INDEX

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Class-MSc.IT

Practical 1

Aim: -Install, configure and run Hadoop and HDFS and explore HDFS on Windows

Code:

Steps to Install Hadoop

1. Install Java JDK 1.8
2. Download Hadoop and extract and place under C drive
3. Set Path in Environment Variables
4. Config files under Hadoop directory
5. Create folder datanode and namenode under data directory
6. Edit HDFS and YARN files
7. Set Java Home environment in Hadoop environment
8. Setup Complete. Test by executing start-all.cmd

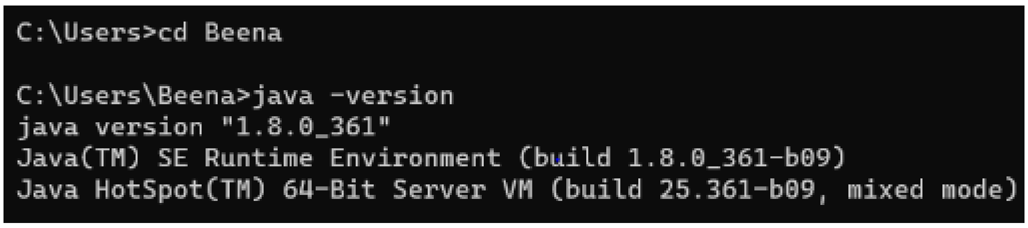
There are two ways to install Hadoop, i.e.

9. Single node
10. Multi node

Here, we use multi node cluster.

1. **Install Java**

    11. – Java JDK Link to download https://www.oracle.com/java/technologies/javase-jdk8-downloads.html
    12. – extract and install Java in C:\Java
    13. – open cmd and type -> javac -version

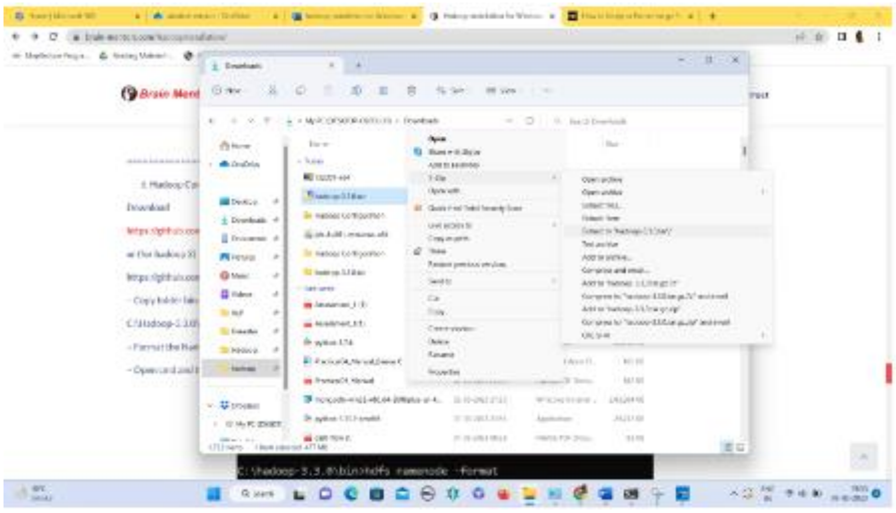


```
C:\Users>cd Beena

C:\Users\Beena>java -version
java version "1.8.0_361"
Java(TM) SE Runtime Environment (build 1.8.0_361-b09)
Java HotSpot(TM) 64-Bit Server VM (build 25.361-b09, mixed mode)
```

2. **Download Hadoop**

    https://www.apache.org/dyn/closer.cgi/hadoop/common/hadoop-3.3.0/hadoop-3.3.0.tar.gz

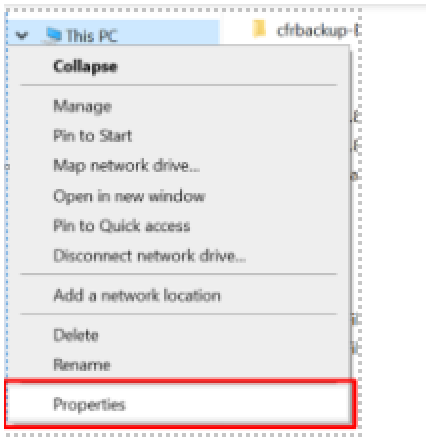
    - right click .rar.gz file -> show more options -> 7-zip->and extract to C:\Hadoop-3.3.0\

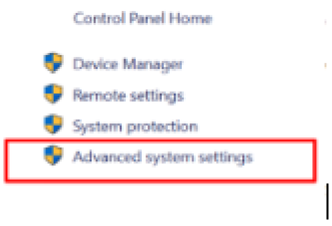


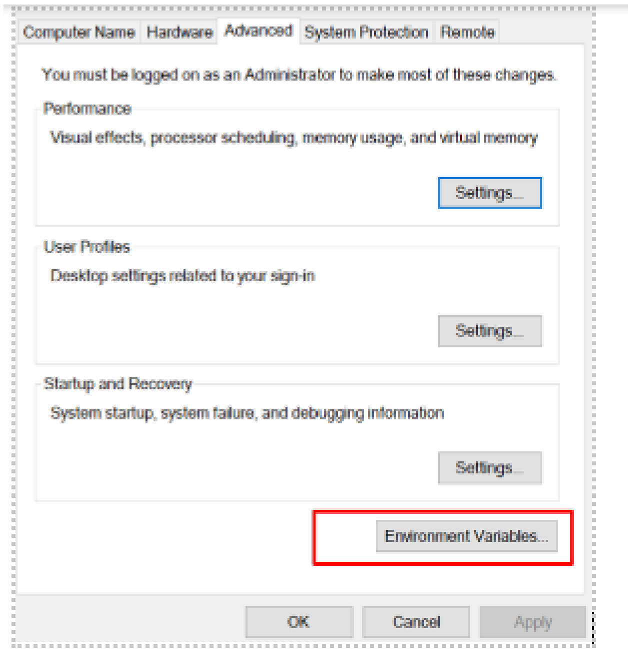
```
C:\hadoop-3.3.0\bin>hdfs namenode -format
```

3 **Set the path JAVA_HOME Environment variable**

4 **Set the path HADOOP_HOME Environment variable**







You must be logged on as an Administrator to make most of these changes.

Performance

Visual effects, processor scheduling, memory usage, and virtual memory

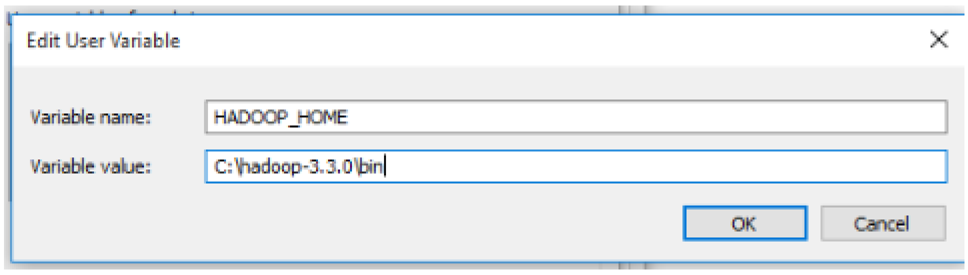
User Profiles

Desktop settings related to your sign-in

Startup and Recovery

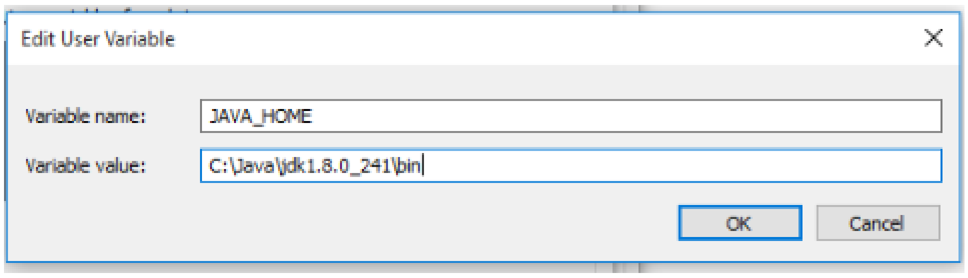
System startup, system failure, and debugging information

Click on **New to both user variables and system variables.**



Variable name: HADOOP_HOME

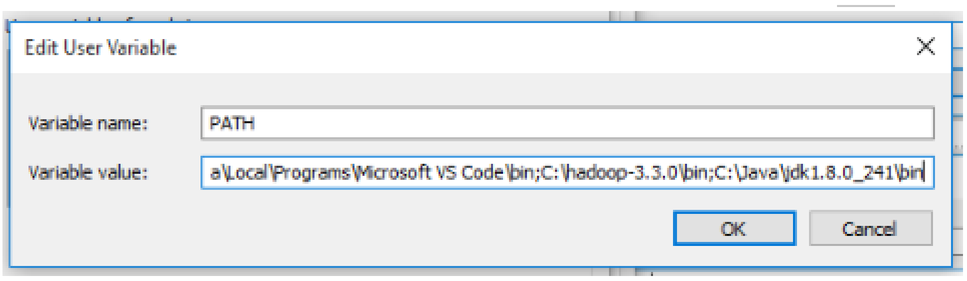
Variable value: C:\hadoop-3.3.0\bin



Variable name: JAVA_HOME

Variable value: C:\Java\jdk1.8.0_241\bin

Click on user variable -> path -> edit-> add path for Hadoop and java upto ‘bin’



Variable name: PATH

Variable value: a\Local\Programs\Microsoft VS Code\bin;C:\hadoop-3.3.0\bin;C:\Java\jdk1.8.0_241\bin

Click Ok, Ok, Ok.

5. **Configurations**

Edit file C:/Hadoop-3.3.0/etc/hadoop/core-site.xml,

paste the xml code in folder and save

==

```
<configuration>
<property>
     <name>fs.defaultFS</name>
     <value>hdfs://localhost:9000</value>
 </property>
</configuration>
```

==

Rename “mapred-site.xml.template” to “mapred-site.xml” and edit this file C:/Hadoop-3.3.0/etc/hadoop/mapred-site.xml, paste xml code and save this file.

==

```
<configuration>
   <property>
      <name>mapreduce.framework.name</name>
      <value>yarn</value>
   </property>
</configuration>
```

==

Create folder “data” under “C:\Hadoop-3.3.0”

Create folder “datanode” under “C:\Hadoop-3.3.0\data”

Create folder “namenode” under “C:\Hadoop-3.3.0\data”

==

Edit file C:\Hadoop-3.3.0/etc/hadoop/hdfs-site.xml,

paste xml code and save this file.

```
<configuration>
<property>
     <name>dfs.replication</name>
```

```
    <value>1</value>
  </property>

  <property>
    <name>dfs.namenode.name.dir</name>
    <value>/hadoop-3.3.0/data/namenode</value>
  </property>
  <property>
    <name>dfs.datanode.data.dir</name>
    <value>/hadoop-3.3.0/data/datanode</value>
  </property>
 </configuration>
```
===

Edit file C:/Hadoop-3.3.0/etc/hadoop/yarn-site.xml,

paste xml code and save this file.

```
<configuration>

</configuration>
```
===

6. **Edit file C:/Hadoop-3.3.0/etc/hadoop/hadoop-env.cmd**
Find "JAVA_HOME=%JAVA_HOME%" and replace it as
set JAVA_HOME="C:\Java\jdk1.8.0_361"
===

7. **Download "redistributable" package**

Download and run VC_redist.x64.exe

This is a "redistributable" package of the Visual C runtime code for 64-bit applications, from Microsoft. It contains certain shared code that every application written with Visual C expects to have available on the Windows computer it runs on.

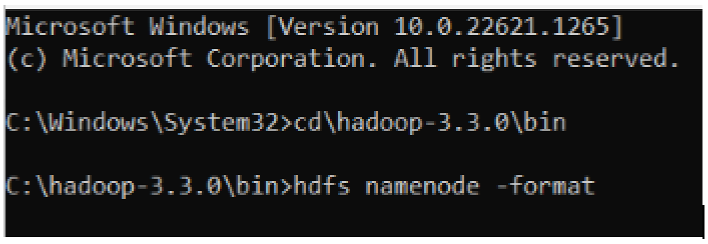
8. **Hadoop Configurations**
Download **bin** folder from

https://github.com/s911415/apache-hadoop-3.1.0-winutils

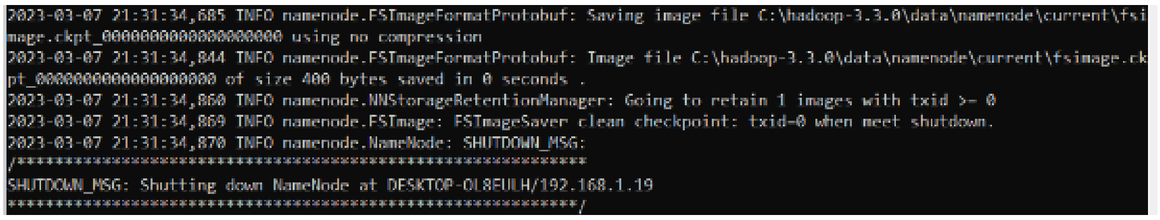
– Copy the bin folder to c:\hadoop-3.3.0. Replace the existing bin folder.

