M.Sc C.S - II
SEM III
Journal

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Subject	**BUSINESS INTELLIGENCE AND BIG DATA ANALYTICS - II**

Thakur Educational Trust's (Regd.)
Thakur College of Science & Commerce
UGC Recognised • Affiliated to University Of Mumbai
(NAAC Accredited with Grade "A" [3rd Cycle] & ISO 9001:2015 Certified)

CERTIFICATE

This is here to certify that Mr. **Priti Sudesh Khochare**, Seat Number **076** of M.Sc. II Computer Science, has satisfactorily completed the required number of experiments prescribed by the UNIVERSITY OF MUMBAI during the academic year 2022 – 2023.

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Teacher In-Charge Head of Department

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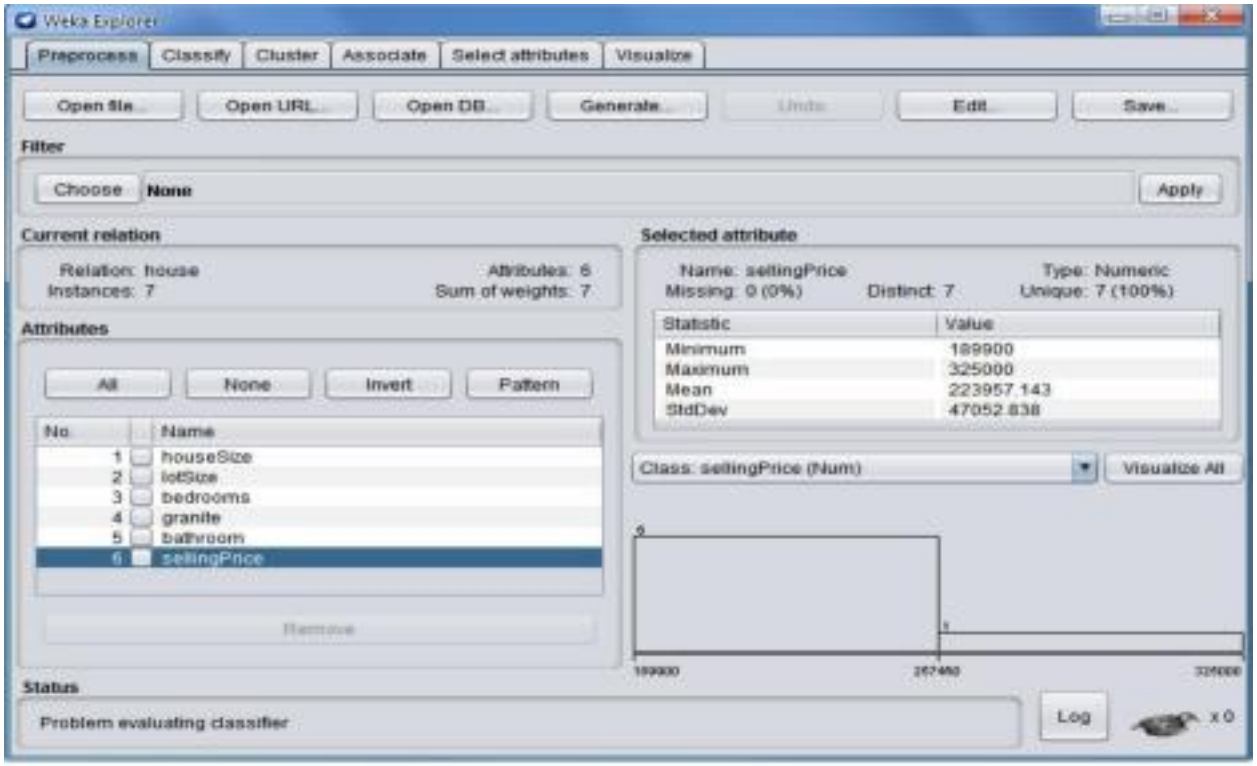
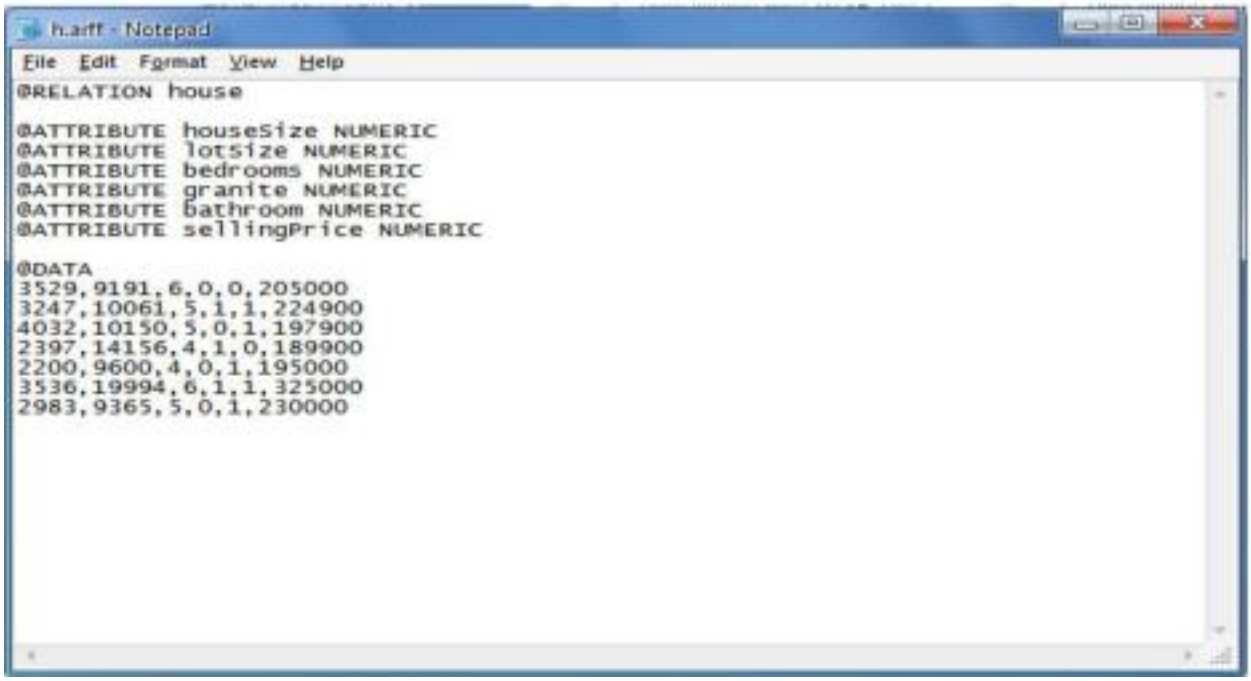
Practical No: 1

