -0.72983871  -0.46572581  -0.6491935
## disp 107.6842040 -96.05168145 -44.37762097 -36.56401210 -50.8026210
## hp    44.1926613 -86.77008065 -24.98790323  -8.32056452  -6.3588710
```

```
## drat  -0.3727207   0.08714073   0.11864919   0.19015121   0.2759879
## wt     0.9573790  -0.30548161  -0.27366129  -0.33810484  -0.4210806
## qsec  -0.3054816   3.19316613   0.67056452  -0.20495968  -0.2804032
## vs    -0.2736613   0.67056452   0.25403226   0.04233871   0.0766129
## am    -0.3381048  -0.20495968   0.04233871   0.24899194   0.2923387
## gear  -0.4210806  -0.28040323   0.07661290   0.29233871   0.5443548
## carb   0.6757903  -1.89411290  -0.46370968   0.04637097   0.3266129
##             carb
## mpg  -5.36310484
## cyl   1.52016129
## disp 79.06875000
## hp   83.03629032
## drat -0.07840726
## wt    0.67579032
## qsec -1.89411290
## vs   -0.46370968
## am    0.04637097
## gear  0.32661290
## carb  2.60887097
```

Correlation

get correlation between mpg and gear:

```
cor(mtcars$mpg, mtcars$gear)
```

Output:

```
[1] 0.4802848
```

get correlation all variables:

```
cor(mtcars[,1:11])
```

Output:

```
              mpg        cyl       disp         hp        drat         wt
## mpg   1.0000000 -0.8521620 -0.8475514 -0.7761684  0.68117191 -0.8676594
## cyl  -0.8521620  1.0000000  0.9020329  0.8324475 -0.69993811  0.7824958
```

```
## disp -0.8475514  0.9020329  1.0000000  0.7909486 -0.71021393  0.8879799
## hp   -0.7761684  0.8324475  0.7909486  1.0000000 -0.44875912  0.6587479
## drat  0.6811719 -0.6999381 -0.7102139 -0.4487591  1.00000000 -0.7124406
## wt   -0.8676594  0.7824958  0.8879799  0.6587479 -0.71244065  1.0000000
## qsec  0.4186840 -0.5912421 -0.4336979 -0.7082234  0.09120476 -0.1747159
## vs    0.6640389 -0.8108118 -0.7104159 -0.7230967  0.44027846 -0.5549157
## am    0.5998324 -0.5226070 -0.5912270 -0.2432043  0.71271113 -0.6924953
## gear  0.4802848 -0.4926866 -0.5555692 -0.1257043  0.69961013 -0.5832870
## carb -0.5509251  0.5269883  0.3949769  0.7498125 -0.09078980  0.4276059
##             qsec         vs          am       gear        carb
## mpg   0.41868403  0.6640389  0.59983243  0.4802848 -0.55092507
## cyl  -0.59124207 -0.8108118 -0.52260705 -0.4926866  0.52698829
## disp -0.43369788 -0.7104159 -0.59122704 -0.5555692  0.39497686
## hp   -0.70822339 -0.7230967 -0.24320426 -0.1257043  0.74981247
## drat  0.09120476  0.4402785  0.71271113  0.6996101 -0.09078980
## wt   -0.17471588 -0.5549157 -0.69249526 -0.5832870  0.42760594
## qsec  1.00000000  0.7445354 -0.22986086 -0.2126822 -0.65624923
## vs    0.74453544  1.0000000  0.16834512  0.2060233 -0.56960714
## am   -0.22986086  0.1683451  1.00000000  0.7940588  0.05753435
## gear -0.21268223  0.2060233  0.79405876  1.0000000  0.27407284
## carb -0.65624923 -0.5696071  0.05753435  0.2740728  1.00000000
```

b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.

Subset

It return subsets of vectors, matrices or data frames meeting given conditions.