9. **copy "hadoop-yarn-server-timelineservice-3.0.3.jar" from ~\hadoop-3.0.3\share\hadoop\yarn\timelineservice to ~\hadoop-3.0.3\share\hadoop\yarn folder.**

10. **Format the NameNode**
– Open cmd '**Run as Administrator**' and type command "**hdfs namenode –format**"



```
Microsoft Windows [Version 10.0.22621.1265]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\System32>cd\hadoop-3.3.0\bin

C:\hadoop-3.3.0\bin>hdfs namenode -format
```



```
2023-03-07 21:31:34,685 INFO namenode.FSImageFormatProtobuf: Saving image file C:\hadoop-3.3.0\data\namenode\current\fsi
mage.ckpt_0000000000000000000 using no compression
2023-03-07 21:31:34,844 INFO namenode.FSImageFormatProtobuf: Image file C:\hadoop-3.3.0\data\namenode\current\fsimage.ck
pt_0000000000000000000 of size 400 bytes saved in 0 seconds .
2023-03-07 21:31:34,860 INFO namenode.NNStorageRetentionManager: Going to retain 1 images with txid >= 0
2023-03-07 21:31:34,869 INFO namenode.FSImage: FSImageSaver clean checkpoint: txid=0 when meet shutdown.
2023-03-07 21:31:34,870 INFO namenode.NameNode: SHUTDOWN_MSG:
/************************************************************
SHUTDOWN_MSG: Shutting down NameNode at DESKTOP-OL8EULH/192.168.1.19
************************************************************/
```

11. Testing

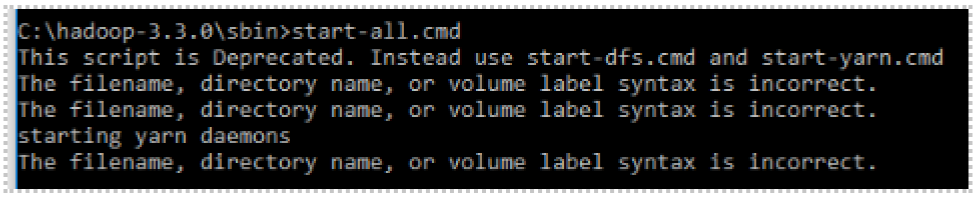
– Open cmd ‘Run as Administrator’ and change directory to C:\Hadoop-3.3.0\sbin

– type start-all.cmd

OR

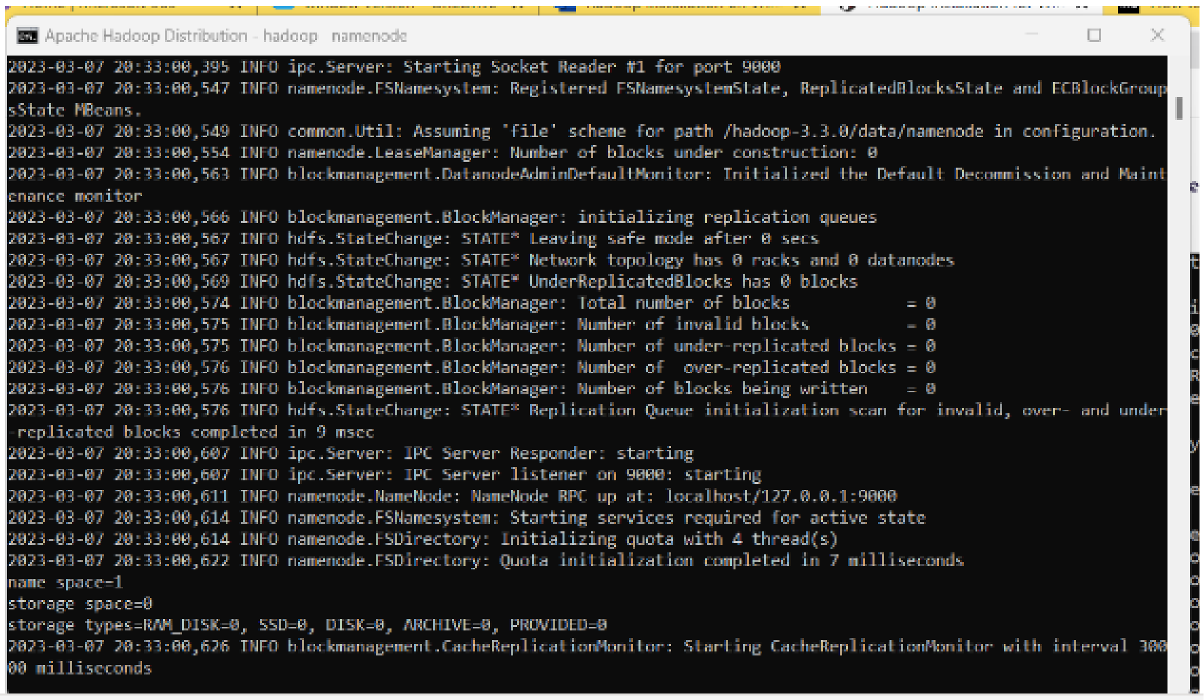
- type start-dfs.cmd

– type start-yarn.cmd



```
C:\hadoop-3.3.0\sbin>start-all.cmd
This script is Deprecated. Instead use start-dfs.cmd and start-yarn.cmd
The filename, directory name, or volume label syntax is incorrect.
The filename, directory name, or volume label syntax is incorrect.
starting yarn daemons
The filename, directory name, or volume label syntax is incorrect.
```

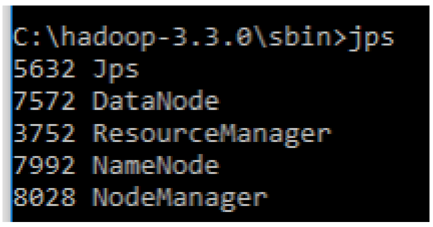
– You will get 4 more running threads for Datanode, namenode, resouce manager and node manager



```
Apache Hadoop Distribution - hadoop   namenode
2023-03-07 20:33:00,395 INFO ipc.Server: Starting Socket Reader #1 for port 9000
2023-03-07 20:33:00,547 INFO namenode.FSNamesystem: Registered FSNamesystemState, ReplicatedBlocksState and ECBlockGroup
sState MBeans.
2023-03-07 20:33:00,549 INFO common.Util: Assuming 'file' scheme for path /hadoop-3.3.0/data/namenode in configuration.
2023-03-07 20:33:00,554 INFO namenode.LeaseManager: Number of blocks under construction: 0
2023-03-07 20:33:00,563 INFO blockmanagement.DatanodeAdminDefaultMonitor: Initialized the Default Decommission and Maint
enance monitor
2023-03-07 20:33:00,566 INFO blockmanagement.BlockManager: initializing replication queues
2023-03-07 20:33:00,567 INFO hdfs.StateChange: STATE* Leaving safe mode after 0 secs
2023-03-07 20:33:00,567 INFO hdfs.StateChange: STATE* Network topology has 0 racks and 0 datanodes
2023-03-07 20:33:00,569 INFO hdfs.StateChange: STATE* UnderReplicatedBlocks has 0 blocks
2023-03-07 20:33:00,574 INFO blockmanagement.BlockManager: Total number of blocks            = 0
2023-03-07 20:33:00,575 INFO blockmanagement.BlockManager: Number of invalid blocks          = 0
2023-03-07 20:33:00,575 INFO blockmanagement.BlockManager: Number of under-replicated blocks = 0
2023-03-07 20:33:00,576 INFO blockmanagement.BlockManager: Number of  over-replicated blocks = 0
2023-03-07 20:33:00,576 INFO blockmanagement.BlockManager: Number of blocks being written    = 0
2023-03-07 20:33:00,576 INFO hdfs.StateChange: STATE* Replication Queue initialization scan for invalid, over- and under
-replicated blocks completed in 9 msec
2023-03-07 20:33:00,607 INFO ipc.Server: IPC Server Responder: starting
2023-03-07 20:33:00,607 INFO ipc.Server: IPC Server listener on 9000: starting
2023-03-07 20:33:00,611 INFO namenode.NameNode: NameNode RPC up at: localhost/127.0.0.1:9000
2023-03-07 20:33:00,614 INFO namenode.FSNamesystem: Starting services required for active state
2023-03-07 20:33:00,614 INFO namenode.FSDirectory: Initializing quota with 4 thread(s)
2023-03-07 20:33:00,622 INFO namenode.FSDirectory: Quota initialization completed in 7 milliseconds
name space=1
storage space=0
storage types=RAM_DISK=0, SSD=0, DISK=0, ARCHIVE=0, PROVIDED=0
2023-03-07 20:33:00,626 INFO blockmanagement.CacheReplicationMonitor: Starting CacheReplicationMonitor with interval 300
00 milliseconds
```

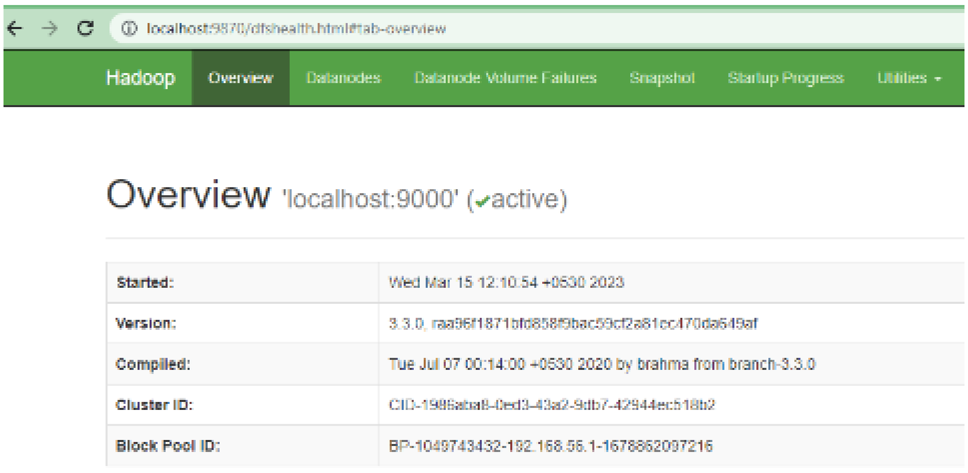
Output:

12. Type JPS command to start-all.cmd command prompt, you will get following output.



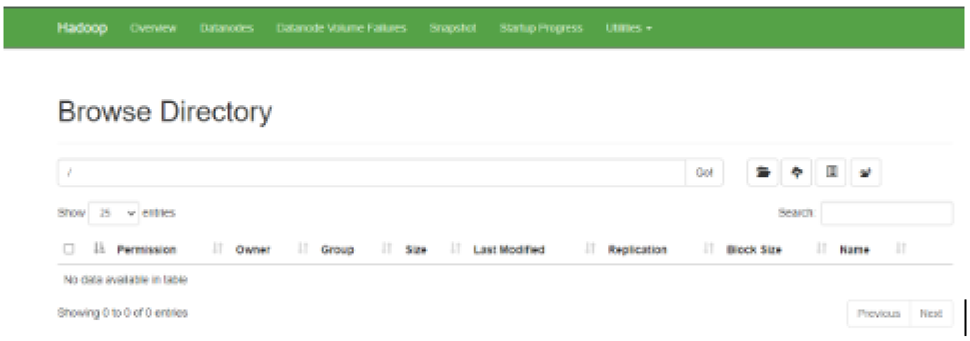
```
C:\hadoop-3.3.0\sbin>jps
5632 Jps
7572 DataNode
3752 ResourceManager
7992 NameNode
8028 NodeManager
```

13. Run http://localhost:9870/ from any browser
Or http://localhost:50070/



Overview 'localhost:9000' (✓active)

Started:	Wed Mar 15 12:10:54 +0530 2023
Version:	3.3.0, raa96f1871bfd858f9bac59cf2a81ec470da649af
Compiled:	Tue Jul 07 00:14:00 +0530 2020 by brahma from branch-3.3.0
Cluster ID:	CID-1986aba8-0ed3-43a2-9db7-42944ec518b2
Block Pool ID:	BP-1049743432-192.168.56.1-1678862097216



Browse Directory

/

	Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
No data available in table								

Showing 0 to 0 of 0 entries

Practical 2

Aim: - Implement Decision tree classification techniquesb.

install.packages('datasets')

install.packages('caTools')

install.packages('party')

install.packages('dplyr')

install.packages('magrittr')

library(datasets)

library(caTools)

library(party)

library(dplyr)

library(magrittr)

data("readingSkills")

head(readingSkills)

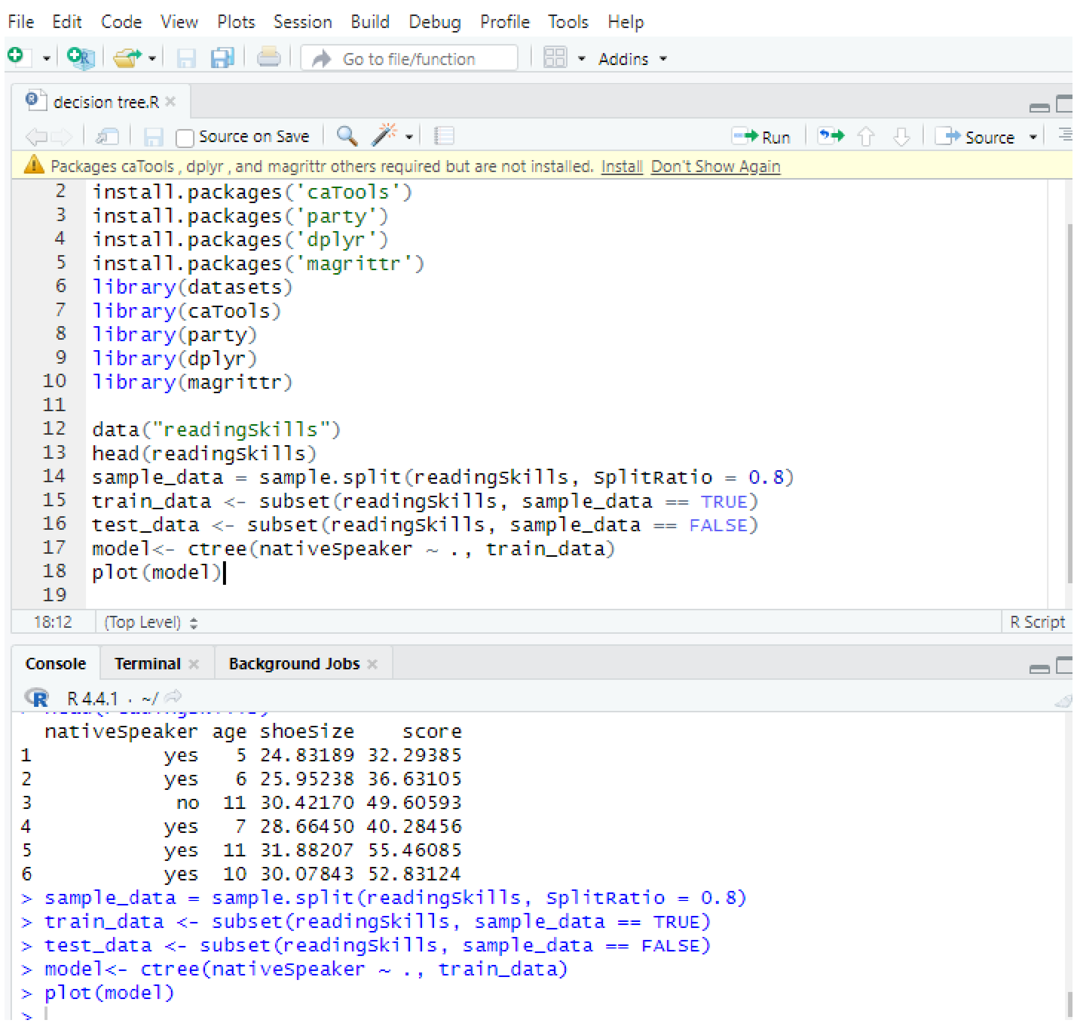
sample_data = sample.split(readingSkills, SplitRatio = 0.8)

train_data <- subset(readingSkills, sample_data == TRUE)

test_data <- subset(readingSkills, sample_data == FALSE)

model<- ctree(nativeSpeaker ~ ., train_data)