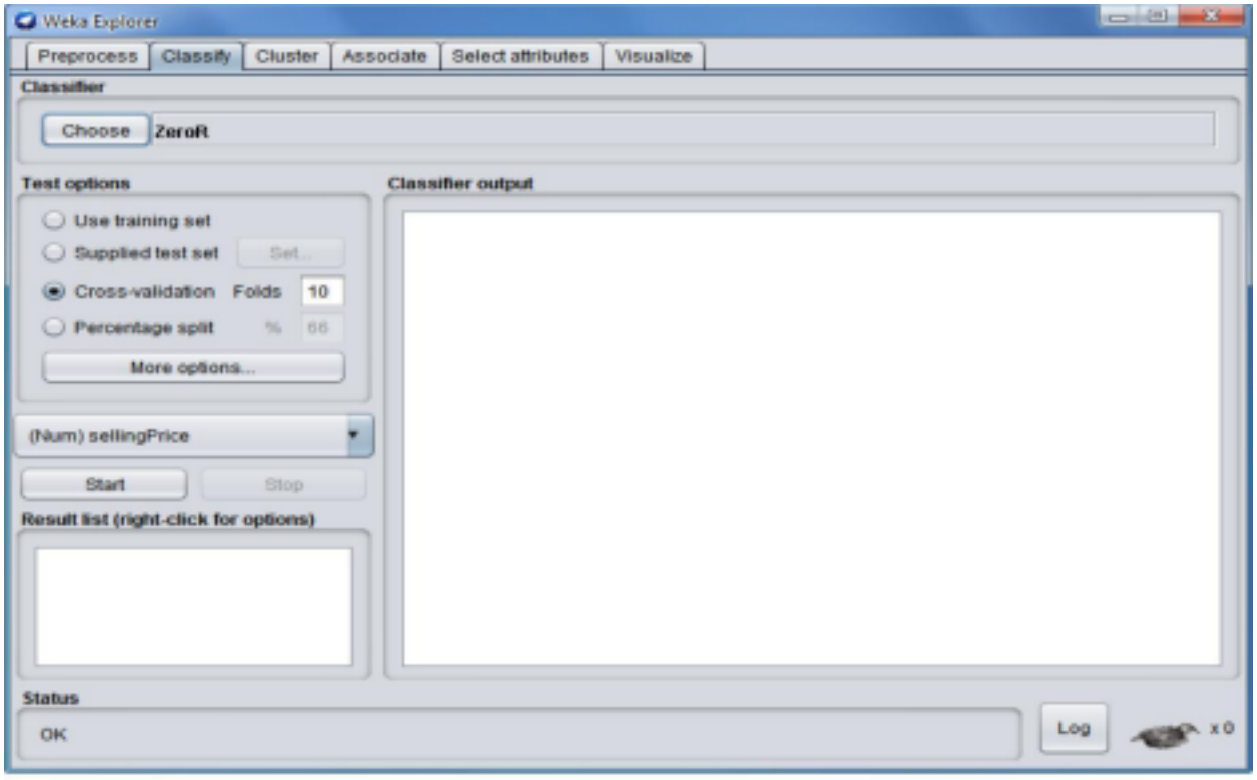
Aim : Generate Regression model and interpret the result for a given data set.

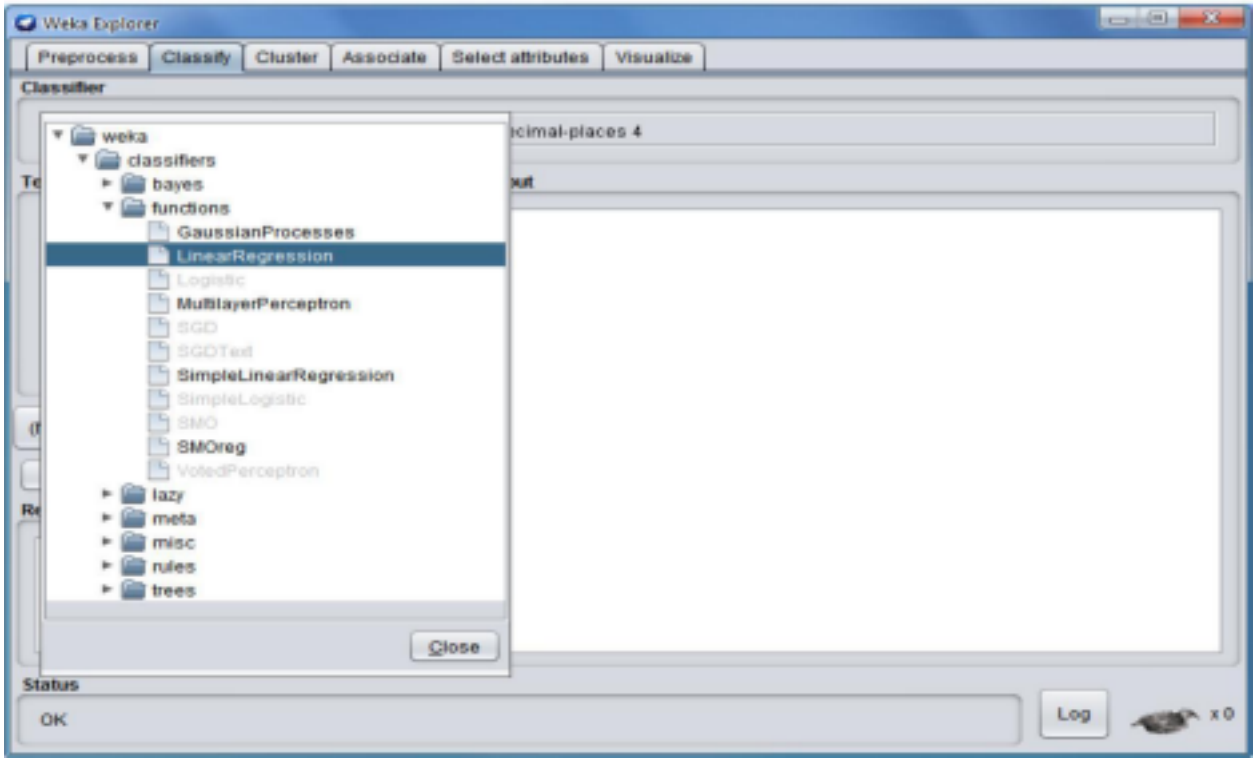
Step 1: Open Weka then open file h.arff in Weka Explorer.