```
>subset(iris,iris$Sepal.Length>7)
```

Output:

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
103	7.1	3.0	5.9	2.1	virginica
106	7.6	3.0	6.6	2.1	virginica
108	7.3	2.9	6.3	1.8	virginica
110	7.2	3.6	6.1	2.5	virginica
118	7.7	3.8	6.7	2.2	virginica
119	7.7	2.6	6.9	2.3	virginica
123	7.7	2.8	6.7	2.0	virginica
126	7.2	3.2	6.0	1.8	virginica
130	7.2	3.0	5.8	1.6	virginica
131	7.4	2.8	6.1	1.9	virginica
132	7.9	3.8	6.4	2.0	virginica
136	7.7	3.0	6.1	2.3	virginica

aggregate ()

aggregate() Function in R Splits the data into subsets, computes summary statistics for each subsets and returns the result in a group by form. Aggregate function in R is similar to group by in SQL. Aggregate() function is useful in performing all the aggregate operations like sum,count,mean, minimum and Maximum.

It splits the data into subsets, computes summary statistics for each, and returns the result in a convenient form.

The most basic uses of aggregate involve base functions such as mean and sd. It is indeed one of the most common uses of aggregate to compare the mean or other properties of sample groups.

Aggregate() function in R applied on iris dataset:

Step1:

Load the dataset

```
data(iris)
```

Step 2:

Apply aggregate() to calculate mean, sum

```
agg_mean = aggregate(iris[,1:4], by=list(iris$Species),FUN=mean)
```

Step 3:

Display the result

```
agg_mean
```

Similarly use aggegate() function to calculate:

- Sum:

```
agg_sum = aggregate(iris[,1:4], by=list(iris$Species),FUN=sum)
```

standard deviation:

```
agg_sd = aggregate(iris[,1:4], by=list(iris$Species),FUN=sd)
```

- Min value

```
agg_min = aggregate(iris[,1:4], by=list(iris$Species),FUN=min)
```

- Max value

```
agg_max = aggregate(iris[,1:4], by=list(iris$Species),FUN=max)
```

3. READING AND WRITING DIFFERENT TYPES OF DATASETS

a. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location.

```
# Set current working directory.

setwd("/DH/rprog”)

#Read the file

data <- read.csv("input.csv")

print(data)
```

b. Reading Excel data sheet in R.

```
#Install xlsx Package

install.packages("xlsx")


# Read the file input.xlsx.

data <- read.xlsx("input.xlsx")

print(data)
```

4.VISUALIZATIONS

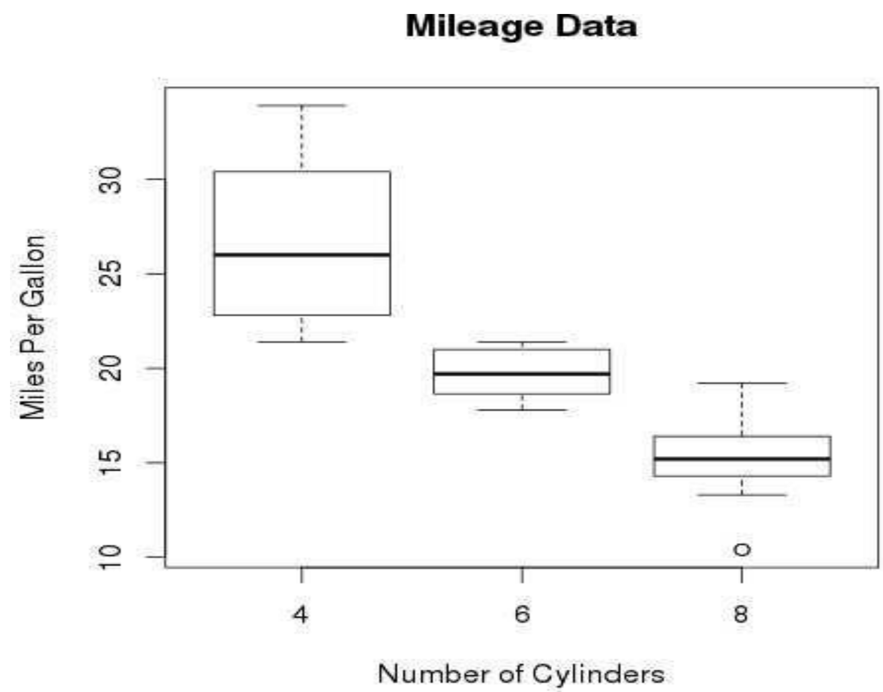
Find the data distributions using box and scatter plot.