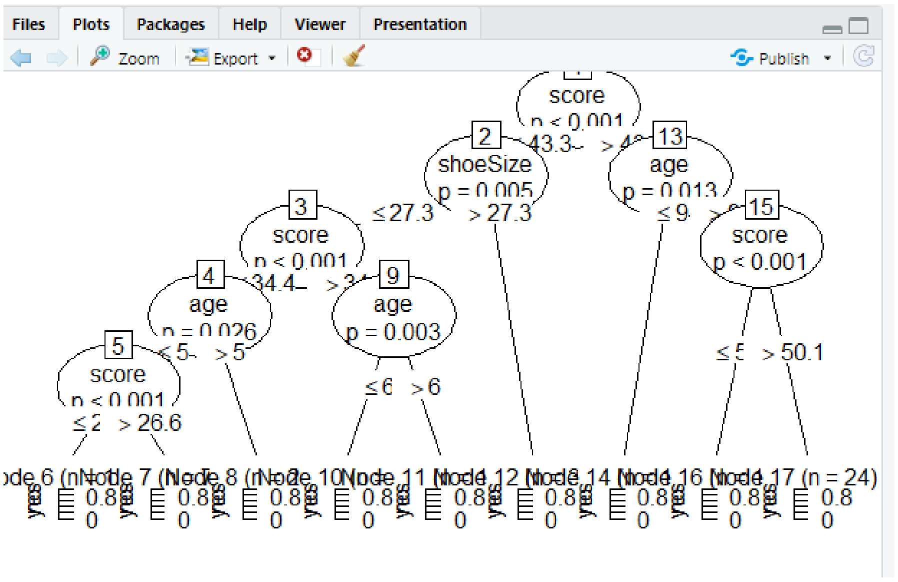
plot(model)



Packages caTools , dplyr , and magrittr others required but are not installed. Install Don't Show Again

```
install.packages('caTools')
install.packages('party')
install.packages('dplyr')
install.packages('magrittr')
library(datasets)
library(caTools)
library(party)
library(dplyr)
library(magrittr)

data("readingSkills")
head(readingSkills)
sample_data = sample.split(readingSkills, SplitRatio = 0.8)
train_data <- subset(readingSkills, sample_data == TRUE)
test_data <- subset(readingSkills, sample_data == FALSE)
model<- ctree(nativeSpeaker ~ ., train_data)
plot(model)
```

```
  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
> sample_data = sample.split(readingSkills, SplitRatio = 0.8)
> train_data <- subset(readingSkills, sample_data == TRUE)
> test_data <- subset(readingSkills, sample_data == FALSE)
> model<- ctree(nativeSpeaker ~ ., train_data)
> plot(model)
```



Practical 3

Aim:- Implement SVM classification techniques

#Code for installation of all necessary packages

install.packages("caret")

install.packages("ggplot2")

install.packages("GGally")

install.packages("psych")

install.packages("ggpubr")

install.packages("reshape")

# Code for importation of all necessary packages

library(caret)

library(ggplot2)

library(GGally)

library(psych)

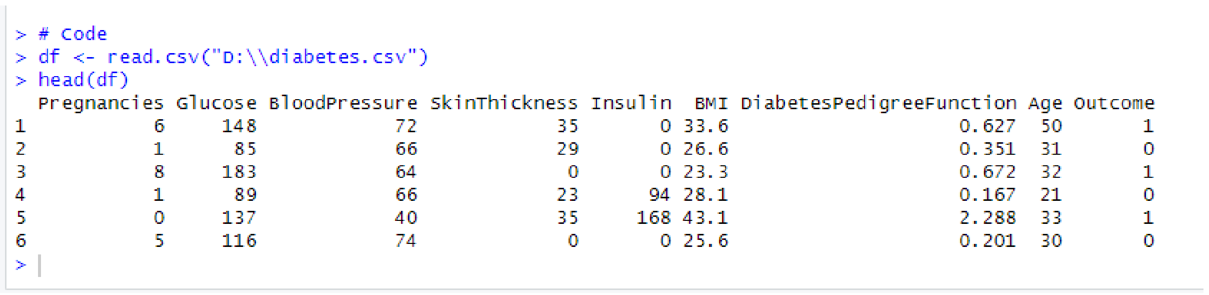
library(ggpubr)

library(reshape)

# Code

df <- read.csv("D:\\diabetes.csv")

head(df)



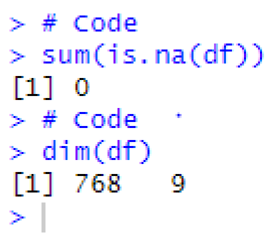
```
> # Code
> df <- read.csv("D:\\diabetes.csv")
> head(df)
  Pregnancies Glucose BloodPressure SkinThickness Insulin  BMI DiabetesPedigreeFunction Age Outcome
1           6     148            72            35       0 33.6                    0.627  50       1
2           1      85            66            29       0 26.6                    0.351  31       0
3           8     183            64             0       0 23.3                    0.672  32       1
4           1      89            66            23      94 28.1                    0.167  21       0
5           0     137            40            35     168 43.1                    2.288  33       1
6           5     116            74             0       0 25.6                    0.201  30       0
> 
```

Code

sum(is.na(df))

Code

dim(df)



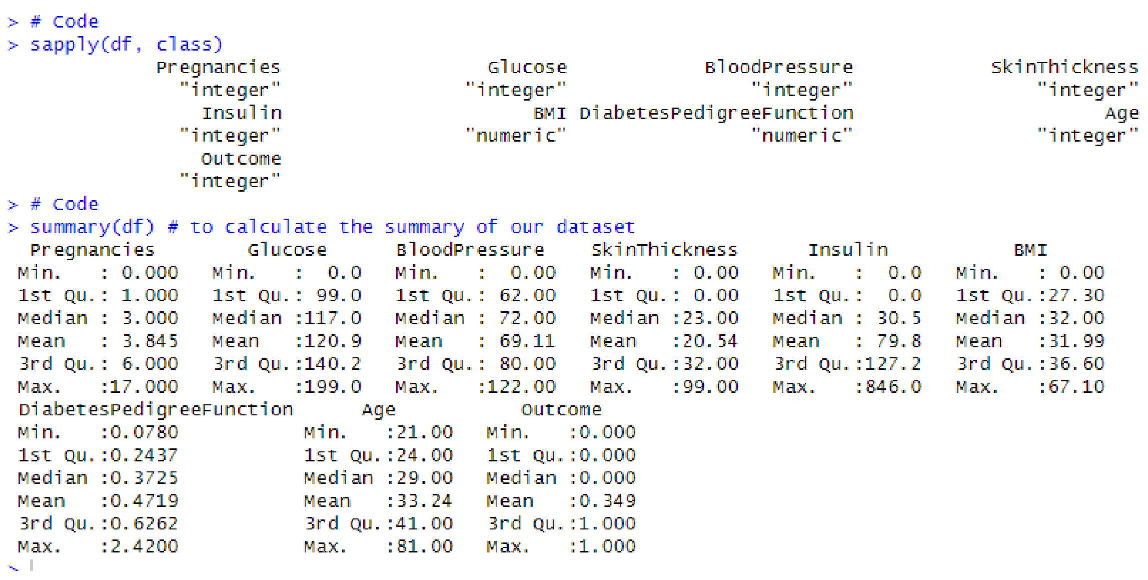
```
> # Code
> sum(is.na(df))
[1] 0
> # Code
> dim(df)
[1] 768   9
> 
```

Code

sapply(df, class)