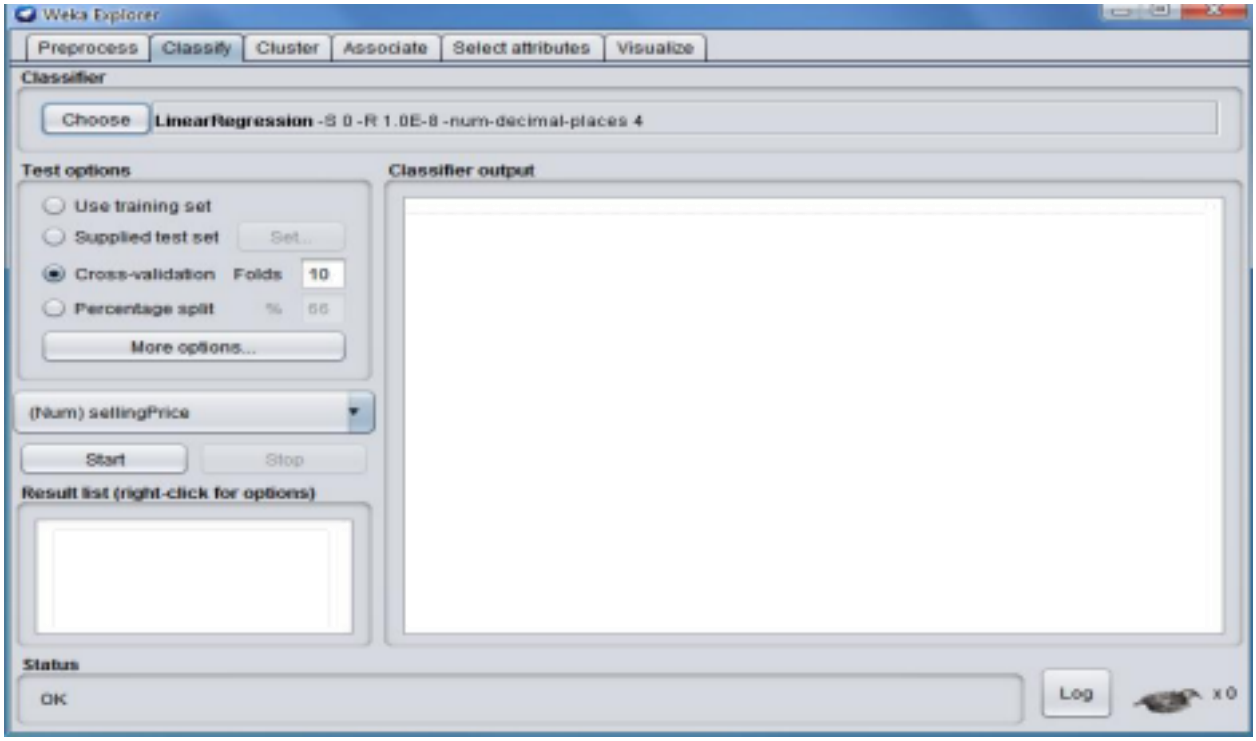




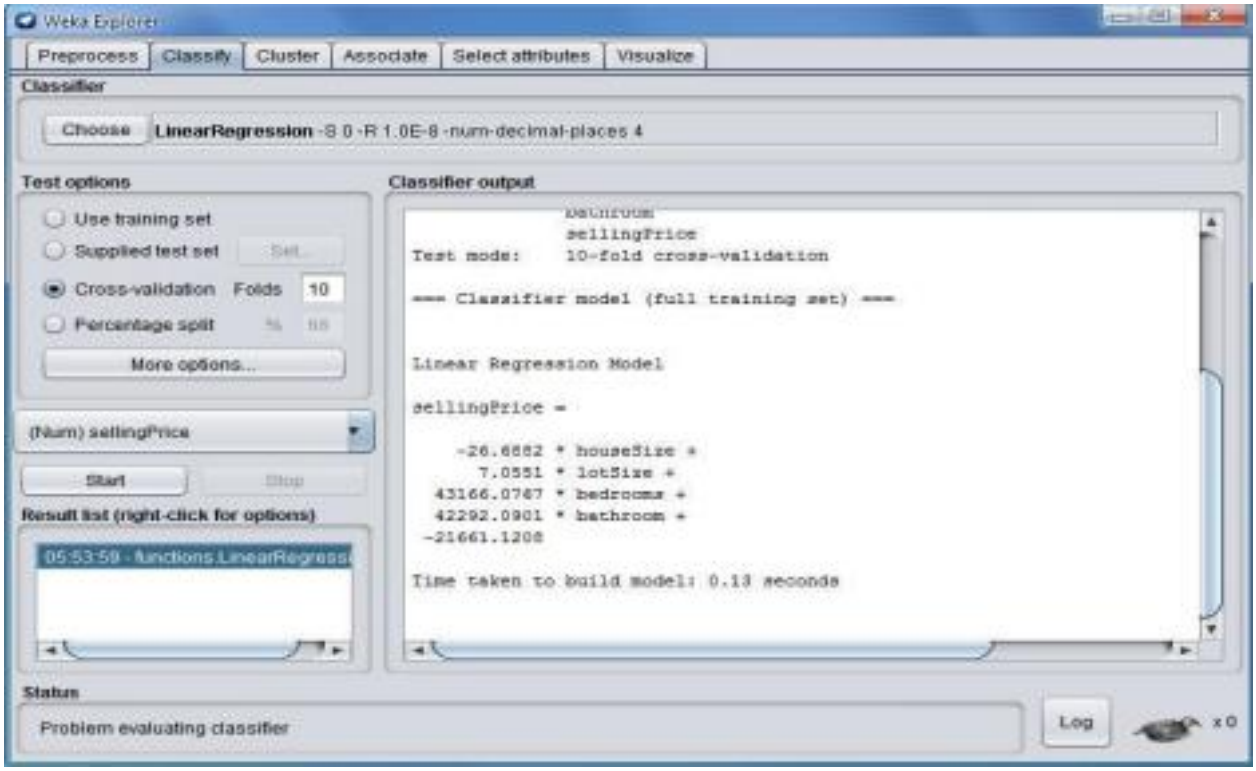
Step 2: Click on Classify, choose weka classifier function LinearRegression -S 0 -R 1.0E-8 -num-decimal-places 4.







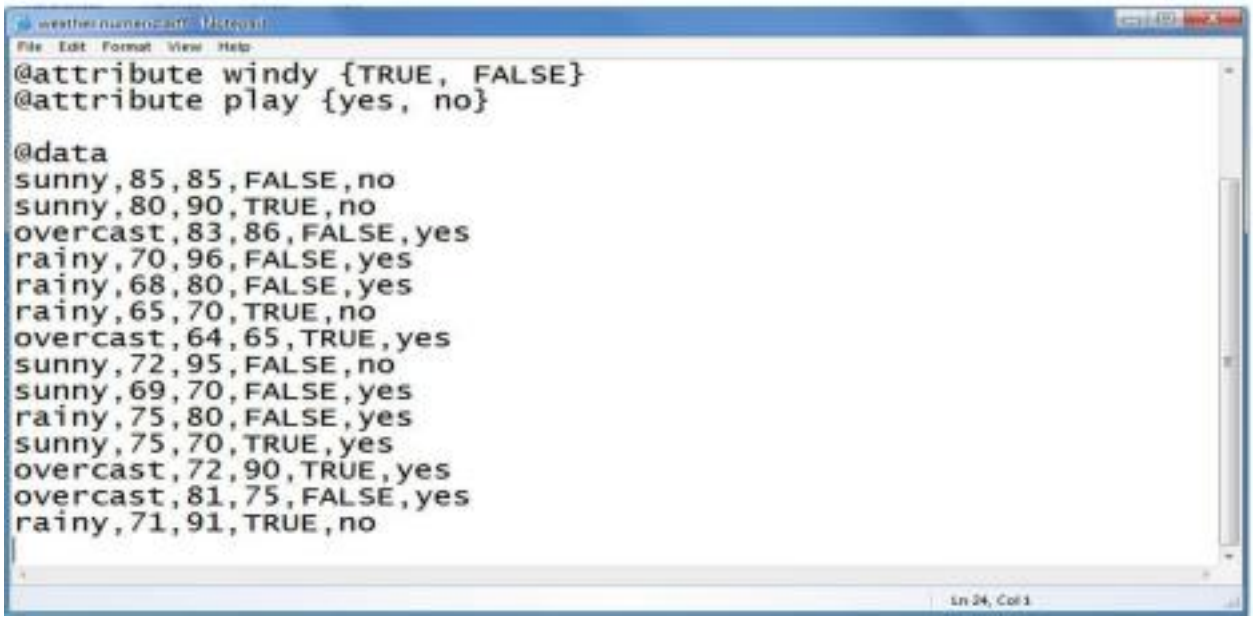
Step 3: Click on Start. You can see the linear regression on the input file.