```
Install.packages(“ggplot2”)
Library(ggplot2)
Input <- mtcars[,c('mpg','cyl')]input

Boxplot(mpg ~ cyl, data = mtcars, xlab = "number of cylinders",ylab = "miles
per gallon", main = "mileage data")

Dev.off()
```

Output :-

```
mpg  cyl
Mazda rx4                    21.0  6
Mazda rx4 wag                  21.0  6
```

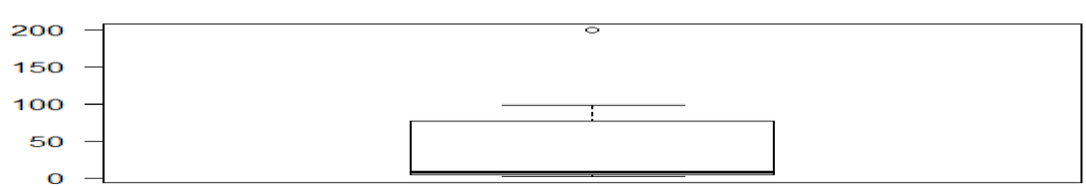
Datsun 710	22.8	4
Hornet 4 drive	21.4	6
Hornet sportabout	18.7	8
Valiant	18.1	6



a. Find the outliers using plot.

v=c(50,75,100,125,150,175,200)

boxplot(v)

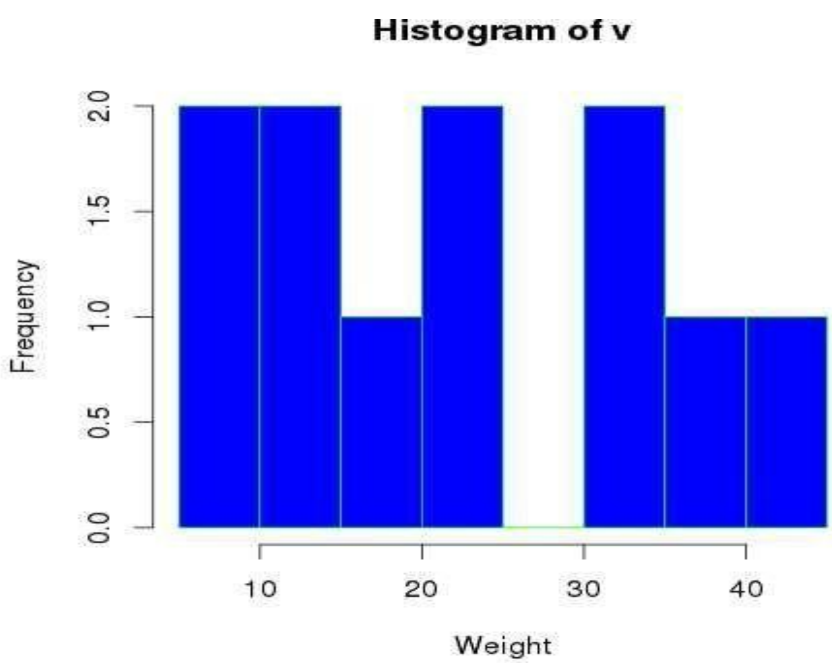


b. Plot the histogram, bar chart and pie chart on sample data.

Histogram

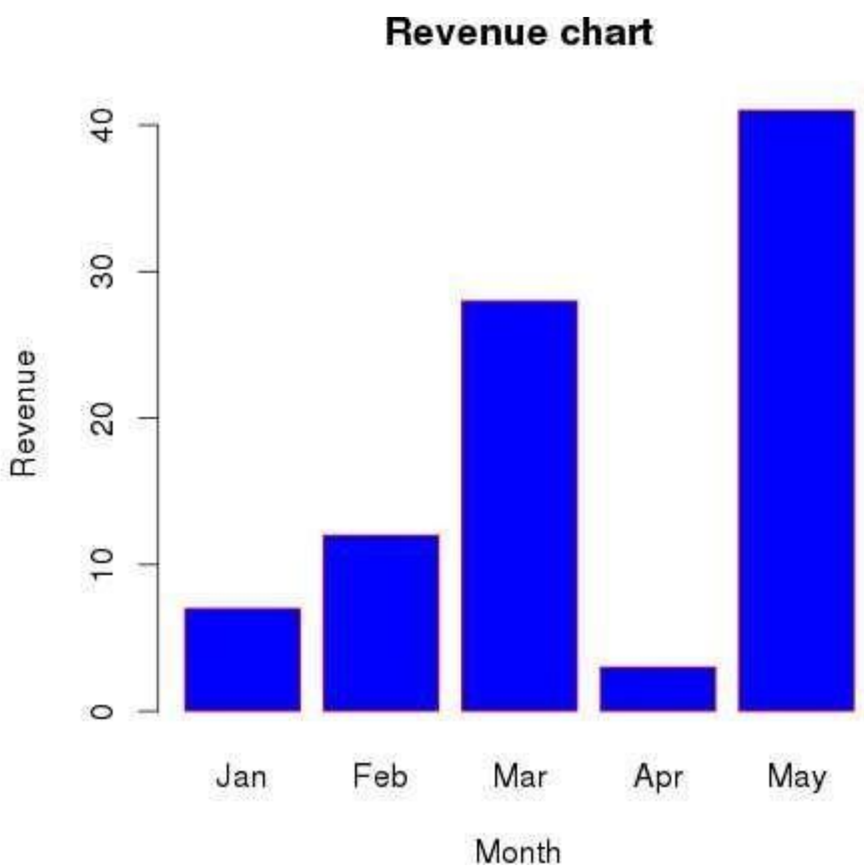
```
library(graphics)
v <-  c(9,13,21,8,36,22,12,41,31,33,19)