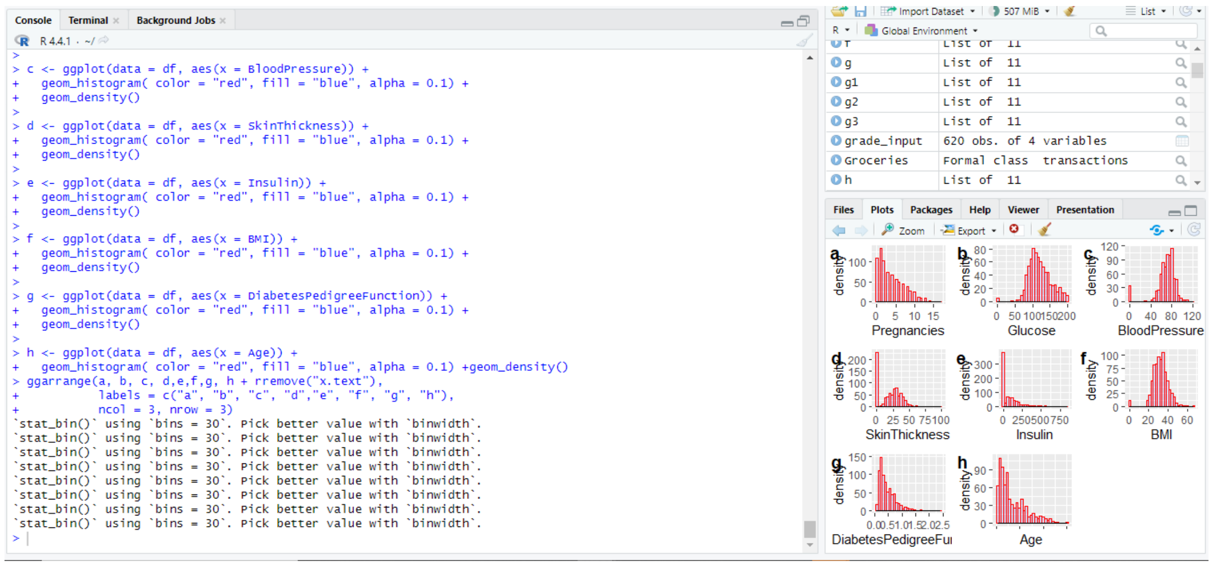
Code

summary(df) # to calculate the summary of our dataset



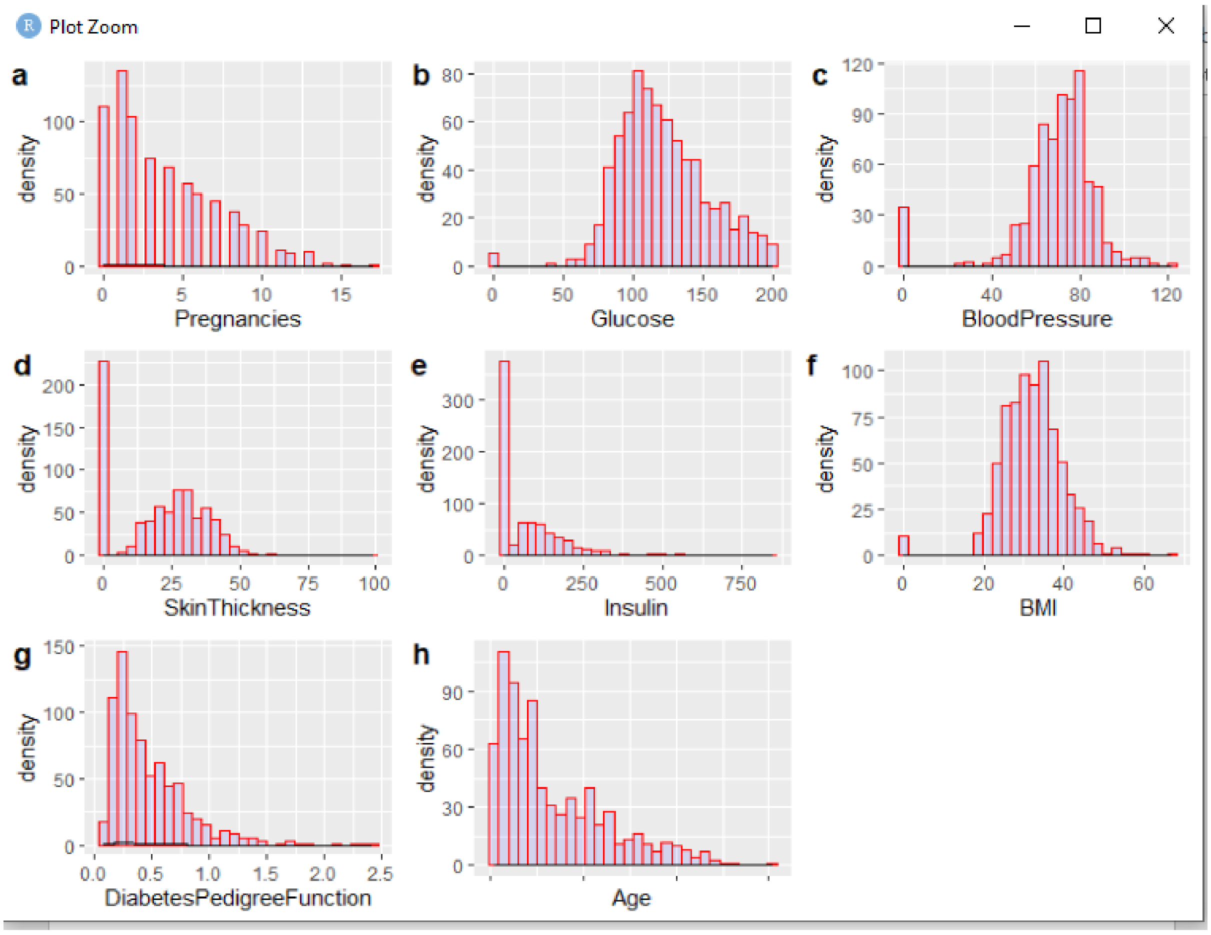
```
> # Code
> sapply(df, class)
             Pregnancies                  Glucose            BloodPressure            SkinThickness 
               "integer"                "integer"                "integer"                "integer" 
                 Insulin                      BMI DiabetesPedigreeFunction                      Age 
               "integer"                "numeric"                "numeric"                "integer" 
                 Outcome 
               "integer" 
> # Code
> summary(df) # to calculate the summary of our dataset
  Pregnancies        Glucose      BloodPressure    SkinThickness      Insulin           BMI       
 Min.   : 0.000   Min.   :  0.0   Min.   :  0.00   Min.   : 0.00   Min.   :  0.0   Min.   : 0.00  
 1st Qu.: 1.000   1st Qu.: 99.0   1st Qu.: 62.00   1st Qu.: 0.00   1st Qu.:  0.0   1st Qu.:27.30  
 Median : 3.000   Median :117.0   Median : 72.00   Median :23.00   Median : 30.5   Median :32.00  
 Mean   : 3.845   Mean   :120.9   Mean   : 69.11   Mean   :20.54   Mean   : 79.8   Mean   :31.99  
 3rd Qu.: 6.000   3rd Qu.:140.2   3rd Qu.: 80.00   3rd Qu.:32.00   3rd Qu.:127.2   3rd Qu.:36.60  
 Max.   :17.000   Max.   :199.0   Max.   :122.00   Max.   :99.00   Max.   :846.0   Max.   :67.10  
 DiabetesPedigreeFunction      Age           Outcome     
 Min.   :0.0780           Min.   :21.00   Min.   :0.000  
 1st Qu.:0.2437           1st Qu.:24.00   1st Qu.:0.000  
 Median :0.3725           Median :29.00   Median :0.000  
 Mean   :0.4719           Mean   :33.24   Mean   :0.349  
 3rd Qu.:0.6262           3rd Qu.:41.00   3rd Qu.:1.000  
 Max.   :2.4200           Max.   :81.00   Max.   :1.000  
```

```
# Code

a <- ggplot(data = df, aes(x = Pregnancies)) +

  geom_histogram( color = "red", fill = "blue", alpha = 0.1) +

  geom_density()

b <- ggplot(data = df, aes(x = Glucose)) +

  geom_histogram( color = "red", fill = "blue", alpha = 0.1) +

  geom_density()

c <- ggplot(data = df, aes(x = BloodPressure)) +

  geom_histogram( color = "red", fill = "blue", alpha = 0.1) +

  geom_density()


d <- ggplot(data = df, aes(x = SkinThickness)) +

  geom_histogram( color = "red", fill = "blue", alpha = 0.1) +

  geom_density()

e <- ggplot(data = df, aes(x = Insulin)) +

  geom_histogram( color = "red", fill = "blue", alpha = 0.1) +

  geom_density()

f <- ggplot(data = df, aes(x = BMI)) +

  geom_histogram( color = "red", fill = "blue", alpha = 0.1) +

  geom_density()

g <- ggplot(data = df, aes(x = DiabetesPedigreeFunction)) +

  geom_histogram( color = "red", fill = "blue", alpha = 0.1) +

  geom_density()

h <- ggplot(data = df, aes(x = Age)) +

  geom_histogram( color = "red", fill = "blue", alpha = 0.1) +geom_density()

ggarrange(a, b, c, d,e,f,g, h + rremove("x.text"),

        labels = c("a", "b", "c", "d","e", "f", "g", "h"),

        ncol = 3, nrow = 3)
```



```
>
> c <- ggplot(data = df, aes(x = BloodPressure)) +
+   geom_histogram( color = "red", fill = "blue", alpha = 0.1) +
+   geom_density()
>
> d <- ggplot(data = df, aes(x = SkinThickness)) +
+   geom_histogram( color = "red", fill = "blue", alpha = 0.1) +
+   geom_density()
>
> e <- ggplot(data = df, aes(x = Insulin)) +
+   geom_histogram( color = "red", fill = "blue", alpha = 0.1) +
+   geom_density()
>
> f <- ggplot(data = df, aes(x = BMI)) +
+   geom_histogram( color = "red", fill = "blue", alpha = 0.1) +
+   geom_density()
>
> g <- ggplot(data = df, aes(x = DiabetesPedigreeFunction)) +
+   geom_histogram( color = "red", fill = "blue", alpha = 0.1) +
+   geom_density()
>
> h <- ggplot(data = df, aes(x = Age)) +
+   geom_histogram( color = "red", fill = "blue", alpha = 0.1) +geom_density()
> ggarrange(a, b, c, d,e,f,g, h + rremove("x.text"),
+           labels = c("a", "b", "c", "d","e", "f", "g", "h"),
+           ncol = 3, nrow = 3)
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
>
```

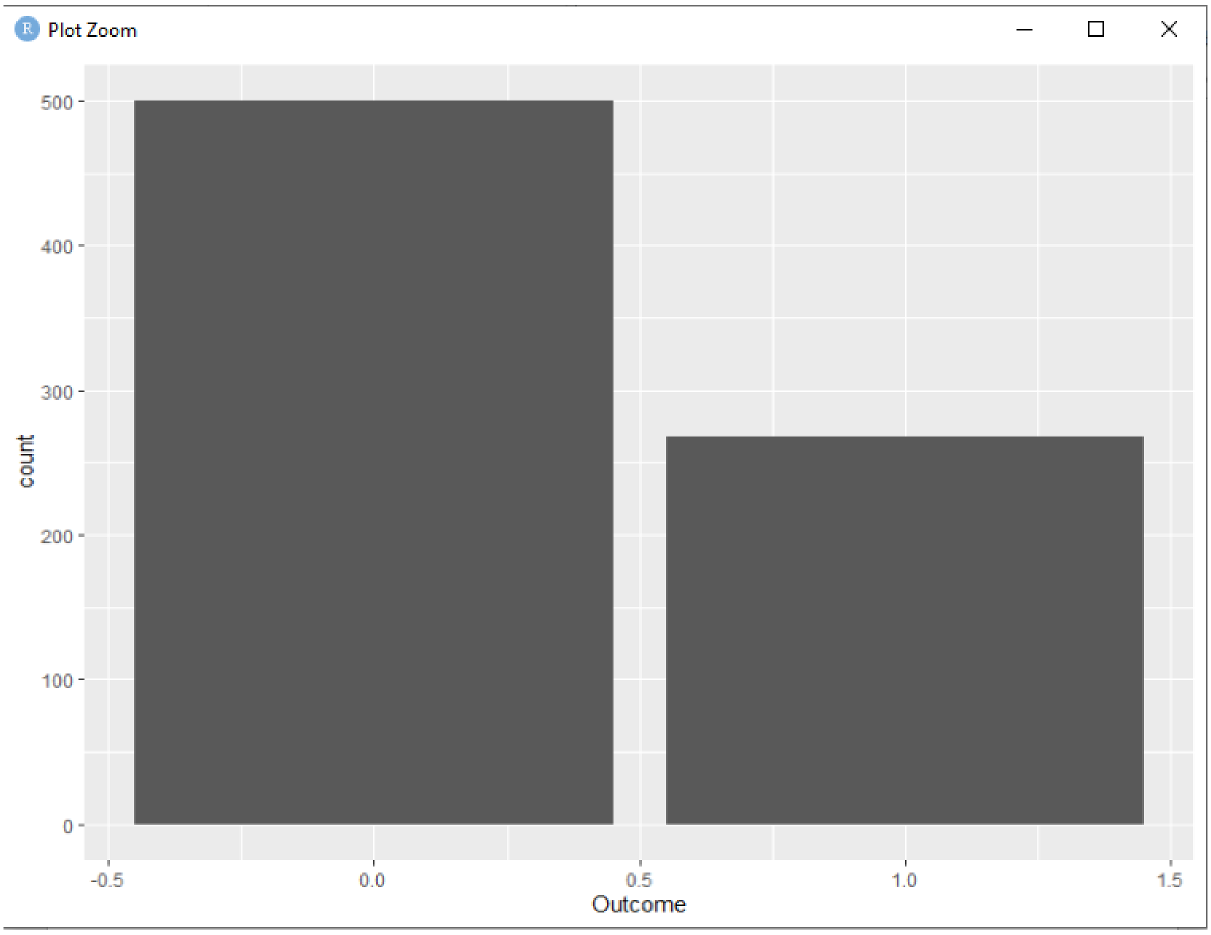
```
T            List of  11
g            List of  11
g1           List of  11
g2           List of  11
g3           List of  11
grade_input  620 obs. of 4 variables
Groceries    Formal class  transactions
h            List of  11
```



# Code

ggplot(data = df, aes(x =Outcome, fill = Outcome)) +

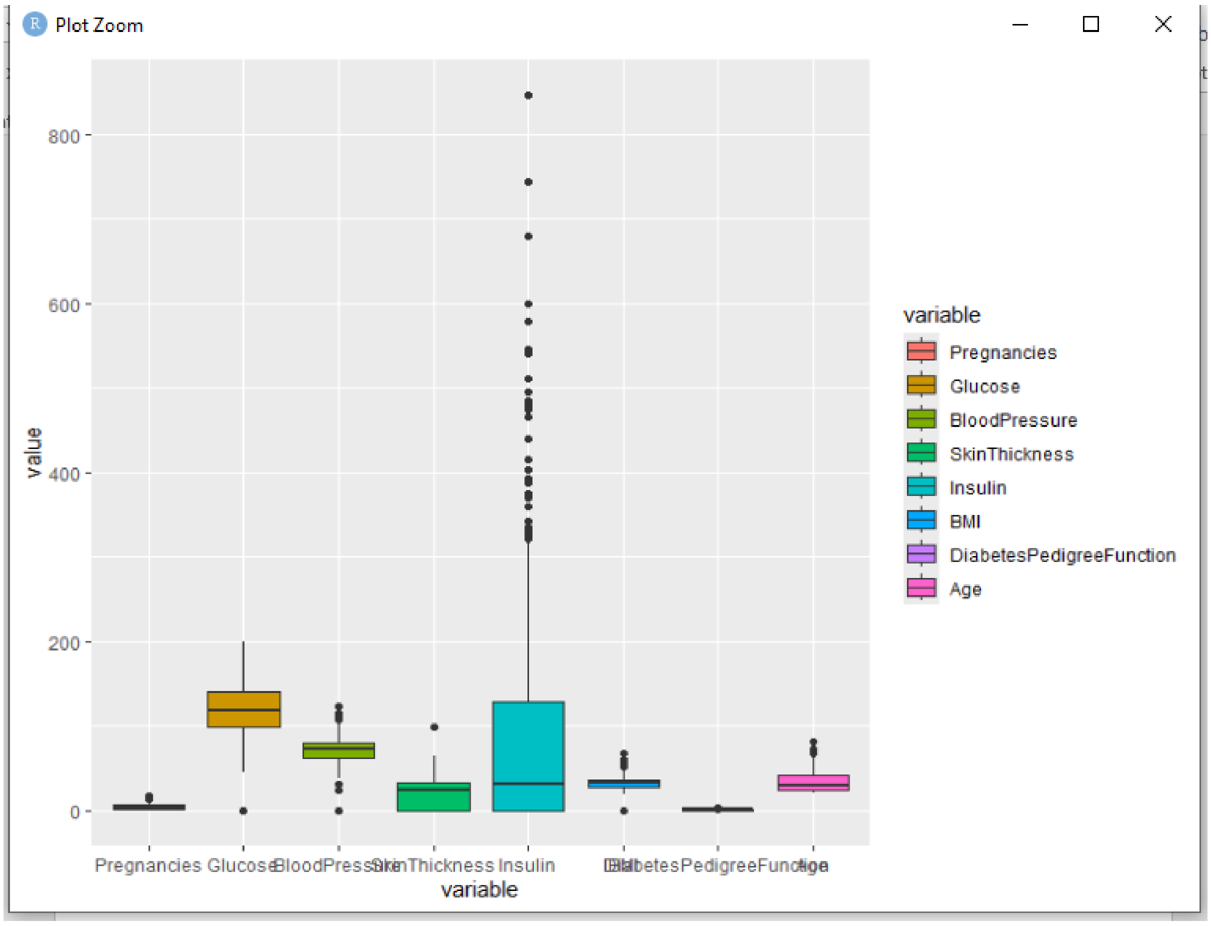
geom_bar()



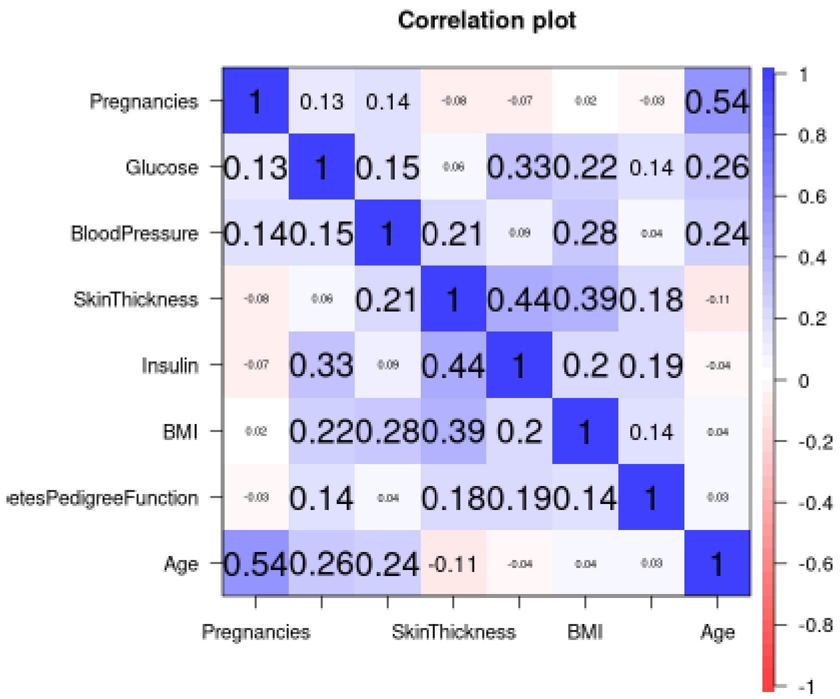
# Code to label our categorical variable as a factor

```
df$Outcome<- factor(df$Outcome,
                levels = c(0, 1),
                labels = c("Negative", "Positive"))
out <- subset(df,
           select = c(Pregnancies,Glucose,
                  BloodPressure,SkinThickness,
                  Insulin,BMI,
                  DiabetesPedigreeFunction,Age))
```

```
# Code for boxplot
ggplot(data = melt(out),
     aes(x=variable, y=value)) +
  geom_boxplot(aes(fill=variable))
```



corPlot(df[, 1:8])



Pregnancies	1	0.13	0.14	-0.08	-0.07	0.02	-0.03	0.54
Glucose	0.13	1	0.15	0.06	0.33	0.22	0.14	0.26
BloodPressure	0.14	0.15	1	0.21	0.09	0.28	0.04	0.24
SkinThickness	-0.08	0.06	0.21	1	0.44	0.39	0.18	-0.11
Insulin	-0.07	0.33	0.09	0.44	1	0.2	0.19	-0.04
BMI	0.02	0.22	0.28	0.39	0.2	1	0.14	0.04
etesPedigreeFunction	-0.03	0.14	0.04	0.18	0.19	0.14	1	0.03
Age	0.54	0.26	0.24	-0.11	-0.04	0.04	0.03	1

cutoff <- createDataPartition(df$Outcome, p=0.85, list=FALSE)

# select 15% of the data for validation

testdf <- df[-cutoff,]

# use the remaining 85% of data to training and testing the models

traindf <- df[cutoff,]

# Code to train the SVM

set.seed(1234)

set the 10 fold crossvalidation with AU

to pick for us what we call the best model

control <- trainControl(method="cv",number=10, classProbs = TRUE)

metric <- "Accuracy"

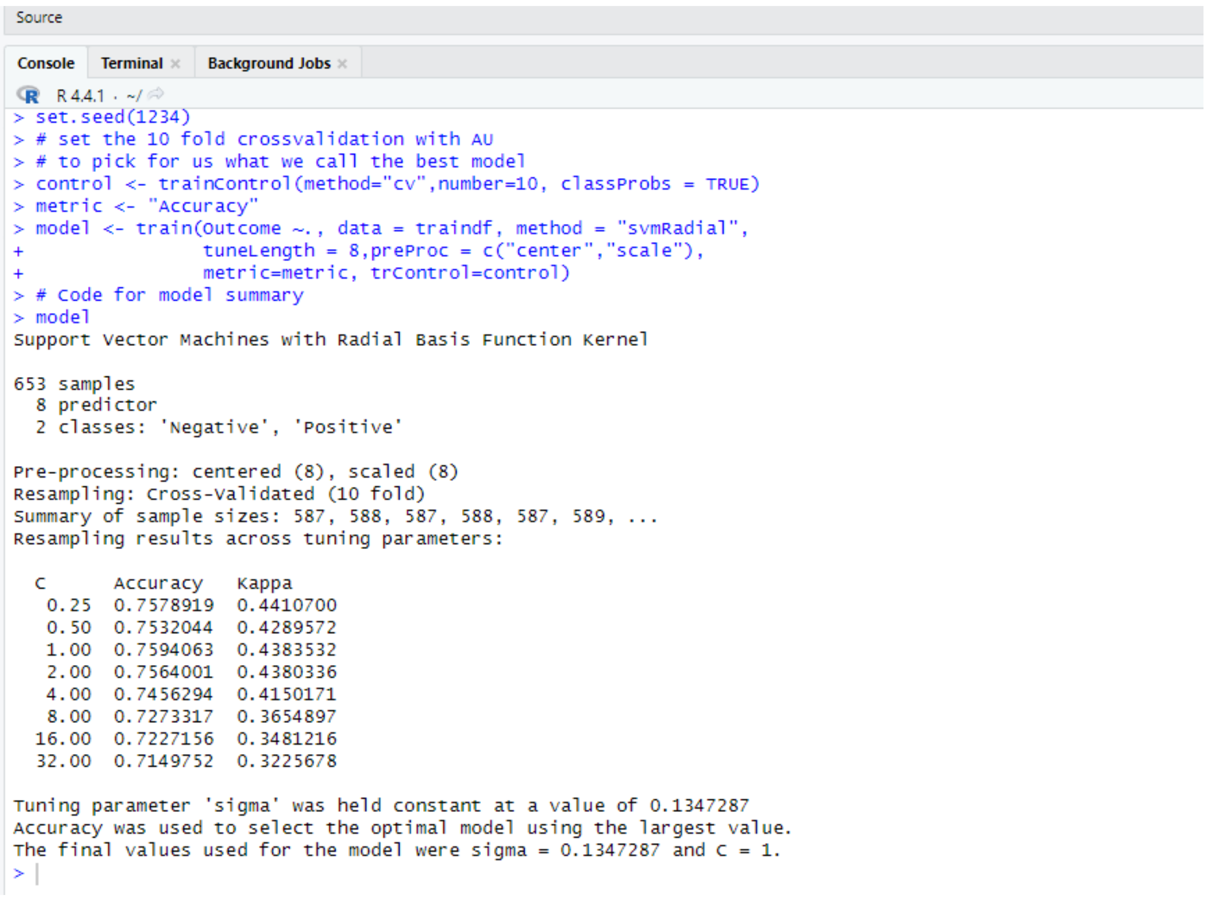
model <- train(Outcome ~., data = traindf, method = "svmRadial",

tuneLength = 8,preProc = c("center","scale"),

metric=metric, trControl=control)

Code for model summary

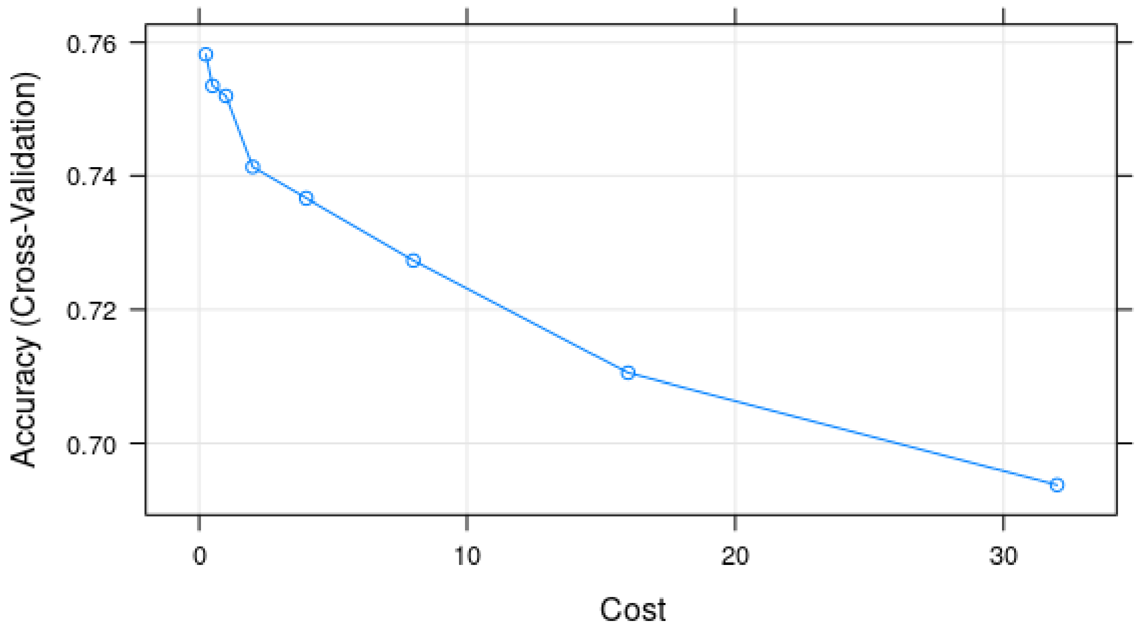
Model



```
> set.seed(1234)
> # set the 10 fold crossvalidation with AU
> # to pick for us what we call the best model
> control <- trainControl(method="cv",number=10, classProbs = TRUE)
> metric <- "Accuracy"
> model <- train(Outcome ~., data = traindf, method = "svmRadial",
+                tuneLength = 8,preProc = c("center","scale"),
+                metric=metric, trControl=control)
> # Code for model summary
> model
Support Vector Machines with Radial Basis Function Kernel 

653 samples
  8 predictor
  2 classes: 'Negative', 'Positive' 

Pre-processing: centered (8), scaled (8) 
Resampling: Cross-Validated (10 fold) 
Summary of sample sizes: 587, 588, 587, 588, 587, 589, ... 
Resampling results across tuning parameters:

  C      Accuracy   Kappa    
   0.25  0.7578919  0.4410700
   0.50  0.7532044  0.4289572
   1.00  0.7594063  0.4383532
   2.00  0.7564001  0.4380336
   4.00  0.7456294  0.4150171
   8.00  0.7273317  0.3654897
  16.00  0.7227156  0.3481216
  32.00  0.7149752  0.3225678

Tuning parameter 'sigma' was held constant at a value of 0.1347287
Accuracy was used to select the optimal model using the largest value.
The final values used for the model were sigma = 0.1347287 and C = 1.
> 
```

Code

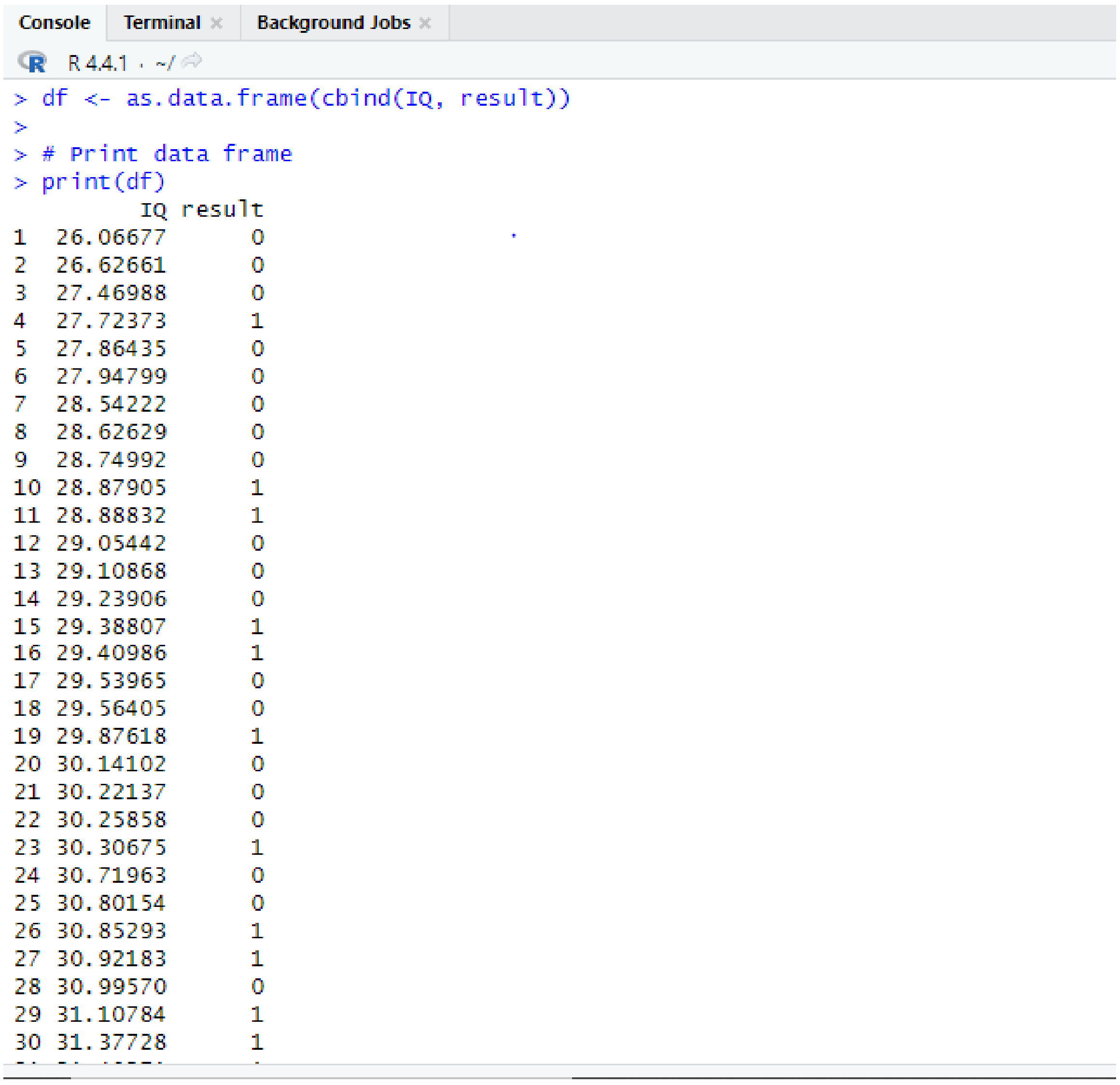
```
plot(model)
```



Practical 4

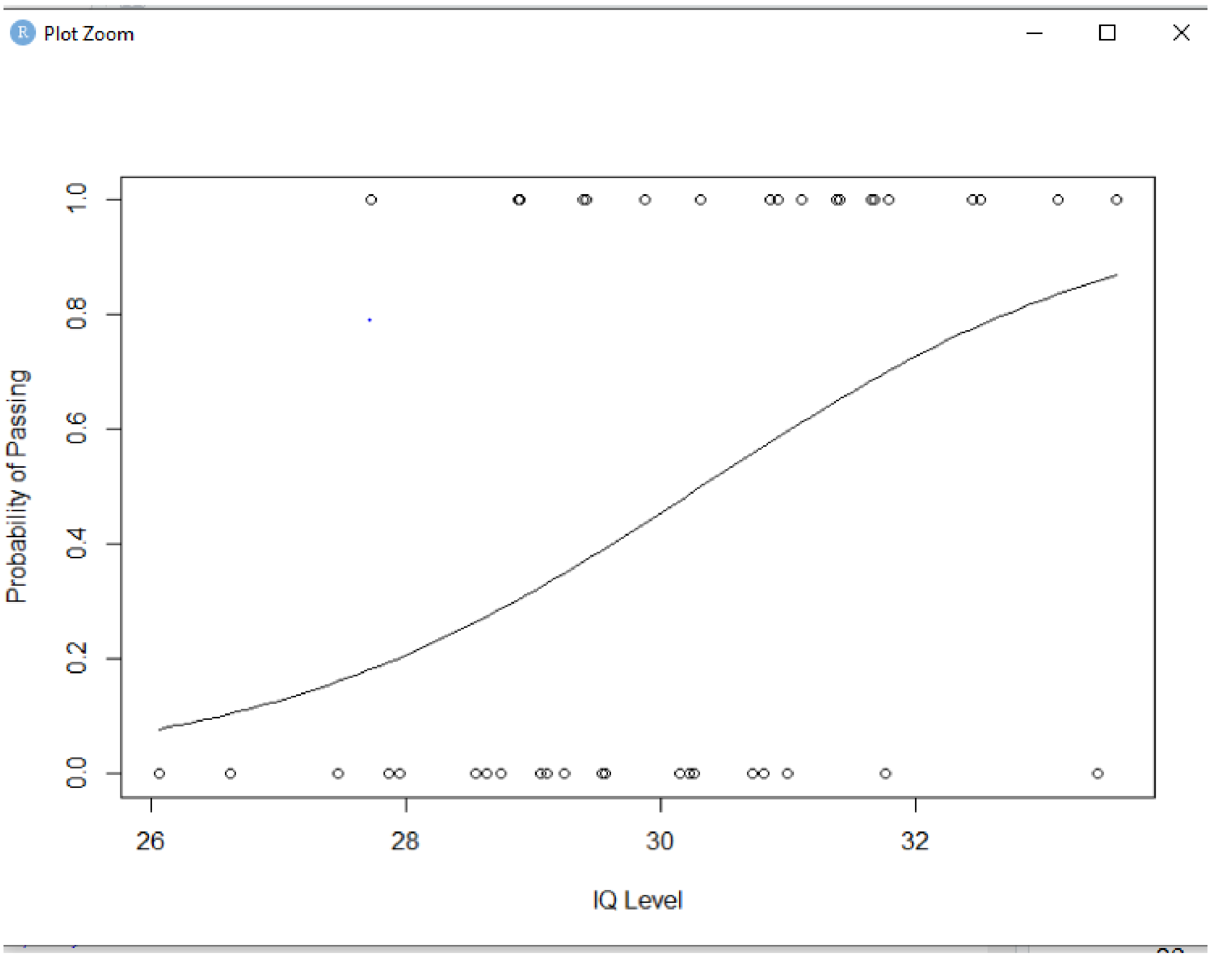
Aim: - Implement of REGRESSION MODLE.

```
# Generate random IQ values with mean = 30 and sd =2

IQ <- rnorm(40, 30, 2)

# Sorting IQ level in ascending order

IQ <- sort(IQ)

# Generate vector with pass and fail values of 40 students

result <- c(0, 0, 0, 1, 0, 0, 0, 0, 0, 1,

        1, 0, 0, 0, 1, 1, 0, 0, 1, 0,

        0, 0, 1, 0, 0, 1, 1, 0, 1, 1,

        1, 1, 1, 0, 1, 1, 1, 1, 0, 1)

# Data Frame

df <- as.data.frame(cbind(IQ, result))

# Print data frame

print(df)
```



```
> df <- as.data.frame(cbind(IQ, result))
>
> # Print data frame
> print(df)
         IQ result
1  26.06677      0
2  26.62661      0
3  27.46988      0
4  27.72373      1
5  27.86435      0
6  27.94799      0
7  28.54222      0
8  28.62629      0
9  28.74992      0
10 28.87905      1
11 28.88832      1
12 29.05442      0
13 29.10868      0
14 29.23906      0
15 29.38807      1
16 29.40986      1
17 29.53965      0
18 29.56405      0
19 29.87618      1
20 30.14102      0
21 30.22137      0
22 30.25858      0
23 30.30675      1
24 30.71963      0
25 30.80154      0
26 30.85293      1
27 30.92183      1
28 30.99570      0
29 31.10784      1
30 31.37728      1
```

```
# Plotting IQ on x-axis and result on y-axis

plot(IQ, result, xlab = "IQ Level",

    ylab = "Probability of Passing")

# Create a logistic model

g = glm(result~IQ, family=binomial, df)

# Create a curve based on prediction using the regression model

curve(predict(g, data.frame(IQ=x), type="resp"), add=TRUE)

# Based on fit to the regression model

points(IQ, fitted(g), pch=30)
```


Plot Zoom
Probability of Passing
1.0
0.8
0.6
0.4
0.2
0.0
26
28
30
32
IQ Level

Summary of the regression model

summary(g)

```
> # Summary of the regression model
> summary(g)

Call:
glm(formula = result ~ IQ, family = binomial, data = df)

Coefficients:
            Estimate Std. Error z value Pr(>|z|)  
(Intercept) -17.6032     7.0531  -2.496   0.0126 *
IQ            0.5808     0.2335   2.488   0.0129 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 55.352  on 39  degrees of freedom
Residual deviance: 47.331  on 38  degrees of freedom
AIC: 51.331

Number of Fisher Scoring iterations: 3
```

Practical 5

Aim :- Implement of Simple Linear Regaression.

years_of_exp = c(7,5,1,3)

salary_in_lakhs = c(21,13,6,8)

#employee.data = data.frame(satisfaction_score, years_of_exp, salary_in_lakhs)

employee.data = data.frame(years_of_exp, salary_in_lakhs)

employee.data

Estimation of the salary of an employee, based on his year of experience and satisfaction score in his company.

model <- lm(salary_in_lakhs ~ years_of_exp, data = employee.data)

summary(model)

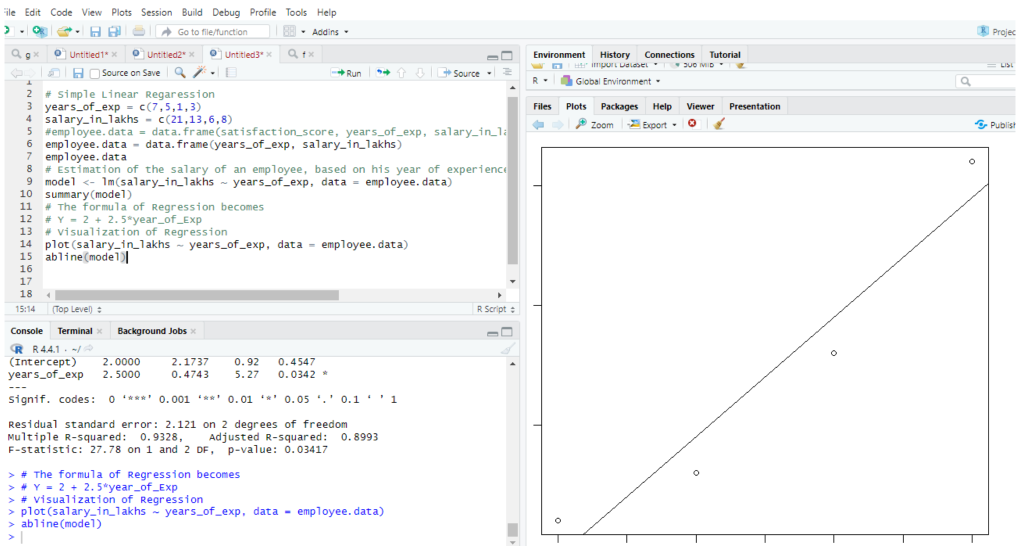
The formula of Regression becomes

Y = 2 + 2.5*year_of_Exp

Visualization of Regression

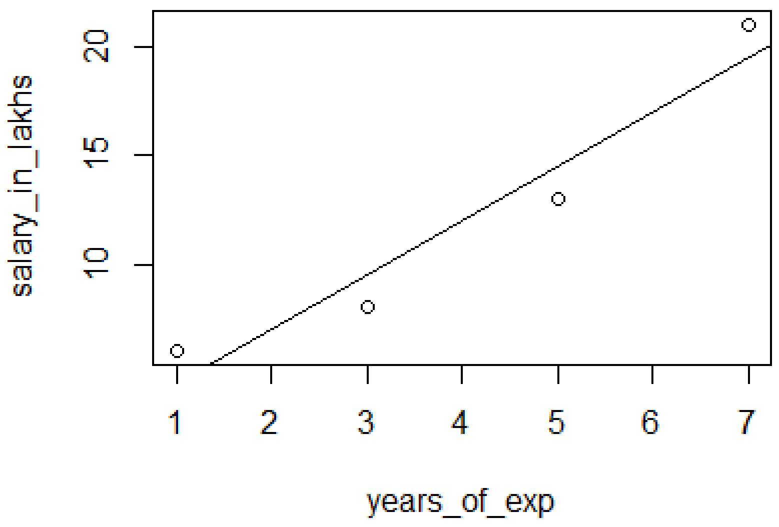
plot(salary_in_lakhs ~ years_of_exp, data = employee.data)

abline(model)



```
# Simple Linear Regaression
years_of_exp = c(7,5,1,3)
salary_in_lakhs = c(21,13,6,8)
#employee.data = data.frame(satisfaction_score, years_of_exp, salary_in_la
employee.data = data.frame(years_of_exp, salary_in_lakhs)
employee.data
# Estimation of the salary of an employee, based on his year of experience
model <- lm(salary_in_lakhs ~ years_of_exp, data = employee.data)
summary(model)
# The formula of Regression becomes
# Y = 2 + 2.5*year_of_Exp
# Visualization of Regression
plot(salary_in_lakhs ~ years_of_exp, data = employee.data)
abline(model)
```

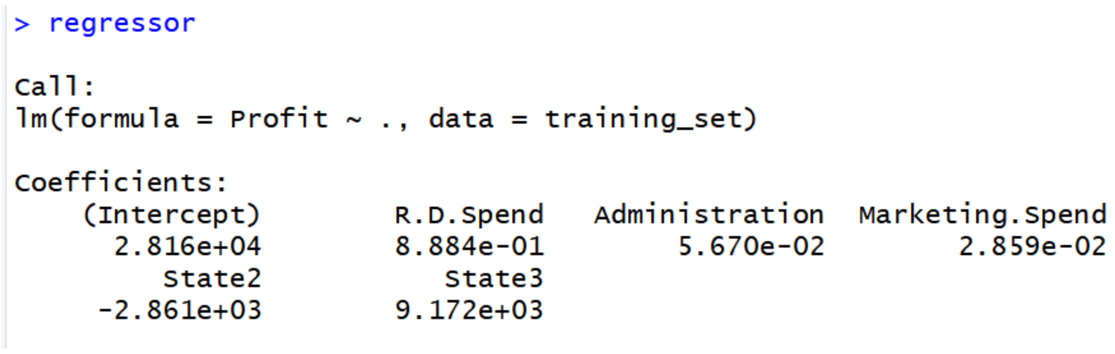
```
(Intercept)    2.0000     2.1737    0.92   0.4547
years_of_exp   2.5000     0.4743    5.27   0.0342 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.121 on 2 degrees of freedom
Multiple R-squared:  0.9328,    Adjusted R-squared:  0.8993
F-statistic: 27.78 on 1 and 2 DF,  p-value: 0.03417

> # The formula of Regression becomes
> # Y = 2 + 2.5*year_of_Exp
> # Visualization of Regression
> plot(salary_in_lakhs ~ years_of_exp, data = employee.data)
> abline(model)
> 
```


salary_in_lakhs
10
15
20
1
2
3
4
5
6
7
years_of_exp

Practical 6

Aim :- Implement of Multiple Linear Regression.

```
# Importing the dataset

dataset = read.csv('D:\\data2.csv')

# Encoding categorical data

dataset$State = factor(dataset$State,

                levels = c('New York', 'California', 'Florida'),

                labels = c(1, 2, 3))

dataset$State

# Splitting the dataset into the Training set and Test set

install.packages('caTools')

library(caTools)

set.seed(123)

split = sample.split(dataset$Profit, SplitRatio = 0.8)

training_set = subset(dataset, split == TRUE)

test_set = subset(dataset, split == FALSE)


# Feature Scaling

# training_set = scale(training_set)

# test_set = scale(test_set)


# Fitting Multiple Linear Regression to the Training set

regressor = lm(formula = Profit ~ .,

          data = training_set)


# Predicting the Test set results

y_pred = predict(regressor, newdata = test_set)
```



```
> regressor

Call:
lm(formula = Profit ~ ., data = training_set)

Coefficients:
    (Intercept)        R.D.Spend   Administration  Marketing.Spend
      2.816e+04        8.884e-01        5.670e-02        2.859e-02
         State2           State3
     -2.861e+03        9.172e+03
```

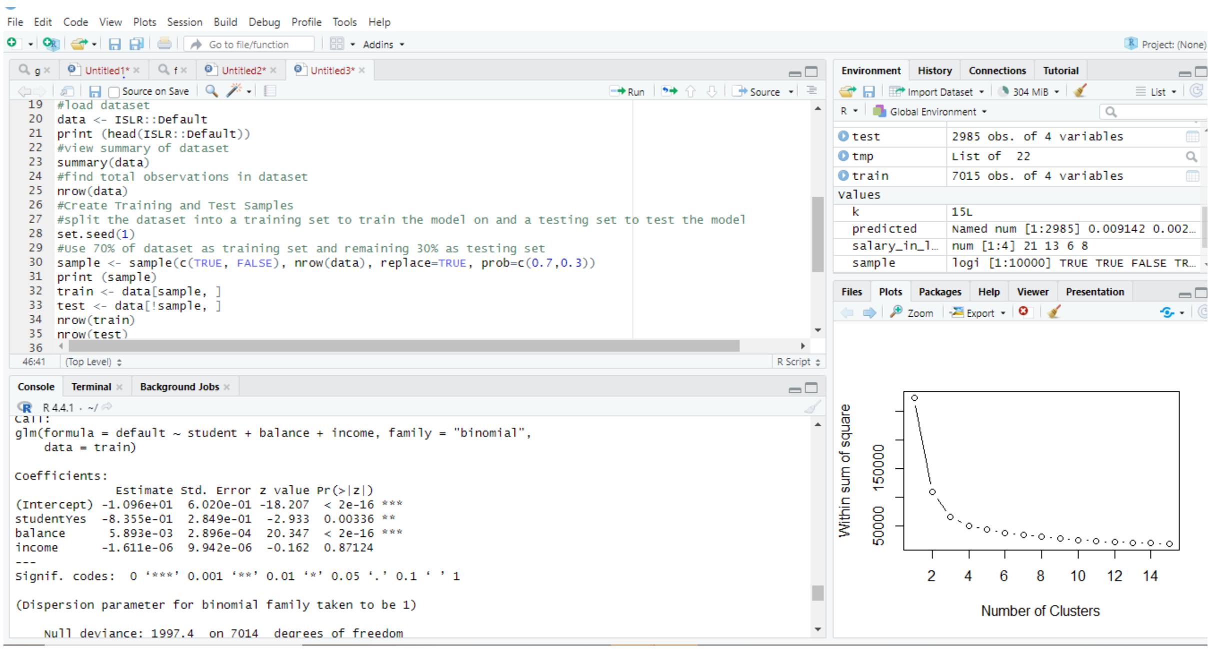
Practical 7

Aim :- Implement of Logistic regression.

Source code:

```
install.packages("ISLR")

library(ISLR)

#load dataset

data <- ISLR::Default

print (head(ISLR::Default))

#view summary of dataset

summary(data)

#find total observations in dataset

nrow(data)

#Create Training and Test Samples

#split the dataset into a training set to train the model on and a testing set to test the model

set.seed(1)

#Use 70% of dataset as training set and remaining 30% as testing set

sample <- sample(c(TRUE, FALSE), nrow(data), replace=TRUE, prob=c(0.7,0.3))

print (sample)

train <- data[sample, ]

test <- data[!sample, ]

nrow(train)

nrow(test)

# Fit the Logistic Regression Model

# use the glm (general linear model) function and specify family="binomial"

#so that R fits a logistic regression model to the dataset

model <- glm(default~student+balance+income, family="binomial", data=train)

#view model summary

summary(model)

#Model Diagnostics

install.packages("InformationValue")
```

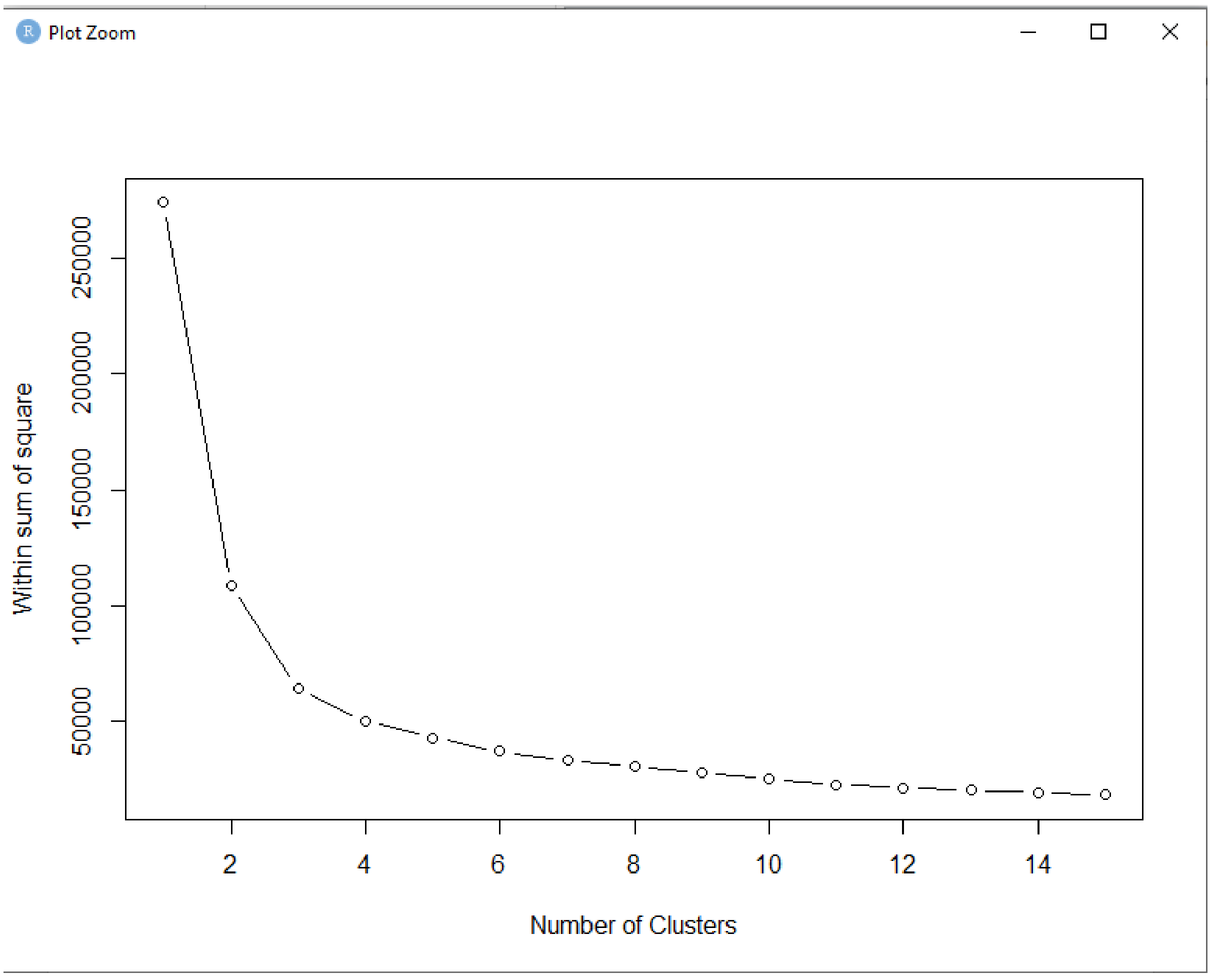
```r
library(InformationValue)

predicted <- predict(model, test, type="response")

confusionMatrix(test$default, predicted)
```



```r
#load dataset
data <- ISLR::Default
print (head(ISLR::Default))
#view summary of dataset
summary(data)
#find total observations in dataset
nrow(data)
#Create Training and Test Samples
#split the dataset into a training set to train the model on and a testing set to test the model
set.seed(1)
#Use 70% of dataset as training set and remaining 30% as testing set
sample <- sample(c(TRUE, FALSE), nrow(data), replace=TRUE, prob=c(0.7,0.3))
print (sample)
train <- data[sample, ]
test <- data[!sample, ]
nrow(train)
nrow(test)
```

```
Call:
glm(formula = default ~ student + balance + income, family = "binomial",
    data = train)

Coefficients:
               Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.096e+01  6.020e-01 -18.207  < 2e-16 ***
studentYes  -8.355e-01  2.849e-01  -2.933  0.00336 **
balance      5.893e-03  2.896e-04  20.347  < 2e-16 ***
income      -1.611e-06  9.942e-06  -0.162  0.87124
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1997.4  on 7014  degrees of freedom
```

```
test         2985 obs. of 4 variables
tmp          List of  22
train        7015 obs. of 4 variables
Values
  k            15L
  predicted    Named num [1:2985] 0.009142 0.002…
  salary_in_l… num [1:4] 21 13 6 8
  sample       logi [1:10000] TRUE TRUE FALSE TR…
```


Plot Zoom
Within sum of square
50000
100000
150000
200000
250000
2
4
6
8
10
12
14
Number of Clusters

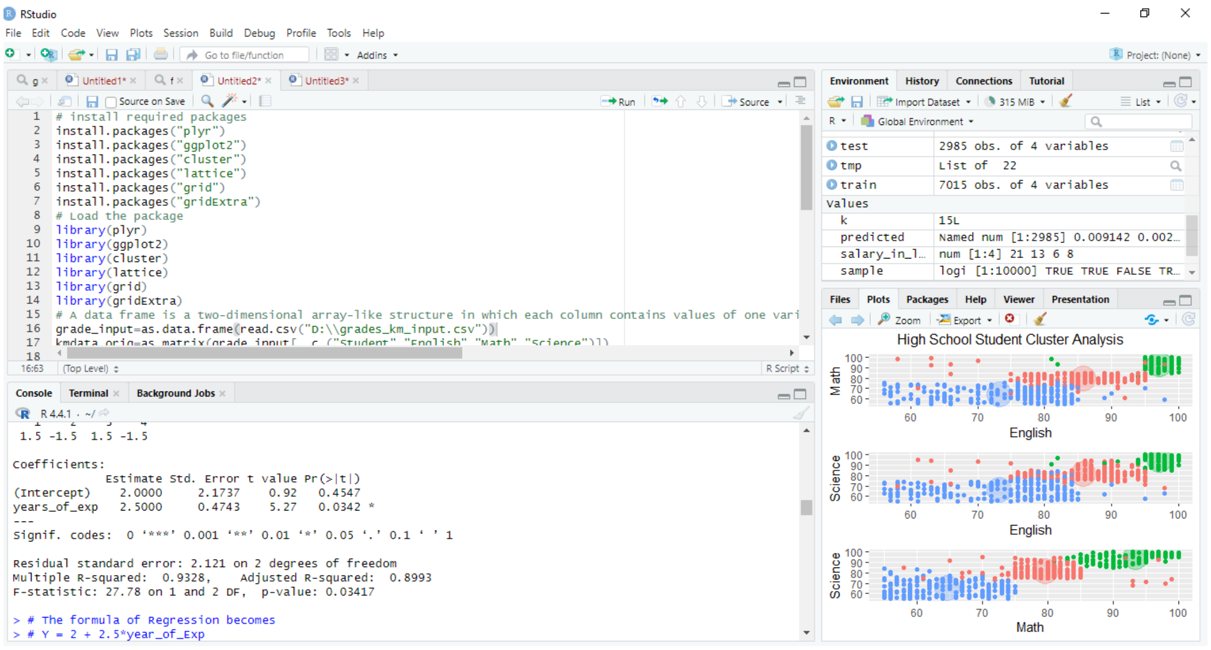
Practical 8

Aim: Read a datafile grades_km_input.csv and apply k-means clustering.

Datafile:

```
# install required packages

install.packages("plyr")

install.packages("ggplot2")

install.packages("cluster")

install.packages("lattice")

install.packages("grid")

install.packages("gridExtra")

# Load the package

library(plyr)

library(ggplot2)

library(cluster)

library(lattice)

library(grid)

library(gridExtra)

# A data frame is a two-dimensional array-like structure in which each column contains values of one
variable and each row contains one set of values from each column.

grade_input=as.data.frame(read.csv("D:\\grades_km_input.csv"))

kmdata_orig=as.matrix(grade_input[, c ("Student","English","Math","Science")])

kmdata=kmdata_orig[,2:4]

kmdata[1:10,]

# the k-means algorithm is used to identify clusters for k = 1, 2, .. . , 15. For each value of k, the WSS
is calculated.

wss=numeric(15)

# the option n start=25 specifies that the k-means algorithm will be repeated 25 times, each starting
with k random initial centroids

for(k in 1:15)wss[k]=sum(kmeans(kmdata,centers=k,nstart=25)$withinss)

plot(1:15,wss,type="b",xlab="Number of Clusters",ylab="Within sum of square")
```

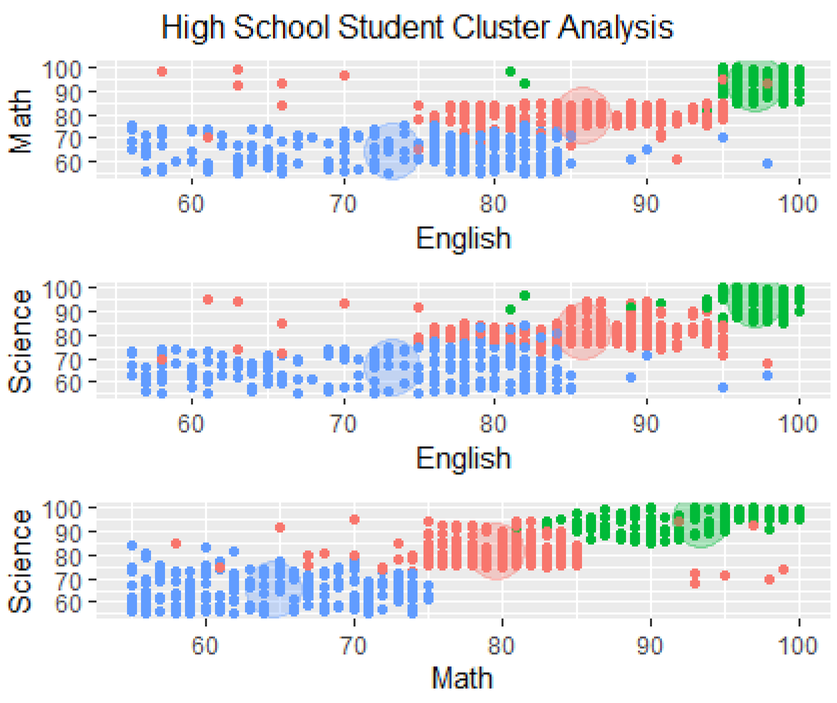
```
#As can be seen, the WSS is greatly reduced when k increases from one to two. Another substantial
reduction in WSS occurs at k = 3. However, the improvement in WSS is fairly linear fork > 3.

km = kmeans(kmdata,3,nstart=25)

km

c( wss[3] , sum(km$withinss))

df=as.data.frame(kmdata_orig[,2:4])

df$cluster=factor(km$cluster)

centers=as.data.frame(km$centers)

g1=ggplot(data=df, aes(x=English, y=Math, color=cluster )) +

  geom_point() + theme(legend.position="right") +

  geom_point(data=centers,aes(x=English,y=Math, color=as.factor(c(1,2,3))),size=10, alpha=.3,
show.legend =FALSE)

g2=ggplot(data=df, aes(x=English, y=Science, color=cluster )) +

  geom_point () +geom_point(data=centers,aes(x=English,y=Science,
color=as.factor(c(1,2,3))),size=10, alpha=.3, show.legend=FALSE)

g3 = ggplot(data=df, aes(x=Math, y=Science, color=cluster )) +

  geom_point () + geom_point(data=centers,aes(x=Math,y=Science,
color=as.factor(c(1,2,3))),size=10, alpha=.3, show.legend=FALSE)

tmp=ggplot_gtable(ggplot_build(g1))

grid.arrange(arrangeGrob(g1 + theme(legend.position="none"),g2 +
theme(legend.position="none"),g3 + theme(legend.position="none"),top ="High School Student
Cluster Analysis" ,ncol=1))
```



```r
# install required packages
install.packages("plyr")
install.packages("ggplot2")
install.packages("cluster")
install.packages("lattice")
install.packages("grid")
install.packages("gridExtra")
# Load the package
library(plyr)
library(ggplot2)
library(cluster)
library(lattice)
library(grid)
library(gridExtra)
# A data frame is a two-dimensional array-like structure in which each column contains values of one vari
grade_input=as.data.frame(read.csv("D:\\grades_km_input.csv"))
kmdata_orig=as.matrix(grade_input[, c ("Student","English","Math","Science")])
```

```
 1.5 -1.5  1.5 -1.5

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   2.0000     2.1737    0.92   0.4547
years_of_exp  2.5000     0.4743    5.27   0.0342 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.121 on 2 degrees of freedom
Multiple R-squared:  0.9328,	Adjusted R-squared:  0.8993
F-statistic: 27.78 on 1 and 2 DF,  p-value: 0.03417

> # The formula of Regression becomes
> # Y = 2 + 2.5*year_of_Exp
```

```
test        2985 obs. of 4 variables
tmp         List of  22
train       7015 obs. of 4 variables
Values
  k           15L
  predicted   Named num [1:2985] 0.009142 0.002…
  salary_in_l… num [1:4] 21 13 6 8
  sample      logi [1:10000] TRUE TRUE FALSE TR…
```



Practical 9

Aim: Perform Apriori algorithm using Groceries dataset from the R arules package.

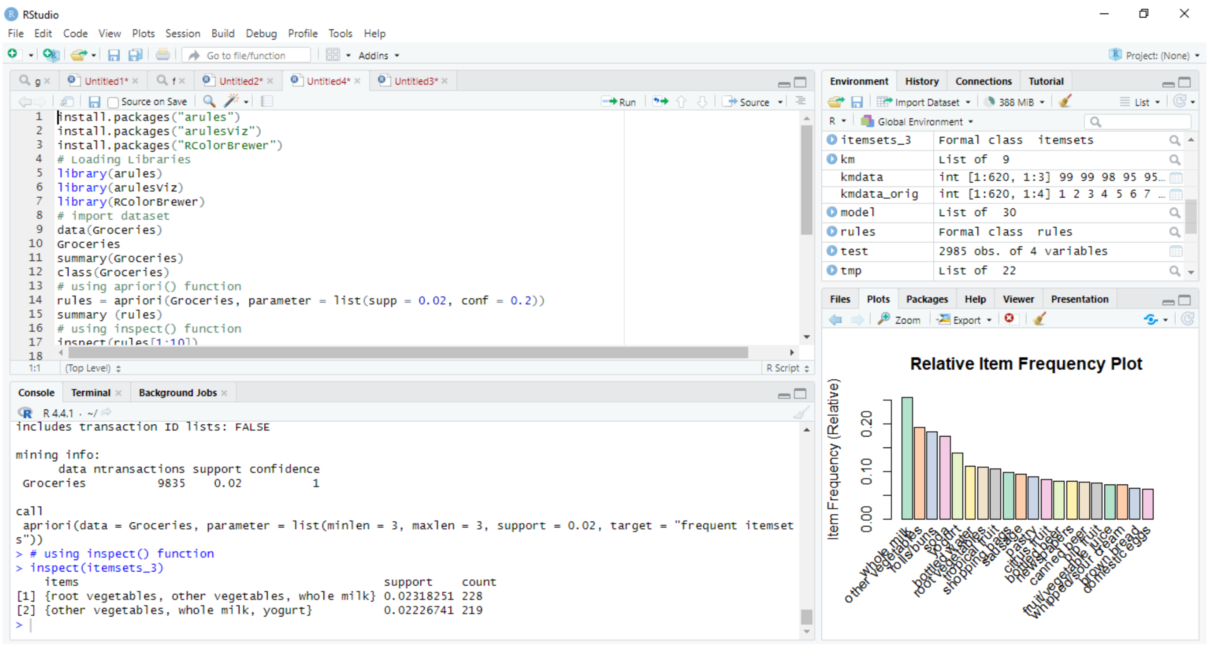
```
install.packages("arules")

install.packages("arulesViz")

install.packages("RColorBrewer")

# Loading Libraries

library(arules)

library(arulesViz)

library(RColorBrewer)

# import dataset

data(Groceries)

Groceries

summary(Groceries)

class(Groceries)

# using apriori() function

rules = apriori(Groceries, parameter = list(supp = 0.02, conf = 0.2))

summary (rules)

# using inspect() function

inspect(rules[1:10])

# using itemFrequencyPlot() function

arules::itemFrequencyPlot(Groceries, topN = 20,

col = brewer.pal(8, 'Pastel2'),

main = 'Relative Item Frequency Plot',

type = "relative",

ylab = "Item Frequency (Relative)")

itemsets = apriori(Groceries, parameter = list(minlen=2, maxlen=2,support=0.02, target="frequent
itemsets"))

summary(itemsets)

# using inspect() function

inspect(itemsets[1:10])
```

itemsets_3 = apriori(Groceries, parameter = list(minlen=3, maxlen=3,support=0.02, target="frequent itemsets"))

summary(itemsets_3)

using inspect() function

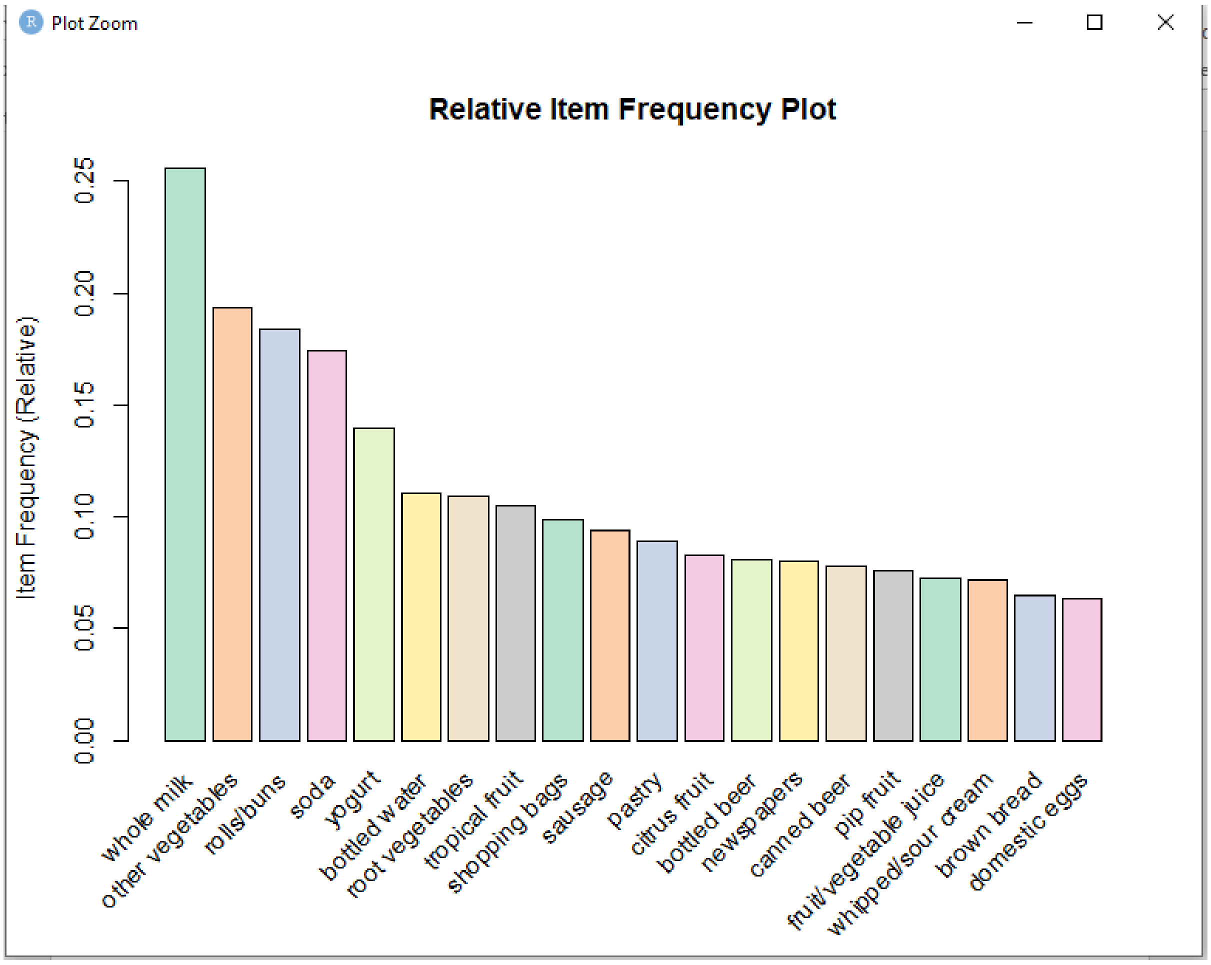
inspect(itemsets_3)



```
install.packages("arules")
install.packages("arulesViz")
install.packages("RColorBrewer")
# Loading Libraries
library(arules)
library(arulesViz)
library(RColorBrewer)
# import dataset
data(Groceries)
Groceries
summary(Groceries)
class(Groceries)
# using apriori() function
rules = apriori(Groceries, parameter = list(supp = 0.02, conf = 0.2))
summary (rules)
# using inspect() function
inspect(rules[1:10])
```

```
itemsets_3     Formal class  itemsets
km             List of  9
kmdata         int [1:620, 1:3] 99 99 98 95 95…
kmdata_orig    int [1:620, 1:4] 1 2 3 4 5 6 7 …
model          List of  30
rules          Formal class  rules
test           2985 obs. of 4 variables
tmp            List of  22
```

```
includes transaction ID lists: FALSE

mining info:
      data ntransactions support confidence
 Groceries          9835    0.02          1

call
 apriori(data = Groceries, parameter = list(minlen = 3, maxlen = 3, support = 0.02, target = "frequent itemset
s"))
> # using inspect() function
> inspect(itemsets_3)
    items                                        support    count
[1] {root vegetables, other vegetables, whole milk} 0.02318251 228
[2] {other vegetables, whole milk, yogurt}          0.02226741 219
> 
```


Plot Zoom
Relative Item Frequency Plot
Item Frequency (Relative)
0.00
0.05
0.10
0.15
0.20
0.25
whole milk
other vegetables
rolls/buns
soda
yogurt
bottled water
root vegetables
tropical fruit
shopping bags
sausage
pastry
citrus fruit
bottled beer
newspapers
canned beer
pip fruit
fruit/vegetable juice
whipped/sour cream
brown bread
domestic eggs