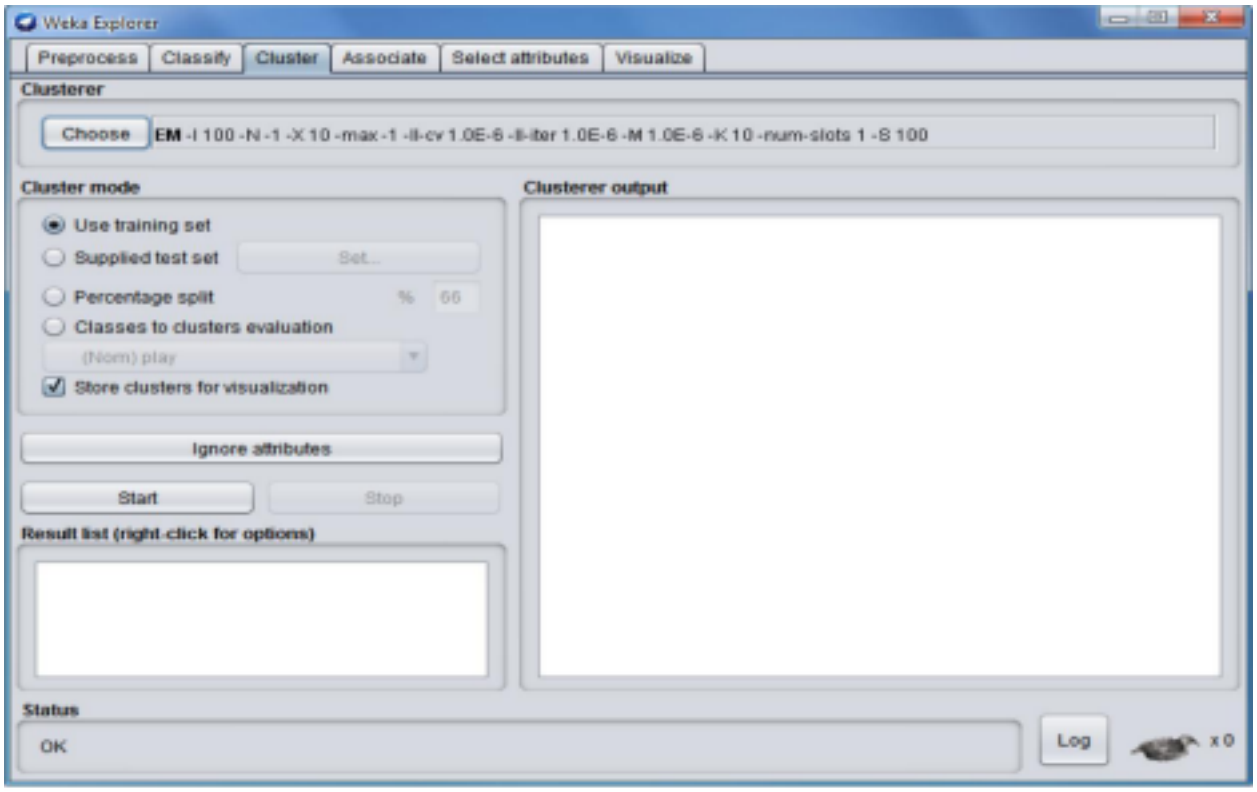
Practical No: 2

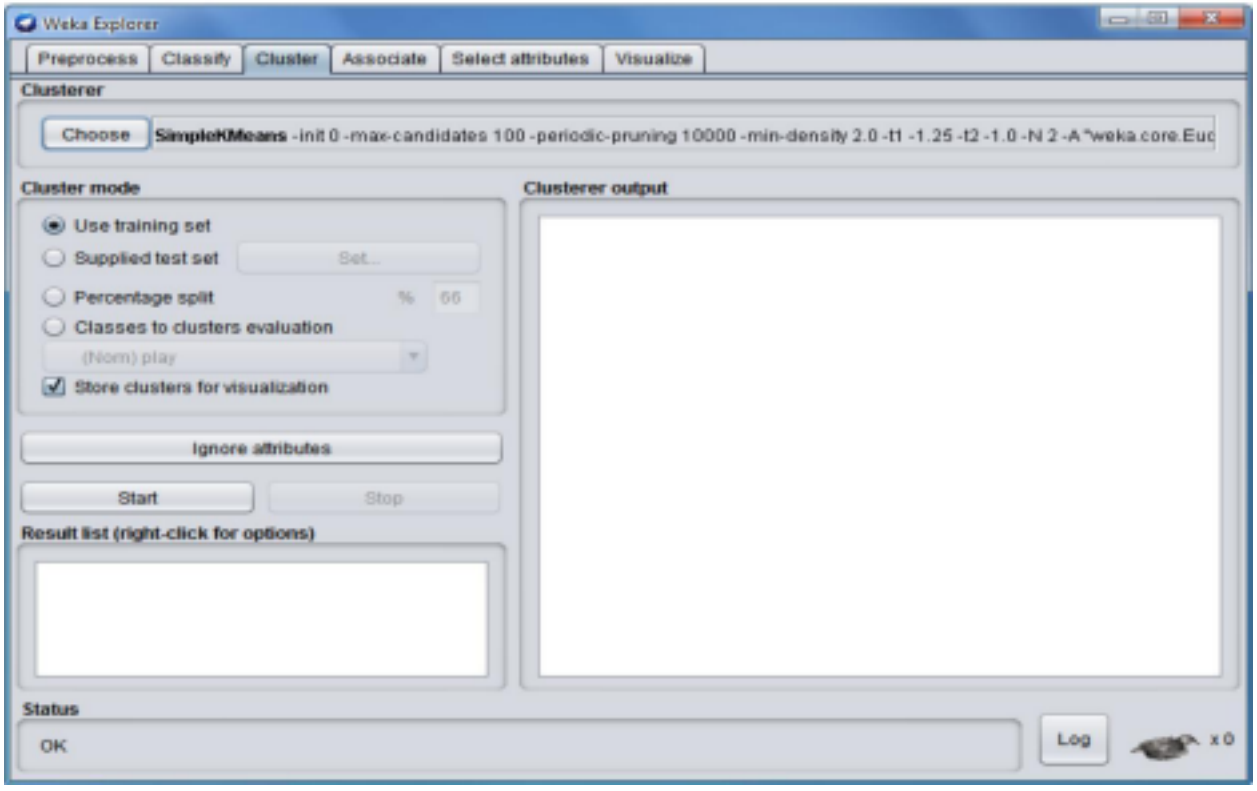
Aim : Generate forecasting model and interpret the result for a given data set.

Step 1: Open Weka then open file Weather.arff in Weka Explorer.