# Create the histogram.
hist(v,xlab = "Weight",col = "blue",border =
"green")dev.off()
```

Output:-



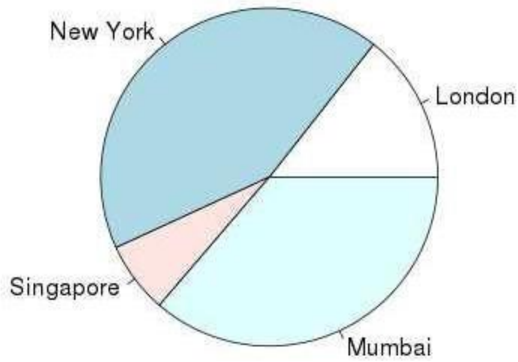
Bar chart

```
library(graphics)
H <- c(7,12,28,3,41)
M <- c("Jan","Feb","Mar","Apr","May")
# Plot the bar chart.
barplot(H, names. arg = M, xlab = "Month", ylab = "Revenue", col = "blue", main = "Revenue chart")
dev.off()
```



Pie Chart

```
library(graphics)
x <- c(21, 62, 10, 53)
labels<- c("London", "NewYork", "Singapore", "Mumbai")
# Plot the Pie chart.
pie(x,labels)
dev.off()
```


New York
London
Singapore
Mumbai

5.CORRELATION AND COVARIANCE

a) Find the corelation matrix