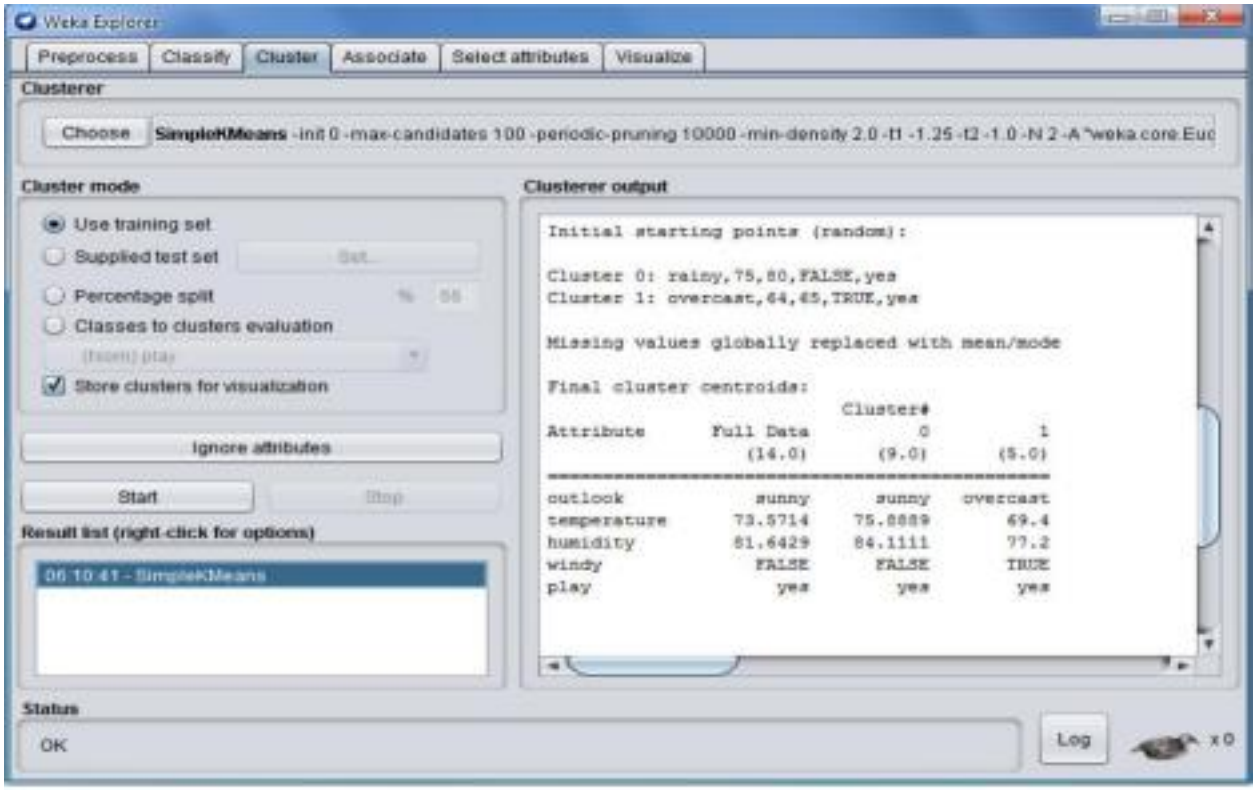


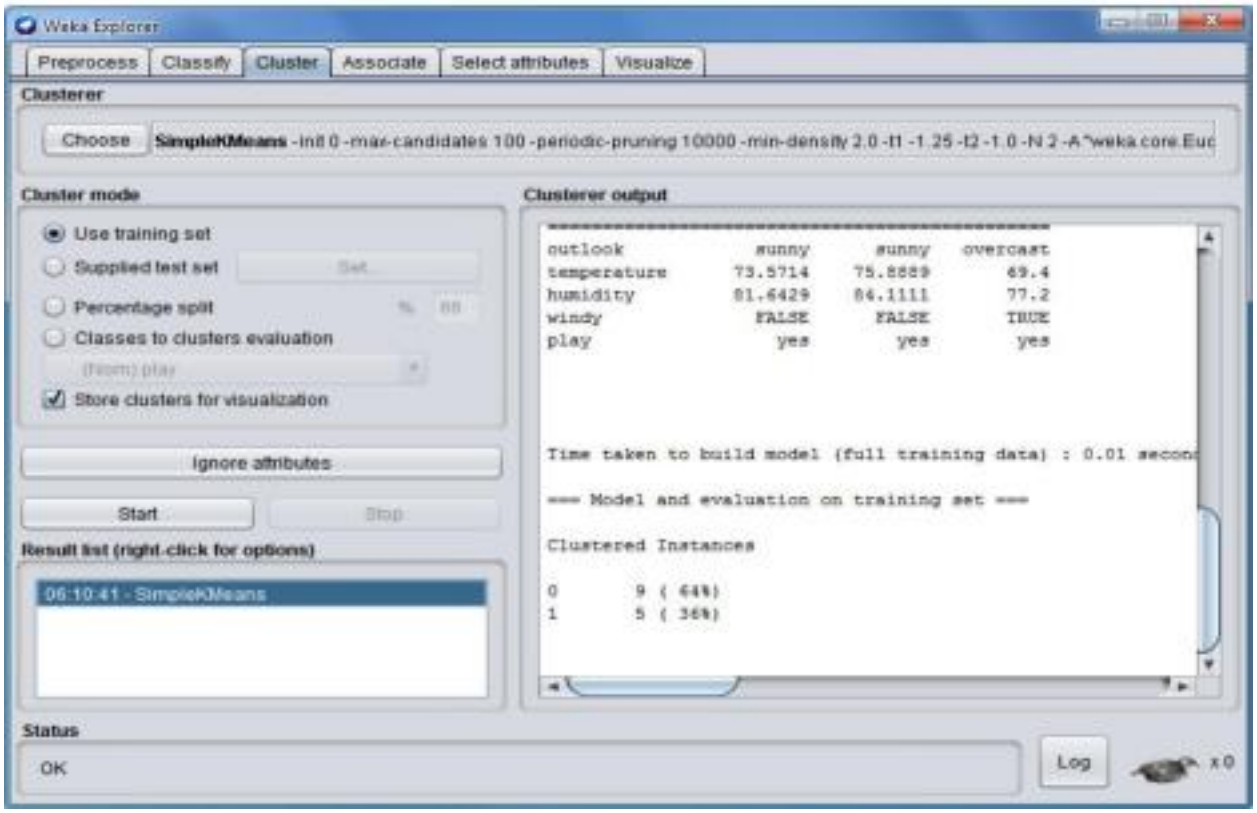
Step 2: Click on Cluster, choose weka forecasting function SimpleKMean.





Step 3: Click on Start. You can see the SimpleKMean on the input file.





Practical No: 3

Aim : Write a map-reduce program to count the number of occurrences of each alphabetic character in the given dataset. The count for each should be case-insensitive(i.e include both upper-case and lower-case versions of the letter, ignore non-alphabetic characters).

Source Code:

Charcount.java(Driver Class)

```
import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
Import org.apache.hadoop.io.IntWritable;

import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;

import org.apache.hadoop.mapreduce.lib.input.FileInputFormatimport
org.apache.hadoop.mapreduce.lib.input.TextInputFormat; import
org.apache.hadoop.mapreduce.lib.output.FileOutputFormat; import
org.apache.hadoop.mapreduce.lib.output.TextOutputFormat;

public class Charcount {

public static void main(String[] args) throws Exception {

// TODO Auto-generated method stub Configuration
conf = new Configuration(); Job job = new Job(conf,
"Charcount"); job.setJarByClass(Charcount.class);
job.setMapperClass(Charmap.class);
job.setReducerClass(Charreduce.class);
job.setInputFormatClass(TextInputFormat.class);
job.setOutputFormatClass(TextOutputFormat.class);
job.setMapOutputKeyClass(Text.class);
job.setMapOutputValueClass(IntWritable.class);
job.setOutputKeyClass(Text.class);
job.setOutputValueClass(IntWritable.class);
FileInputFormat.addInputPath(job, new Path(args[0]));
FileOutputFormat.setOutputPath(job, new Path(args[1]));
System.exit(job.waitForCompletion(true) ? 0 : 1);

        }

}
```

Charmap.java(Mapper Class)

```
import java.io.IOException;
import java.util.StringTokenizer;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.LongWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Mapper;

public class Charmap extends Mapper<LongWritable, Text, Text, IntWritable> {
public void map(LongWritable key, Text value, Context context)

throws IOException, InterruptedException {

String line = value.toString();
char[] carr = line.toCharArray();

for (char c : carr) {
     System.out.println(c);
      context.write(new Text(String.valueOf(c)), new IntWritable(1));
               }

          }

   }
```

Charreduce.java(Reducer Class)

```
import java.io.IOException;

import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Reducer;

public class Charreduce extends Reducer<Text, IntWritable, Text, IntWritable> { public
void reduce(Text key,Iterable<IntWritable> values,Context context)throws
IOException,InterruptedException{
int count = 0;

IntWritable result = new IntWritable();
for (IntWritable val : values) {
count +=val.get();
result.set(count);

}
String found = key.toString();
if (found.equals("a") || found.equals("t") || found.equals("c") || found.equals("g")) {
conttext.write(key, result); }

                    }
                }
```

Practical No: 4

Aim : Write a map-reduce program to count the number of occurrences of each word in the given dataset.(A word is defined as any string of alphabetic characters appearing between non-alphabetic characters like nature's is two words. The count should be case-insensitive. If a word occurs multiple times in a line, all should be counted).

WordCount.java(Driver Class)

```
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.conf.*;
import org.apache.hadoop.io.*;
import org.apache.hadoop.mapred.*;
import org.apache.hadoop.util.*;



public class WordCount extends Configured implements Tool{ public
    int run(String[] args) throws Exception

    {

//creating a JobConf object and assigning a job name for identification purposes

        JobConf conf = new JobConf(getConf(), WordCount.class);
        conf.setJobName("WordCount");

        //Setting configuration object with the Data Type of output Key
        and Value conf.setOutputKeyClass(Text.class);

        conf.setOutputValueClass(IntWritable.class);

        //Providing the mapper and reducer class names
        conf.setMapperClass(WordCountMapper.class);
        conf.setReducerClass(WordCountReducer.class);

//We wil give 2 arguments at the run time, one in input path and other is output path
        Path inp = new Path(args[0]);
        Path out = new Path(args[1]);

        //the hdfs input and output directory to be fetched from the command line
        FileInputFormat.addInputPath(conf, inp);
        FileOutputFormat.setOutputPath(conf, out);
        JobClient.runJob(conf);
        return 0;
    }

    public static void main(String[] args) throws Exception
    {
        // this main function will call run method defined above.

      int res = ToolRunner.run(new Configuration(), new WordCount(),args);
        System.exit(res);
```

```
    }
}
```

WordCountMapper.java(Mapper Class)

```
import java.io.IOException;
import java.util.StringTokenizer;

import org.apache.hadoop.io.*;
import org.apache.hadoop.mapred.*;

public class WordCountMapper extends MapReduceBase implements
Mapper<LongWritable, Text, Text, IntWritable> {

    //hadoop supported data types

    private final static IntWritable one = new IntWritable(1); private
    Text word = new Text();

//map method that performs the tokenizer job and framing the initial key value pairs


// after all lines are converted into key-value pairs, reducer is called.

    public void map(LongWritable key, Text value, OutputCollector<Text,
IntWritable> output, Reporter reporter) throws IOException

    {

        //taking one line at a time from input file and tokenizing the
        same String line = value.toString();

        StringTokenizer tokenizer = new StringTokenizer(line);
//iterating through all the words available in that line and forming the key value pair
        while (tokenizer.hasMoreTokens())
        {
          word.set(tokenizer.nextToken());

//sending to output collector which inturn passes the same to reducer
            output.collect(word, one);

        }
    }
}
```

WordCountReducer.java(Reducer Class)

```
import java.io.IOException;
import java.util.Iterator;

import org.apache.hadoop.io.*;
import org.apache.hadoop.mapred.*;

public class WordCountReducer extends MapReduceBase implements Reducer<Text,

IntWritable, Text, IntWritable>
{

    //reduce method accepts the Key Value pairs from mappers, do the aggregation
based on keys and produce the final out put

    public void reduce(Text key, Iterator<IntWritable> values,
OutputCollector<Text, IntWritable> output, Reporter reporter) throws
IOException

    {
        int sum = 0;

  /*iterates through all the values available with a key and add them together and give the

          final result as the key and sum of its values*/ while
        (values.hasNext()) {

            sum += values.next().get();

        }
        output.collect(key, new IntWritable(sum));
    }
}
```

Practical No: 5

Aim :Write a program to construct different types of k-shingles for given document.
Installation of required packages before executing program:-

```
install.packages("tm")
require("tm")
install.packages("devtools")
```

```
readinteger <- function()

 {

        n <- readline(prompt="Enter value of k-1:
        ") k<-as.integer(n)

        u1 <- readLines(E:/BA/Hadoop.txt")
        Shingle<-0

        i <-0
        while(i<nchar(u1)-k+1)
         {

                Shingle[i] <- substr(u1, start=i, stop=i+k)
                print(Shingle[i])

                i=i+1
        }

}
if(interactive()) readinteger()
```

Output:

```
> if(interactive()) readinteger()
Enter value of k-1: 2 character(0)
[1] "thi"
[1] "his"
[1] "is "
[1] "s i"
[1] " is"
[1] "is "
[1] "s a"
[1] " a "
[1] "a t"
[1] " te"
[1] "tex"
[1] "ext"
[1] "xt."
```

Output:

```
> if(interactive()) readinteger() Enter
value of k-1: 3 character(0) [1] "this"
[1] "his "
[1] "is i"
[1] "s is"
[1] " is "
[1] "is a"
[1] "s a "
[1] " a t"
[1] "a te"
```

Output:

```
> if(interactive()) readinteger() Enter
value of k-1: 4 character(0) [1] "this "
[1] "his i"
[1] "is is"
[1] "s is "
[1] " is a"
[1] "is a "
[1] "s a t"
[1] " a te"
[1] "a tex"
[1] " text"
[1] "text."
[1] "ext. "
```

Practical No: 6

Aim: Write a program for measuring similarity among documents and detecting passages which have been reused.

Installation of required packages before executing program:

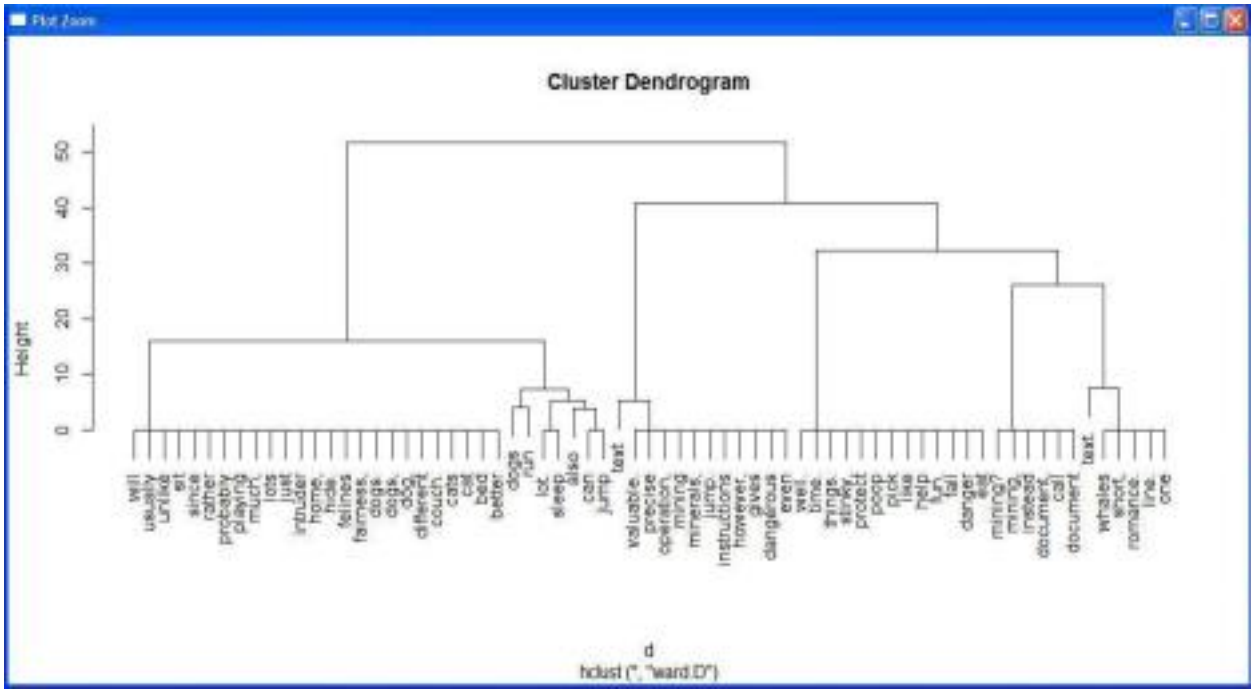
```
install.packages("tm")
require("tm")
install.packages("ggplot2")
install.packages("textreuse")
install.packages("devtools")
```

Source Code 1:

```
my.corpus <- Corpus(DirSource("c:/msc/r-corpus"))

my.corpus <- tm_map(my.corpus, removeWords, stopwords("english"))
my.tdm <- TermDocumentMatrix(my.corpus)
#inspect(my.tdm)
my.dtm <- DocumentTermMatrix(my.corpus, control = list(weighting =

weightTfIdf, stopwords = TRUE))
#inspect(my.dtm)
my.df <- as.data.frame(inspect(my.tdm))
my.df.scale <- scale(my.df)

d <-
dist(my.df.scale,method="euclidean") fit <-
hclust(d, method="ward") plot(fit)
```

Output:

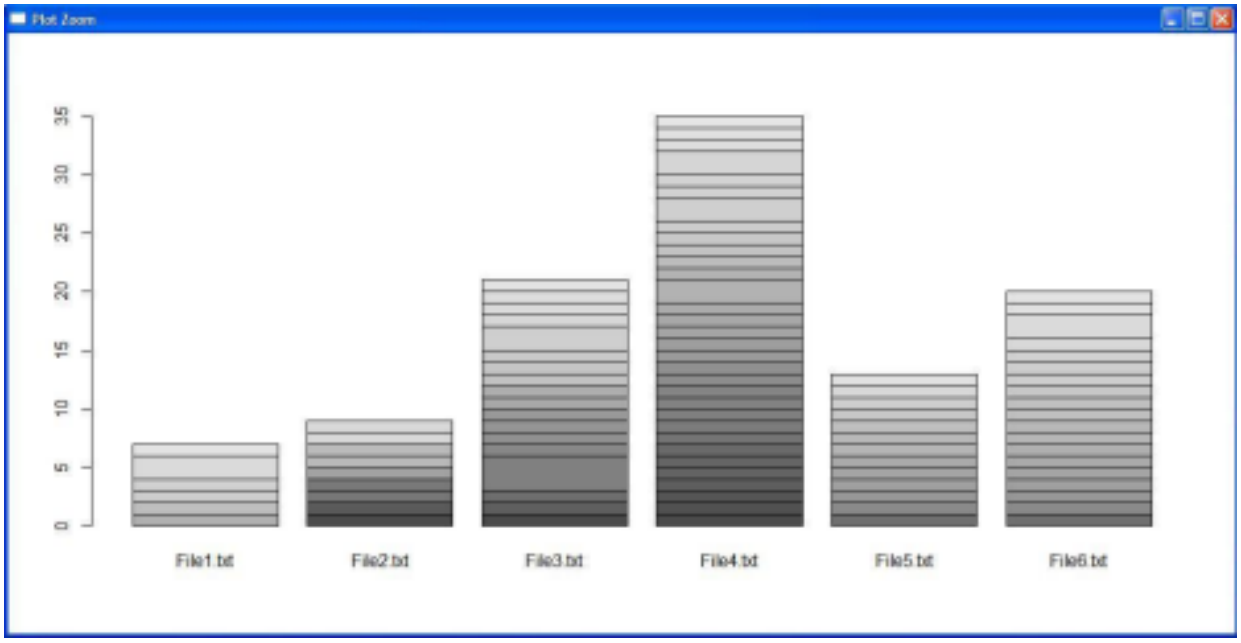
```
<<TermDocumentMatrix (terms: 69, documents: 6)>>
Non-/sparse entries: 97/317
Sparsity : 77%
Maximal term length: 12
Weighting : term frequency (tf)
Docs
Terms File1.txt File2.txt File3.txt File4.txt File5.txt File6.txt also 0 1 1 1 0 0 bed 0 0 0 1 0 0 better 0
0 0 1 0 0 call 0 1 0 0 0 0 can 0 0 1 1 0 0 cat 0 0 0 1 0 0 cats 0 0 0 1 0 0 couch. 0 0 0 1 0 0
> barplot(as.matrix(my.tdm))
> my.df.scale <- scale(my.df)
> d <- dist(my.df.scale,method="euclidean")
> fit <- hclust(d, method="ward")

The "ward" method has been renamed to "ward.D"; note new "ward.D2" >
plot(fit)
```



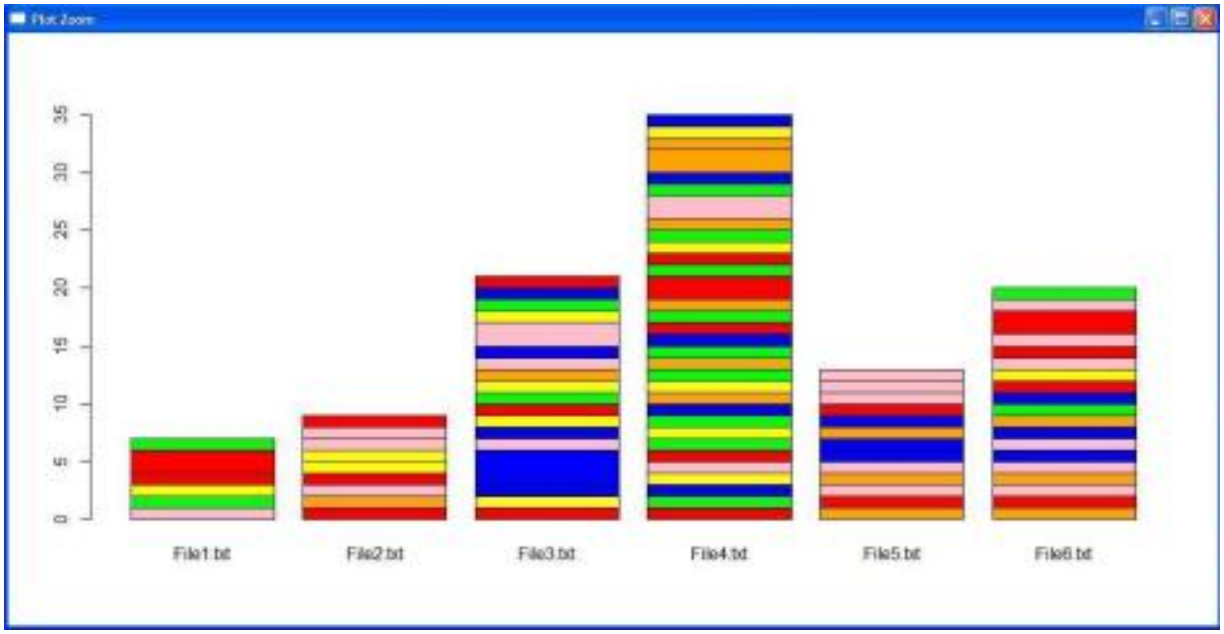
Source code 2 (using bar plot with and without color):

```
my.corpus <- Corpus(DirSource("c:/msc/r-corpus"))

my.corpus <- tm_map(my.corpus, removeWords, stopwords("english"))
my.tdm <- TermDocumentMatrix(my.corpus)

inspect(my.tdm)
my.df <- as.data.frame(inspect(my.tdm))
barplot(as.matrix(my.tdm))
#barplot(as.matrix(my.tdm),col = color)
```

OutPut:




```
barplot(as.matrix(my.tdm),col = color)
```



Jaccard similarity

Similarity of asymmetric binary attributes[edit]

Given two objects, *A* and *B*, each with *n* binary attributes, the Jaccard coefficient is a useful measure of the overlap that *A* and *B Share* with their attributes. Each attribute of *A* and *B* can either be 0 or 1. The total number of each combination of attributes for both *A* and *B* are specified as follows:

- represents the total number of attributes where *A* and *B* both have a value of 1.
- represents the total number of attributes where the attribute of *A* is 0 and the attribute of *B* is 1.
- represents the total number of attributes where the attribute of *A* is 1 and the attribute of *B* is 0.
- represents the total number of attributes where *A* and *B* both have a value of 0.

Each attribute must fall into one of these four categories, meaning that

$$M_{11} + M_{01} + M_{10} + M_{00} = n.$$

The Jaccard similarity coefficient, J, is given as

$$J = \frac{M_{11}}{M_{01} + M_{10} + M_{11}}.$$

The Jaccard distance, d_J, is given as

$$d_J = \frac{M_{01} + M_{10}}{M_{01} + M_{10} + M_{11}} = 1 - J.$$

		A	
		0	1
B	0	M_{00}	M_{10}
	1	M_{01}	M_{11}

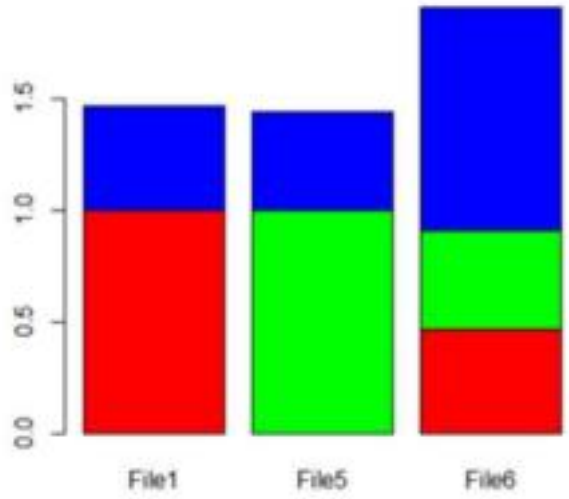
Source code 3 (using minhash and jaccard similarity): library(textreuse)

Source Code:

```
minhash <- minhash_generator(200, seed = 235)

ats <- TextReuseCorpus(dir = "c:/msc/r-corpus", tokenizer = tokenize_ngrams, n = 5,
minhash_func = minhash)

buckets <- lsh(ats, bands = 50, progress = interactive())
candidates <- lsh_candidates(buckets)
scores <- lsh_compare(candidates, ats, jaccard_similarity, progress = FALSE)
scores

color <- c("red","green","blue","orange","yellow","pink")

barplot(as.matrix(scores),col = color)
```

Output:

```
     a      b         score
  <chr>  <chr>       <dbl>
1 File1 File6 0.4651163
2 File5 File6 0.4418605
```



Practical No: 7

Aim : Write a program to compute the n-moment for a given stream where n is given.

Source Code:

```
import java.io.*;
import java.util.*;

class n_moment2
{
 public static void main(String args[])
  {

        int n=15;
String stream[]={"a","b","c","b","d","a","c","d","a","b","d","c","a","a","b"};

        int
        zero_moment=0,first_moment=0,second_moment=0,count=1,
        flag=0; ArrayList<Integer> arrlist=new ArrayList();;

       System.out.println("Arraylist elements are :: ");
       for(int i=0;i<15;i++)
       {
              System.out.print(stream[i]+" ");
        }

       Arrays.sort(stream);

       //Calculate Zeroth moment(calculates unique elements-
       raised to zero) for(int i=1;i<n;i++)
       {

              if(stream[i]==stream[i-1])
              {
                     count++;
              }

             else
              {
                     arrlist.add(count);
                     count=1;

              }
        }
       arrlist.add(count);

     zero_moment=arrlist.size();
     System.out.println("\n\n\nValue of Zeroth moment for given stream

     ::"+zero_moment); //Calculate First moment(Calculate length of the stream-
```

```
                raised to one)

                    for(int i=0;i<arrlist.size();i++)
                    {
                            first_moment+=arrlist.get(i);
                    }
System.out.println("\n\nValue of First moment for given stream ::"+first_moment);

                    //Calculate Second moment(raised to two)
                    for(int i=0;i<arrlist.size();i++)
                    {

                            int j=arrlist.get(i);
                            second_moment+=(j*j);
                    }
System.out.println("\n\nValue of Second moment for given stream ::"+second_moment);

                }
            }
```

Output:

Arraylist elements are ::
a b c b d a c d a b d c a a b

Value of Zeroth moment for given stream ::4

Value of First moment for given stream ::15

Value of Second moment for given stream ::59

Practical No: 8

Aim : Write a program to demonstrate the Alon-Matias-Szegedy Algorithm for second moments.

Source Code:

```
import java.io.*;
import java.util.*;
class AMSA
{ public static int findCharCount(String stream,char XE,int random,int n) {
        int countOccurance=0;
        for(int i=random;i<n;i++)
        {
            if(stream.charAt(i)==XE)
            {
countOccurance++;//System.out.println(countOccurance+" "+i);
            }
        }
        return countOccurance;
    }
    public static int estimateValue(int XV1,int n)
    {
        int ExpValue;
        ExpValue=n*(2*XV1-1);
        return ExpValue;
     } public static void main(String args[])
    {
        int n=15;
        String stream="abcbdacdabdcaab";
        int random1=3,random2=8,random3=13;
        char XE1,XE2,XE3;
        int XV1,XV2,XV3;
```

```
                    int ExpValuXE1, ExpValuXE2, ExpValuXE3;

                    int apprSecondMomentValue;
                    XE1=stream.charAt(random1-1);
                    XE2=stream.charAt(random2-1);

                    XE3=stream.charAt(random3-1);

                    //System.out.println(XE1+" "+XE2+" "+XE3);

                     XV1=findCharCount(stream,XE1,random1-1,n);

                    XV2=findCharCount(stream,XE2,random2-1,n);

                    XV3=findCharCount(stream,XE3,random3-1,n);

                    System.out.println(XE1+"="+XV1+" "+XE2+"="+XV2+"

                    "+XE3+"="+XV3); ExpValuXE1=estimateValue(XV1,n);

                    ExpValuXE2=estimateValue(XV2,n);

                    ExpValuXE3=estimateValue(XV3,n);

                    System.out.println("Expected value for "+XE1+" is ::

                    "+ExpValuXE1); System.out.println("Expected value for

                    "+XE2+" is :: "+ExpValuXE2); System.out.println("Expected

                    value for "+XE3+" is :: "+ExpValuXE3);

                    apprSecondMomentValue=(ExpValuXE1+ExpValuXE2+ExpV

                    aluXE3)/3;


System.out.println("Approximate Second moment value using
Alon-Matias-Szegedy is :: "+apprSecondMomentValue);

                        }
                }
```

Output:

c=3 d=2 a=2

Expected value for c is :: 75

Expected value for d is :: 45

Expected value for a is :: 45

Approximate Second moment value using Alon-Matias-Szegedy is :: 55