```
d<-data.frame(x1=rnorm(!0),x2=rnorm(10),x3=rnorm(10))cor(d)
m<-cor(d) #get correlations
library(„corrplot")
corrplot(m,method=”square”)
x<-matrix(rnorm(2),,nrow=5,ncol=4)
y<-matrix(rnorm(15),nrow=5,ncol=3)
COR<-cor(x,y)
COR
```

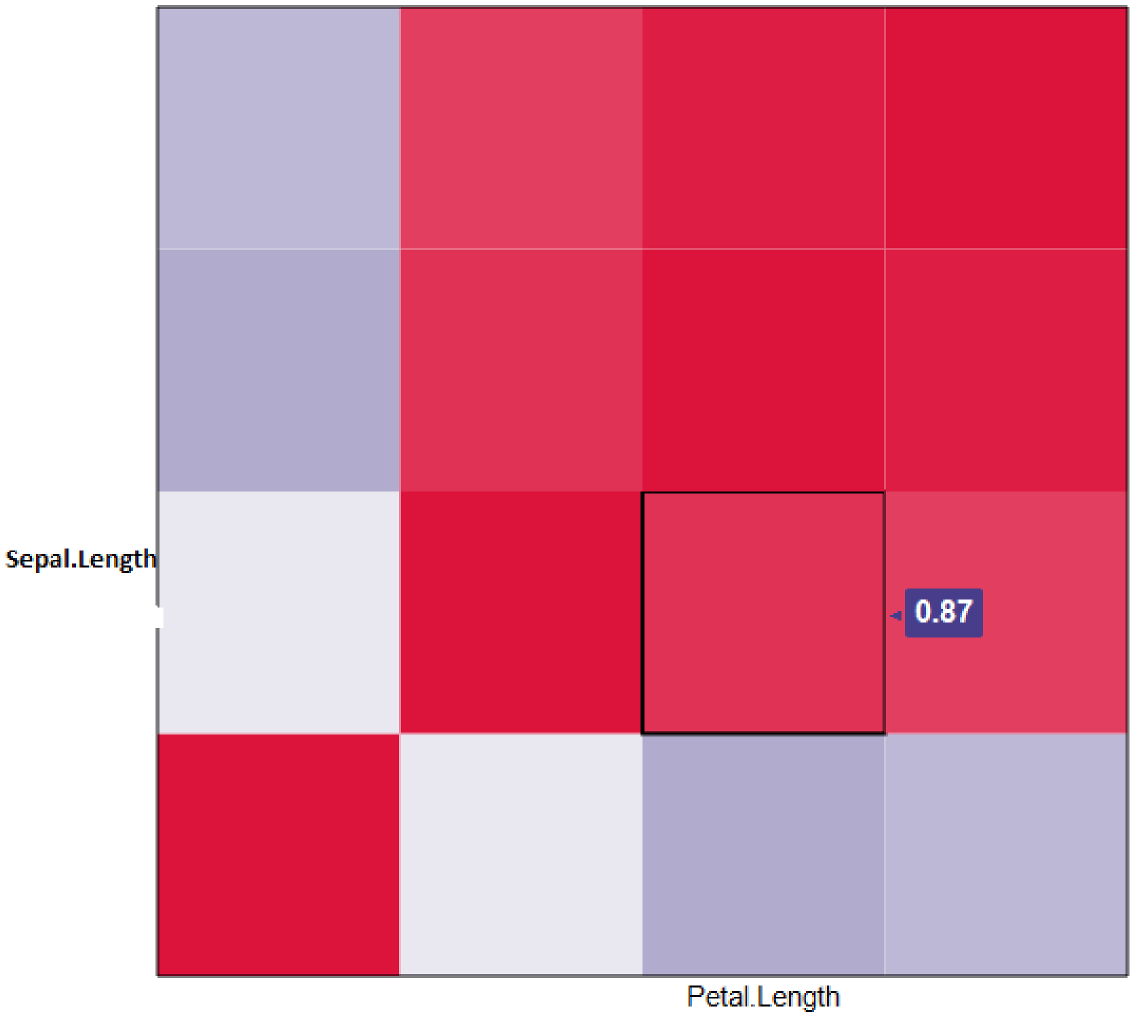
b) Plot the correlation plot on dataset and visualize giving an overview of relationships amongdata on iris data.

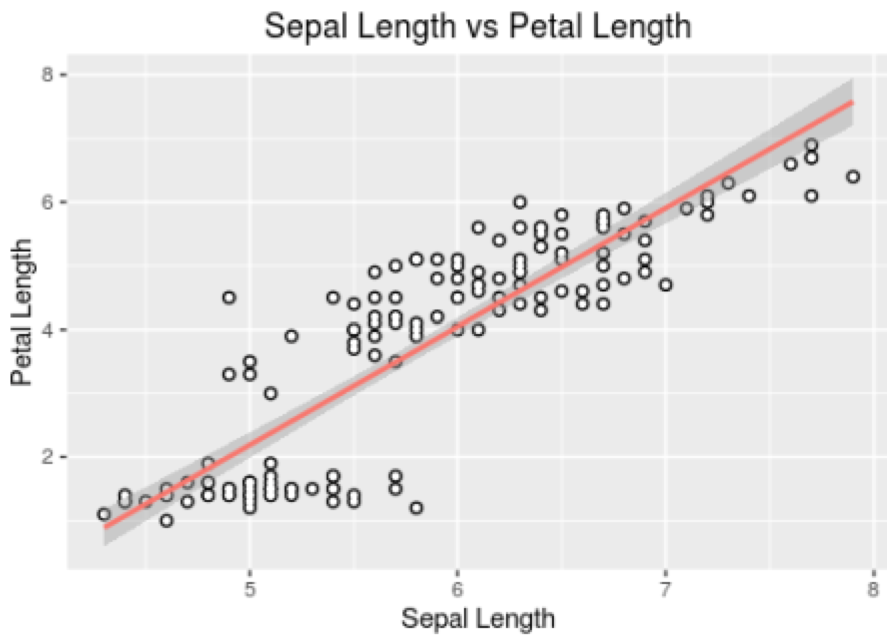
```
Image(x=seq(dim(x)[2])
Y<-seq(dim(y)[2])
Z=COR,xlab=”xcolumn”,ylab=”y column”)
Library(gtlcharts)
Data(iris) Iris$species<-NULL
Iplotcorr(iris,reoder=TRUE)
```

c) Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

```
library(ggplot2)data(iris) str(iris)
ggplot(data=iris,aes(x=sepal.length,y=petal.length))+geom_point(size=2,colour=”black”)+geom_
point(size=1,colour=”white”)+geom_smooth(aes(colour=”black”),method=”lm")+ggtitle(“sepal.l
engthvspetal.length”)+xlab(“sepal.length”)+ylab(“petal.length”)+these(legend.position=”none”)
```

OUTPUT:





Sepal Length vs Petal Length
Petal Length
Sepal Length
8
6
4
2
5
6
7
8

6. REGRESSION MODEL

Import a data from web storage. Name the dataset and perform Logistic Regression to find out relation between variables the model. Also check the model is fit or not [require (foreign), require(MASS)]

>mydata$rank<-factor(mydata$rank)

>mylogit<-glm(admit~gre+gpa+rank,data=mydata,family=”binomial”)

>summary(mylogit)

OUTPUT:

```
> mydata$rank <- factor(mydata$rank)
> mylogit <- glm(admit ~ gre + gpa + rank, data = mydata, family = "binomial")
> summary(mylogit)

Call:
glm(formula = admit ~ gre + gpa + rank, family = "binomial",
    data = mydata)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.6268  -0.8662  -0.6388   1.1490   2.0790

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -3.989979   1.139951  -3.500 0.000465 ***
gre          0.002264   0.001094   2.070 0.038465 *
gpa          0.804038   0.331819   2.423 0.015388 *
rank2       -0.675443   0.316490  -2.134 0.032829 *
rank3       -1.340204   0.345306  -3.881 0.000104 ***
rank4       -1.551464   0.417832  -3.713 0.000205 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 499.98  on 399  degrees of freedom
Residual deviance: 458.52  on 394  degrees of freedom
AIC: 470.52

Number of Fisher Scoring iterations: 4
```

7.CLASSIFICATION MODEL

b. Choose classifier for classification problem.

Classifier used: Decision Tree.

The R package "party" is used to create decision trees.

Use the below command in R console to install the package. You also have to install the dependent packages if any.

install. packages("party")

The package "party" has the function ctree() which is used to create and analyze decison tree.

Syntax

The basic syntax for creating a decision tree in R is −

ctree(formula, data)

Here,

formula is a formula describing the predictor and response variables.

data is the name of the data set used.

Input Data

We will use the R in-built data set named readingSkills to create a decision tree. It describes the score of someone's readingSkills if we know the variables "age", "shoesize", "score" and whether the person is a native speaker or not.

Sample data from dataset readingSkills

Sno	**nativeSpeaker**	**age**	**shoeSize**	**score**
1	yes	5	24.83189	32.29385
2	yes	6	25.95238	36.63105
3	no	11	30.42170	49.60593
4	yes	7	28.66450	40.28456
5	yes	11	31.88207	55.46085
6	yes	10	30.07843	52.83124

Program:

```
# Load the party package. It will automatically load other dependent packages.

library(party)

# Create the input data frame.

input.dat <- readingSkills[c(1:105),]

# Give the chart file a name.

png(file = "decision_tree.png")

# Create the tree.

  output.tree <- ctree(  nativeSpeaker ~ age + shoeSize + score,   data = input.dat)

# Plot the tree.

plot(output.tree)

# Save the file.

dev.off()
```

Output:

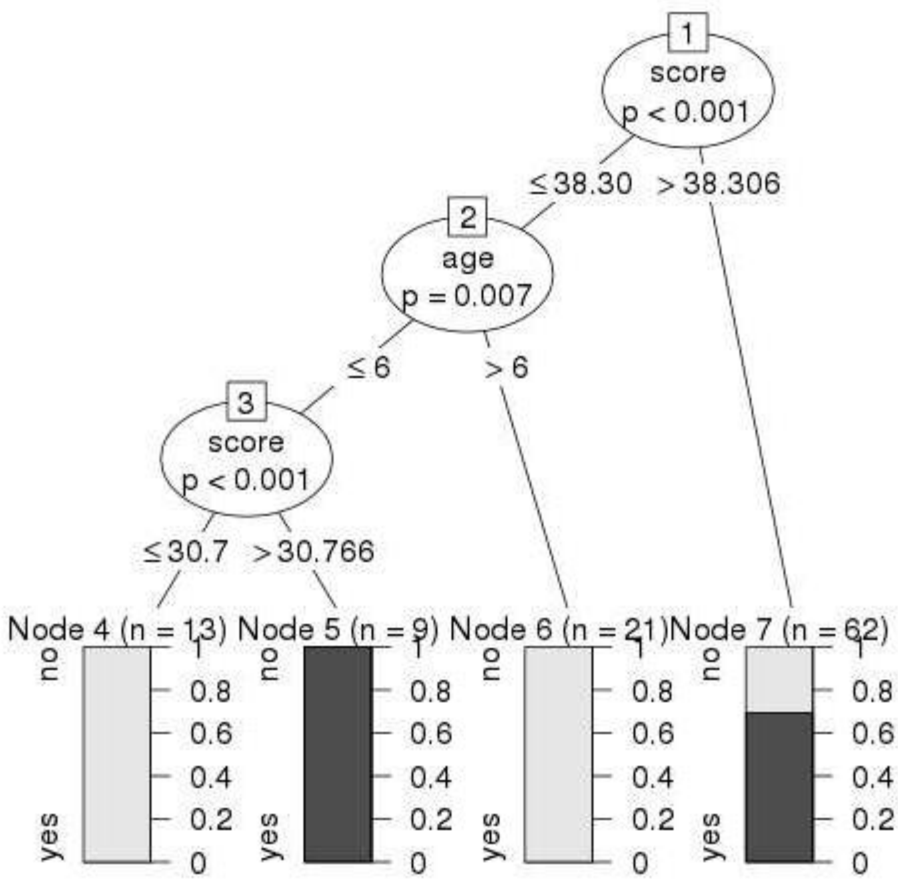
```
null device

        1

Loading required package: methods

Loading required package: grid

Loading required package: mvtnorm

Loading required package: modeltools

Loading required package: stats4

Loading required package: strucchange

Loading required package: zoo
```

Attaching package: 'zoo'

The following objects are masked from 'package:base':

  as.Date, as.Date.numeric

Loading required package: sandwich



8.CLUSTERING MODEL

a. Clustering algorithms for unsupervised classification.

Using iris dataset and K-means Clustering algorithm

```
library(cluster)
> set.seed(20)
> irisCluster <- kmeans(iris[, 3:4], 3, nstart = 20)
# nstart = 20. This means that R will try 20 different random starting assignments and then select the one with the lowest within cluster variation.
> irisCluster
```

output:

```
  Petal.Length Petal.Width
1    1.462000    0.246000
2    4.269231    1.342308
3    5.595833    2.037500
```

Clustering vector:

```
  [1] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 [42] 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 2 2 2 2
 [83] 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 2 3 3 3 3 3 3 3 3 3 3 3 3 2 3 3 3
[124] 3 3 3 2 3 3 3 3 3 3 3 3 3 3 3 2 3 3 3 3 3 3 3 3 3 3 3
```

Within cluster sum of squares by cluster:

```
[1] 2.02200 13.05769 16.29167
 (between_SS / total_SS =  94.3 %)
```

Available components:

```
[1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"

[6] "betweenss"    "size"         "iter"         "ifault"
```

b. Plot the cluster data using R visualizations

```
> irisCluster$cluster <- as.factor(irisCluster$cluster)
> ggplot(iris, aes(Petal.Length, Petal.Width, color = irisCluster$cluster)) + geom_point()
```

Output: