**MAT6001-ADVANCED STATISTICAL METHODS**

**LAB ASSESSMENT 6 (FINAL LAB)**

**SLOT: L31+L32**

**PROGRAMMING IN R PROJECT**

**Introduction:**

In this project we are going to statistically analyze the online retail -features dataset which we have downloaded from the Kaggle by using RStudio Software.

**About the dataset:**

Features data – Contains additional data related to the store, department, and regional activity for the given dates

- Store - the store number
- Date - the week
- Temperature - average temperature in the region
- Fuel Price - cost of fuel in the region
- MarkDown1-5 - anonymized data related to promotional markdowns. Mark Down data is only available after Nov 2011, and is not available for all stores all the time. **Any missing value is marked with an NA.**
- CPI - the consumer price index
- Unemployment - the unemployment rate
- IsHoliday - whether the week is a special holiday week.

**# Read the input file**

r1= read.csv("C:/Users/admin/Downloads/Features data set.csv")

r1

```
> r1= read.csv("C:/Users/admin/Downloads/Features data set.csv")
> r1= read.csv("C:/Users/admin/Downloads/Features data set.csv")
> r1
   Store       Date Temperature Fuel_Price MarkDown1 MarkDown2 MarkDown3 MarkDown4 MarkDown5      CPI Unemployment IsHoliday
1      1 05/02/2010       42.31       2.572        NA        NA        NA        NA        NA 211.0964        8.106     FALSE
2      1 12/02/2010       38.51       2.548        NA        NA        NA        NA        NA 211.2422        8.106      TRUE
3      1 19/02/2010       39.93       2.514        NA        NA        NA        NA        NA 211.2891        8.106     FALSE
4      1 26/02/2010       46.63       2.561        NA        NA        NA        NA        NA 211.3196        8.106     FALSE
5      1 05/03/2010       46.50       2.625        NA        NA        NA        NA        NA 211.3501        8.106     FALSE
6      1 12/03/2010       57.79       2.667        NA        NA        NA        NA        NA 211.3806        8.106     FALSE
7      1 19/03/2010       54.58       2.720        NA        NA        NA        NA        NA 211.2156        8.106     FALSE
8      1 26/03/2010       51.45       2.732        NA        NA        NA        NA        NA 211.0180        8.106     FALSE
9      1 02/04/2010       62.27       2.719        NA        NA        NA        NA        NA 210.8204        7.808     FALSE
10     1 09/04/2010       65.86       2.770        NA        NA        NA        NA        NA 210.6229        7.808     FALSE
11     1 16/04/2010       66.32       2.808        NA        NA        NA        NA        NA 210.4887        7.808     FALSE
12     1 23/04/2010       64.84       2.795        NA        NA        NA        NA        NA 210.4391        7.808     FALSE
13     1 30/04/2010       67.41       2.780        NA        NA        NA        NA        NA 210.3895        7.808     FALSE
14     1 07/05/2010       72.55       2.835        NA        NA        NA        NA        NA 210.3400        7.808     FALSE
15     1 14/05/2010       74.78       2.854        NA        NA        NA        NA        NA 210.3374        7.808     FALSE
16     1 21/05/2010       76.44       2.826        NA        NA        NA        NA        NA 210.6171        7.808     FALSE
17     1 28/05/2010       80.44       2.759        NA        NA        NA        NA        NA 210.8968        7.808     FALSE
18     1 04/06/2010       80.69       2.705        NA        NA        NA        NA        NA 211.1764        7.808     FALSE
19     1 11/06/2010       80.43       2.668        NA        NA        NA        NA        NA 211.4561        7.808     FALSE
20     1 18/06/2010       84.11       2.637        NA        NA        NA        NA        NA 211.4538        7.808     FALSE
21     1 25/06/2010       84.34       2.653        NA        NA        NA        NA        NA 211.3387        7.808     FALSE
22     1 02/07/2010       80.91       2.669        NA        NA        NA        NA        NA 211.2235        7.787     FALSE
23     1 09/07/2010       80.48       2.642        NA        NA        NA        NA        NA 211.1084        7.787     FALSE
24     1 16/07/2010       83.15       2.623        NA        NA        NA        NA        NA 211.1004        7.787     FALSE
25     1 23/07/2010       83.36       2.608        NA        NA        NA        NA        NA 211.2351        7.787     FALSE
26     1 30/07/2010       81.84       2.640        NA        NA        NA        NA        NA 211.3699        7.787     FALSE
27     1 06/08/2010       87.16       2.627        NA        NA        NA        NA        NA 211.5047        7.787     FALSE
28     1 13/08/2010       87.00       2.692        NA        NA        NA        NA        NA 211.6394        7.787     FALSE
29     1 20/08/2010       86.65       2.664        NA        NA        NA        NA        NA 211.6034        7.787     FALSE
30     1 27/08/2010       85.22       2.619        NA        NA        NA        NA        NA 211.5673        7.787     FALSE
```

**# View the file**

View(r1)

Filter

| | Store | Date | Temperature | Fuel_Price | MarkDown1 | MarkDown2 | MarkDown3 | MarkDown4 | MarkDown5 | CPI | Unemployment | IsHoliday |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 05/02/2010 | 42.31 | 2.572 | NA | NA | NA | NA | NA | 211.0964 | 8.106 | FALSE |
| 2 | 1 | 12/02/2010 | 38.51 | 2.548 | NA | NA | NA | NA | NA | 211.2422 | 8.106 | TRUE |
| 3 | 1 | 19/02/2010 | 39.93 | 2.514 | NA | NA | NA | NA | NA | 211.2891 | 8.106 | FALSE |
| 4 | 1 | 26/02/2010 | 46.63 | 2.561 | NA | NA | NA | NA | NA | 211.3196 | 8.106 | FALSE |
| 5 | 1 | 05/03/2010 | 46.50 | 2.625 | NA | NA | NA | NA | NA | 211.3501 | 8.106 | FALSE |
| 6 | 1 | 12/03/2010 | 57.79 | 2.667 | NA | NA | NA | NA | NA | 211.3806 | 8.106 | FALSE |
| 7 | 1 | 19/03/2010 | 54.58 | 2.720 | NA | NA | NA | NA | NA | 211.2156 | 8.106 | FALSE |
| 8 | 1 | 26/03/2010 | 51.45 | 2.732 | NA | NA | NA | NA | NA | 211.0180 | 8.106 | FALSE |
| 9 | 1 | 02/04/2010 | 62.27 | 2.719 | NA | NA | NA | NA | NA | 210.8204 | 7.808 | FALSE |
| 10 | 1 | 09/04/2010 | 65.86 | 2.770 | NA | NA | NA | NA | NA | 210.6229 | 7.808 | FALSE |
| 11 | 1 | 16/04/2010 | 66.32 | 2.808 | NA | NA | NA | NA | NA | 210.4887 | 7.808 | FALSE |
| 12 | 1 | 23/04/2010 | 64.84 | 2.795 | NA | NA | NA | NA | NA | 210.4391 | 7.808 | FALSE |
| 13 | 1 | 30/04/2010 | 67.41 | 2.780 | NA | NA | NA | NA | NA | 210.3895 | 7.808 | FALSE |
| 14 | 1 | 07/05/2010 | 72.55 | 2.835 | NA | NA | NA | NA | NA | 210.3400 | 7.808 | FALSE |
| 15 | 1 | 14/05/2010 | 74.78 | 2.854 | NA | NA | NA | NA | NA | 210.3374 | 7.808 | FALSE |
| 16 | 1 | 21/05/2010 | 76.44 | 2.826 | NA | NA | NA | NA | NA | 210.6171 | 7.808 | FALSE |
| 17 | 1 | 28/05/2010 | 80.44 | 2.759 | NA | NA | NA | NA | NA | 210.8968 | 7.808 | FALSE |
| 18 | 1 | 04/06/2010 | 80.69 | 2.705 | NA | NA | NA | NA | NA | 211.1764 | 7.808 | FALSE |
| 19 | 1 | 11/06/2010 | 80.43 | 2.668 | NA | NA | NA | NA | NA | 211.4561 | 7.808 | FALSE |
| 20 | 1 | 18/06/2010 | 84.11 | 2.637 | NA | NA | NA | NA | NA | 211.4538 | 7.808 | FALSE |
| 21 | 1 | 25/06/2010 | 84.34 | 2.653 | NA | NA | NA | NA | NA | 211.3387 | 7.808 | FALSE |

Showing 1 to 22 of 8,190 entries, 12 total columns

**# display the summary of the data**

summary(r1)

```
> # display the summary of the data
> summary(r1)
     Store        Date           Temperature      Fuel_Price      MarkDown1       MarkDown2          MarkDown3          MarkDown4
 Min.   : 1   Length:8190        Min.   : -7.29   Min.   :2.472   Min.   : -2781   Min.   :  -265.76   Min.   :  -179.26   Min.   :    0.22
 1st Qu.:12   Class :character   1st Qu.: 45.90   1st Qu.:3.041   1st Qu.:  1578   1st Qu.:    68.88   1st Qu.:     6.60   1st Qu.:  304.69
 Median :23   Mode  :character   Median : 60.71   Median :3.513   Median :  4744   Median :   364.57   Median :    36.26   Median : 1176.42
 Mean   :23                      Mean   : 59.36   Mean   :3.406   Mean   :  7032   Mean   :  3384.18   Mean   :  1760.10   Mean   : 3292.94
 3rd Qu.:34                      3rd Qu.: 73.88   3rd Qu.:3.743   3rd Qu.:  8923   3rd Qu.:  2153.35   3rd Qu.:   163.15   3rd Qu.: 3310.01
 Max.   :45                      Max.   :101.95   Max.   :4.468   Max.   :103185   Max.   :104519.54   Max.   :149483.31   Max.   :67474.85
                                                                  NA's   :4158     NA's   :5269        NA's   :4577        NA's   :4726
   MarkDown5            CPI         Unemployment    IsHoliday
 Min.   :  -185.2   Min.   :126.1   Min.   : 3.684   Mode :logical
 1st Qu.:  1440.8   1st Qu.:132.4   1st Qu.: 6.634   FALSE:7605
 Median :  2727.1   Median :182.8   Median : 7.806   TRUE :585
 Mean   :  4132.2   Mean   :172.5   Mean   : 7.827
 3rd Qu.:  4832.6   3rd Qu.:213.9   3rd Qu.: 8.567
 Max.   :771448.1   Max.   :229.0   Max.   :14.313
 NA's   :4140       NA's   :585     NA's   :585
> |
```



**# understand the min and max fuel price in the data**

min(r1$Fuel_Price)

max(r1$Fuel_Price)

```
> # understand the min and max fuel price in the data
> min(r1$Fuel_Price)
[1] 2.472
> max(r1$Fuel_Price)
[1] 4.468
> |
```

**# mean and median of Fuel price**

mean(r1$Fuel_Price)

median(r1$Fuel_Price)

```
> # mean and median of Fuel price
> mean(r1$Fuel_Price)
[1] 3.405992
> median(r1$Fuel_Price)
[1] 3.513
> |
```

**# variance and standard deviation of fuel price**

```
var(r1$Fuel_Price)

sd(r1$Fuel_Price)
```

```
> # variance and standard deviation of fuel price
> var(r1$Fuel_Price)
[1] 0.1860512
> sd(r1$Fuel_Price)
[1] 0.4313366
>
```

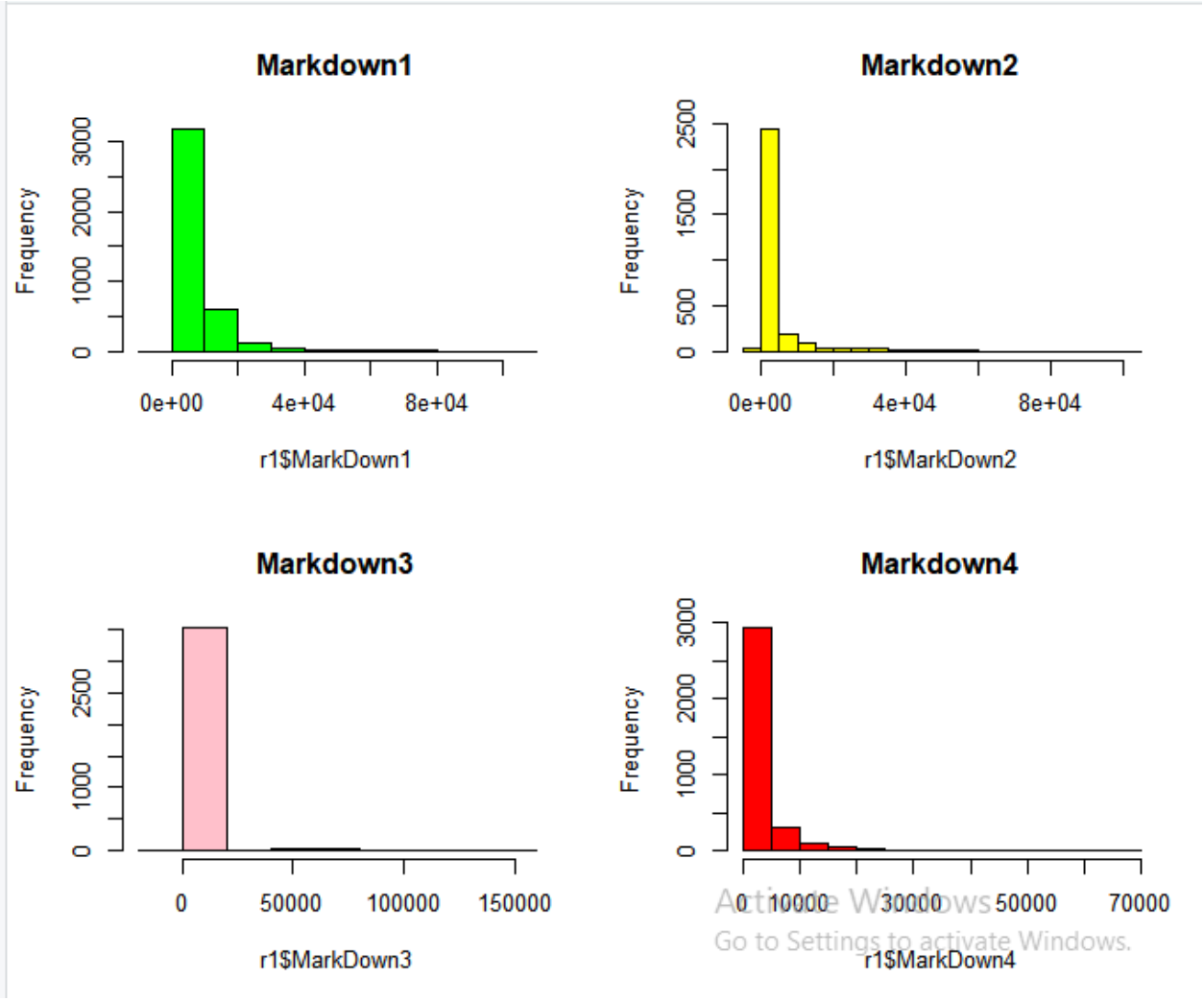
**# correlation of Fuel price with CPI**

```
cor(r1$Fuel_Price,r1$CPI)
```

```
> # correlation of Fuel price with CPI
> cor(r1$Fuel_Price,r1$CPI)
[1] NA
>
```

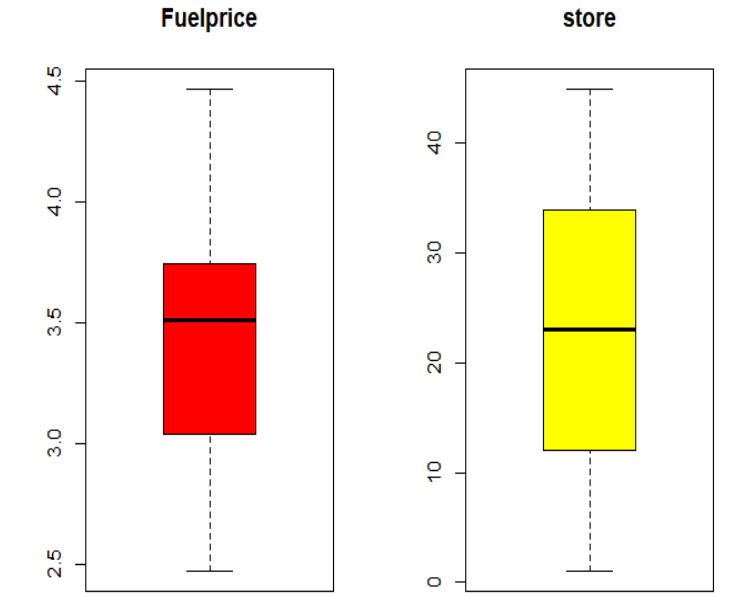
```
> # correlation of Fuel price with CPI
> cor(r1$Fuel_Price,r1$Store)
[1] 0.06668205
>
```

```
par(mfrow=c(2,2))

hist(r1$MarkDown1,main = "Markdown1",breaks = 10,col="green")

hist(r1$MarkDown2,main = "Markdown2",breaks = 15,col="Yellow")

hist(r1$MarkDown3,main = "Markdown3",breaks = 10,col="pink")

hist(r1$MarkDown4,main = "Markdown4",breaks = 15,col="red")
```




**#BOXPLOT**

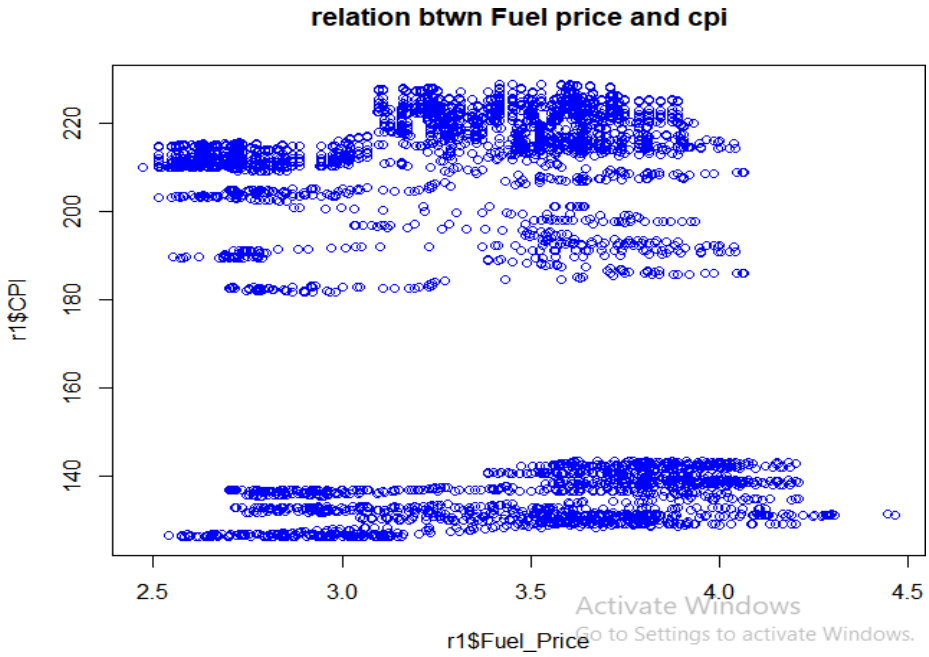
```
par(mfrow=c(1,2))
boxplot(r1$Fuel_Price,main = "Fuelprice",col="red")
boxplot(r1$Store,main = "store",col="Yellow")
boxplot(m[,1:4])
```






**#SCATTERPLOT**

plot(r1$Fuel_Price,r1$CPI,col ="blue",main="relation btwn Fuel price and cpi")



**# imputing NA with 0 term**

```
m[is.na(m)]=0
```

**#correlation**

```
core=cor.test(m$Temperature,m$Fuel_Price,method ="pearson")

core
```

```
        Pearson's product-moment correlation

data:  m$Temperature and m$Fuel_Price
t = 9.2188, df = 8188, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.07987158 0.12274276
sample estimates:
      cor
0.1013542
```

```
> cor(m$Temperature,m$Fuel_Price)
[1] 0.1013542
>
```

```
> cor(m$Temperature,m$Unemployment)
[1] -0.05486039
>
```

**Partial correlation**

```
x=m$Temperature

y=m$Fuel_Price

z=m$Unemployment

d1=data.frame(x,y,z)

d1
```

pcor.test(z,x,y,method="pearson")

```
> pcor.test(x,y,z,method="pearson")
    estimate      p.value statistic    n gp  Method
1 0.09543893 4.928788e-18  8.675109 8190  1 pearson
>
```

```
> pcor.test(z,x,y,method="pearson")
    estimate      p.value statistic    n gp  Method
1 -0.0428606 0.0001045513 -3.881682 8190  1 pearson
>
```

**Regression**

x=m$Temperature

y=m$Fuel_Price

regs=lm(x~y)

regs

plot(y,x)

abline(regs)

cor(x,y)

```
Call:
lm(formula = x ~ y)

Coefficients:
(Intercept)            y
     44.407        4.389
```

```
> plot(y,x)
> abline(regs)
```

**Multiple Regression**

```
> re=lm(x~y+z,data=d1)
> re

Call:
lm(formula = x ~ y + z, data = d1)

Coefficients:
(Intercept)            y            z
    47.3455       4.1587      -0.2963
```

**F-TEST:**

```
x1<- m$Temperature

x2<-m$Fuel_Price

n1=length(x1)

n2=length(x2)

f=var.test(x1,x2)

f
```

**OUTPUT:**

```
        F test to compare two variances

data:  x1 and x2
F = 1875.2, num df = 8189, denom df = 8189, p-value < 2.2e-16
alternative hypothesis: true ratio of variances is not equal to 1
95 percent confidence interval:
 1795.736 1958.259
sample estimates:
ratio of variances
          1875.238

> |
```

**T-TEST:**

```
x1<- m$Temperature

x2<-m$Fuel_Price

t.test(x1,x2,alt="less",var.equal = TRUE)
```

**OUTPUT:**

```
        Two Sample t-test

data:  x1 and x2
t = 271.01, df = 16378, p-value = 1
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
     -Inf 56.28981
sample estimates:
mean of x mean of y
59.356198  3.405992

>
```

**CHI-SQUARE TEST:**

```
chisq.test(m$Temperature,m$Fuel_Price,correct=FALSE)
```

**OUTPUT:**

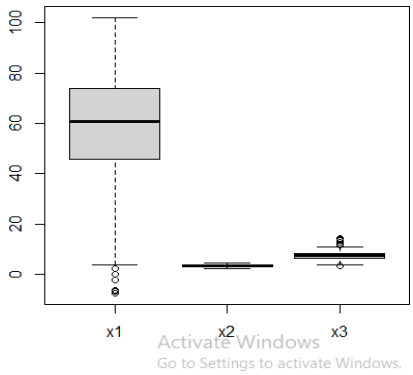
```
> chisq.test(m$Temperature,m$Fuel_Price,correct=FALSE)

        Pearson's Chi-squared test

data:  m$Temperature and m$Fuel_Price
X-squared = 5221495, df = 4218770, p-value < 2.2e-16
```

**ANOVA:**

```
x1<- m$Temperature

x2<-m$Fuel_Price

x3<-m$Unemployment

it<-data.frame(cbind(x1,x2,x3))

summary(it)

stgr<-stack(it)

crd<-aov(x1~x2,data=stgr)

summary(crd)

boxplot(it)
```

**OUTPUT:**

```
> x1<- m$Temperature
> x2<-m$Fuel_Price
> x3<-m$Unemployment
> it<-data.frame(cbind(x1,x2,x3))
> summary(it)
       x1               x2              x3
 Min.   : -7.29   Min.   :2.472   Min.   : 3.684
 1st Qu.: 45.90   1st Qu.:3.041   1st Qu.: 6.634
 Median : 60.71   Median :3.513   Median : 7.806
 Mean   : 59.36   Mean   :3.406   Mean   : 7.827
 3rd Qu.: 73.88   3rd Qu.:3.743   3rd Qu.: 8.567
 Max.   :101.95   Max.   :4.468   Max.   :14.313
                                  NA's   :585
> stgr<-stack(it)
> crd<-aov(x1~x2,data=stgr)
> summary(crd)
              Df  Sum Sq Mean Sq F value Pr(>F)
x2             1   29350   29350   84.99 <2e-16 ***
Residuals   8188 2827713     345
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> boxplot(it)
>
```





**Decompose of Time series:**

```
m= read.csv("C:/Users/admin/Downloads/Features.csv")

m

apts <- ts(m, frequency=12)

f <- decompose(apts)

f

f$figure

plot(f$figure, type="b",xaxt="n",xlab="")

plot(f)
```

**OUTPUT:**

```
$x
      Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov
1   42.31 38.51 39.93 46.63 46.50 57.79 54.58 51.45 62.27 65.86 66.32
2   67.41 72.55 74.78 76.44 80.44 80.69 80.43 84.11 84.34 80.91 80.48
3   83.36 81.84 87.16 87.00 86.65 85.22 81.21 78.69 82.11 80.94 71.89
4   67.18 69.86 69.64 58.74 59.61 51.41 64.52 49.27 46.33 49.84 52.33
5   48.27 35.40 44.04 43.83 42.27 36.39 57.36 62.90 59.58 53.56 62.76
6   59.17 67.84 71.27 72.99 72.03 64.61 75.64 67.63 77.72 83.00 83.13
7   83.58 85.55 85.83 88.54 85.77 86.83 91.65 90.76 89.94 87.96 87.83
8   79.94 75.80 79.69 69.31 71.74 63.71 66.57 54.98 59.11 62.25 60.14
9   43.93 51.63 47.96 44.55 49.01 48.53 54.11 54.26 56.55 48.02 45.32
10  60.96 58.76 64.74 65.93 67.61 70.43 69.07 66.76 67.23 75.55 73.77
11  77.22 77.95 78.30 79.35 78.39 84.88 81.57 77.12 80.42 82.66 86.11
12  84.85 77.66 80.49 83.96 74.97 69.87 76.08 68.55 62.99 67.97 69.16
13  61.24 52.92 56.23 52.34 64.12 48.89 56.02 44.79 41.73 50.32 42.92
14  56.46 56.67 49.66 50.25 48.01 50.81 55.33 63.42 51.00 58.59 62.72
15  59.23 66.66 63.90 69.53 77.19 78.02 76.44 79.86 81.35 83.94 79.85
16  79.26 81.54 40.19 38.49 39.69 46.10 47.17 57.56 54.52 51.26 63.27
17  68.07 65.11 66.98 71.28 73.31 74.83 81.13 81.81 83.40 85.81 86.26
18  82.59 85.32 87.66 83.49 89.53 89.05 88.70 87.12 81.83 79.09 82.05
19  69.24 63.19 65.80 68.50 66.24 57.85 59.69 50.81 62.98 49.33 45.50
20  49.97 47.30 44.69 33.02 41.40 42.83 38.25 33.19 57.83 60.80 57.77
21  62.32 69.42 55.43 67.00 69.48 69.39 69.21 61.48 74.61 67.14 76.42
22  83.40 86.53 85.17 85.69 87.70 89.83 89.34 90.07 93.34 91.58 89.86
23  89.64 77.97 78.85 75.58 78.14 69.92 71.67 64.53 65.87 55.53 59.33
24  56.36 48.74 41.76 50.13 46.66 44.57 46.75 45.99 51.70 50.50 55.21
25  43.82 54.63 58.79 57.11 63.68 64.01 66.83 68.43 68.08 65.69 67.20
26  73.87 71.27 78.19 78.38 78.69 80.56 81.04 86.32 84.20 80.17 83.23
27  90.22 88.55 84.79 76.91 82.64 87.65 75.88 71.09 79.45 70.27 60.97
28  69.79 56.40 61.90 52.72 58.06 52.64 64.19 47.69 55.14 41.56 39.12
29  40.98 51.33 54.75 56.08 48.92 48.16 46.08 51.12 55.14 59.97 50.54
30  61.23 67.05 58.13 65.26 63.51 70.55 76.83 78.05 76.20 80.91 81.11
31  79.48 85.41 79.16 83.17 45.71 47.93 47.07 52.05 53.04 63.08 60.42
32  65.56 68.00 66.98 67.87 70.24 73.47 77.18 75.81 78.60 78.53 82.10
33  83.79 82.20 81.75 84.32 83.32 82.04 85.13 86.74 88.02 86.15 84.16
```

Bseasonal

| | Jan | reb | cal- | Apr | May | Jun |
|---|---|---|---|---|---|---|
| 1 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63 | —0.09787OO6 |
| 2 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63 | —0.09787OO6 |
| a | o.os€sssov | -o oszi4oi3 | o.onaaa4zz | —O.2G3G32II | D.06296 3 | —0.00788TOO6 |
| 4 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63 | —0.09787OO6 |
| g | o.os65§sos | -o ogzi4oi3 | o.o9aza4zz | —O.2G3GS2GI | D.0629T63- | —0.09788TOO6 |
| 6 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63 | —0.09787OO6 |
| | o.obfibb9o9 | -o oszi4oza | 0.09222477 | -0.26365261 | D.Dd2963 | —0.0U78TOO6 |
| 6 | 0.056559 09 | —0.05z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63 | —0.09787OO6 |
| 9 | 0.056559 09 | —0.05z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63 | —0.09787OO6 |
| io | o.o5655ooO | -o os?i4oia | 0.09222477 | —O.2535S251 | D.0629T63—0.0078TOO6 | |
| 11 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| iz | o.os6ssso9 | —o oszi4oi3 | 0.09222477— | O.2G3G32II | D.06296 3—0.097'8TOO6 | |
| 13 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| 14 | o.o5€55sos | -o os?i4oi3 | 0.09222477 | —O.2G3C'S2GI | D.06296 3-—0.0978TOO6 | |
| 15 | 0.05655909 | -O.O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| 16 | 0.05655909 | -O.O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| 1, | 0.05655909 | -O.O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| 16 | 0.05655909 | -O.O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| i9 | o.o5655ooO | -o os?i4oia | 0.09222477 | —O.2535S251 | D. O629?63 -O.OO7870O6 | |
| 20 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| ai | o.os6ssos | -o oszi4oi3 | 0.09222477 | —O.2G3G32GI | D.06296 3—0.097'8TOO6 | |
| 22 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| za | o.o5€55sos | -o oszi4oi3 | 0.09222477 | **-0.2G]652G1** | D.06296 3-—0.OS78TOO6 | |
| 24 | 0.05655909 | -O. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| 25 | 0.05655909 | -O.O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| 26 | 0.05655909 | -O.O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| 2, | 0.05655909 | -O.O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |
| zs | o.os€sssoP | -o oszi4oi3 | 0. O92Z2477 | —O.2G3GS2II | D.06296 3—0.0€78TOO6 | |
| 29 | 0.05655909 | -0. O5z14D13 | 0.09222477 | —0.2G3G52G1 | D.10629,63—0.09787OO6 | |

$trend

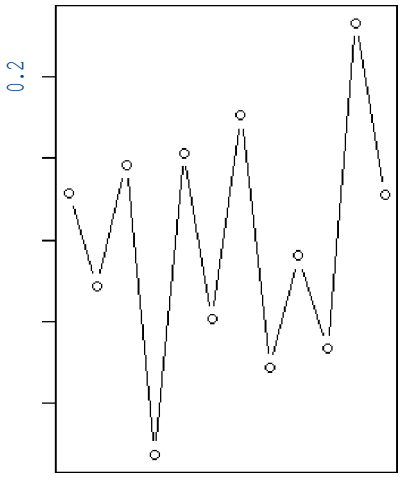
| | Jan | Feb | Rar | Apl | May | Prin | 3u1 | ug |
|---|---|---|---|---|---|---|---|---|
| 1 | NA | N4 | NA | MA | NA | NA | 54.3.28333 | 5C.192100 |
| 2 | 60.21201* | 71.G50833 | /3.9312 50 | ,5.477SI7' | zC.C93600 | z8.04,9L, | ,9.4754t7 | 80.32 *08 3 |
| 3 | 83.7533 3 3 | 83. 060000 | 83.241 2 S0 | 63.140583 | 8Z.*92917 | 81.63416 | 60.1 S9167 | 78,98 3833 |
| 4 | 68.90541* | G6.984167 | 64.2 6 500 | 61.480833 | 19.3z0000 | 57.90916 | 56.47 5417 | 54.2 o1 CC* |
| 5 | 46.445000 | 46. 714583 | 47.83456 i | 46.5416674 | 9.131 2 30 | 50.463333 | 51.815000 | 53.C208 3 3 |
| 6 | 65.265000 | G6. 223750 | 67.1888 | 69.150167 | 71.2 34383 | 72.766333 | ,4.470417 | 7C.2 2 341* |
| ? | 83.1362 SO | 84.M?0B3 | 86.24 0000 | 66.OSS833 | 8*.3?8333 | 87.AZ04LV | 66.5 35000 | 8?.9* *063 |
| 6 | 70.315833 | .780000 | 74.00456 i | ,1.648750 | C9.4237 30 | 67.141250 | 64.51208 3 | 62.004 3 8 3 |
| 9 | 52.61166* | 52.062500 | 51.925833 | 51.226250 | 30.01 3 8 33 | 49.745633 | 50.802917 | 51.8093 8 3 |
| 10 | SS.285000 | 60.429167 | 61.3 95000 | 62.087083 | G3.319?83 | 67.050000 | 66.272 500 | 6 9. *4 9? 6 3 |
| 11 | 75.420833 | 76.373333 | 7z.3 54 56 | 76.200417 | 79.0108 33 | 80.136333 | 61.06958 3 | 81.3 * 341* |
| 12 | 80.16541* | 79.579583 | 78.4962 50 | „.157217 | 73.8393 83 | 73.894563 | ,1.67208 3 | 6 9. C3 * 300 |
| 13 | 60.48166* | 58.655833 | 56.760000 | 55.158750 | ?3.3 30000 | 52.1554LV | II.87 5000 | 51.8 3 206 3 |
| 14 | SO.05541* | 50.802917 | 51.98 54 IN | 52.606250 | 13.8Co833 | 55.2629L | 55.950417 | 5C.48 208 3 |
| 15 | 65.27041* | 66.835000 | 68.764563 | ,1.105417 | 72.8*3417 | 74.2 5 666 | ,5.758750 | 7*.213 3 3 3 |
| 16 | 66.266250 | 64.117500 | 62.0 04 IN | 59.500833 | 1*.?38333 | 56.109563 | 54.505417 | 53.*?4?63 |
| IN | 64.645833 | 67.071250 | 69.26 J000 | 1.027017 | 74.3 2 0417 | ?6.0054LV | .3 32 500 | 78.**9?83 |
| 16 | 85.214563 | 85.751250 | 85.90,06 I | 65.561667 | '83.1OC230 | 84.891250 | 64.295417 | 82.81*08 3 |
| L9 | 73.074583 | 70.352917 | 68.0 34 56 5 | 66.020167 | G3.2GG2?0 | 60.31666 | 36.08708 3 | 5G.G2 206 3 |
| 20 | 47.02916* | 45.401667 | 44.4 52 91 | 44.716250 | 43.*00417 | 46.431250 | 4.160417 | 48.?9CCC* |
| 21 | 59.088333 | 61.557083 | 63.4 35000 | 64.308333 | C3.43 9383 | 67.482063 | 69.6258 33 | 7'1.21708 3 |
| 22 | 80.026250 | 82.056250 | 84.02, 91, | 65.826667 | 8z.403000 | 88.272500 | 66.840000 | 88.*43 3 3 3 |
| 23 | 83.82541* | 82.025000 | 79.816230 | 7 .160583 | 74.39?417 | ?1.936333 | 69.366667 | 6G.*G206 3 |
| 24 | 54.558333 | 52.747500 | 51.3 64 56 | 50.584583 | 30.203333 | 49.4054LV | 46.256667 | 47.97 938 3 |
| 25 | 54.100833 | 55.872500 | 57.490000 | 56.805417 | 39.93*917 | 61.67 06 3 | 64.168750 | 6C.11 41C* |
| 26 | 73.418750 | 74.756250 | 76.153 35 | 7 .448333 | 76.*I9?83 | ?9.78916 | 60.87208 3 | 82.2 * 3333 |
| 27 | 84.125833 | 83.276250 | 82.443750 | 81.833333 | 80.493333 | 78.803750 | 77.190417 | 74.000583 |

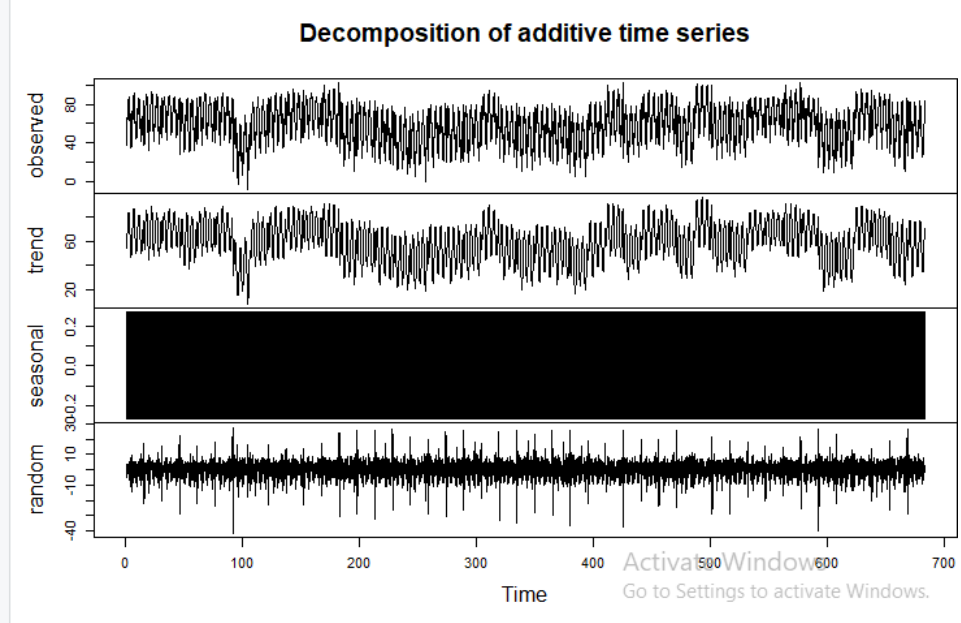
$ r and one

| | Jan | e b | Mas | Apr | nay |
|---|---|---|---|---|---|
| | NA | NA | NA | N A | NA |
| 2 | —1. 8S947Ge—00 | 9. 563068e-01 | r . 56 52 52e —01 | 1 225736e+00 | 3636.’02e+00 |
| 3 | —4. 498924e —01 | -1.662860e+00 | 3. 626 52 5e+00 | 4 114069e+00 | 3..’50.’86e+00 |
| 4 | —1. 78197Ge—00 | 2.932973e+00 | 5.2 8027 5e+00 | -2 4""181e+00 | 1.33’022e-01 |
| 5 | 1. 768441e—00 | -1.125744e+01 | —3. 686808 e+00 | —4. 448 014 e+00 | -B.9B’548e+00 |
| 6 | —6. lS15S9e—00 | 1.673390e+00 | 4. 001109e+00 | 4. 094486e+00 | 6.691188e-01 |
| | 3.871009e-01 | 8.400J68e-01 | —5.022248e—01 | 1. 84 Z 819e+00 | -1.694631e+00 |
| 6 | 5.67607Ge-01 | -9.228J99e-01 | 5. 59 31OF e+00 | -2.OZ5097e+00 | 2.209952e+00 |
| 9 | -8.73822Ge-OO | -3.753J99e-01 | —4. 058058 e+00 | -I412J97e+00 | -1.112131e+00 |
| 10 | 1.618441e-OO | —1. 61202 7 e+00 | 3.252775e+00 | 3.2O6J69e+00 | 2.164l1Oe+00 |
| 11 | I.742608e-OO | 1. 63 3 807 e+00 | 6.S31O1Oe-01 | 1413236e+00 | -?.2?1312e-01 |
| 12 | 4.628024e-OO | —1. 862443 e+00 | 1.901525e+00 | ?. OG5736e+00 | -9.756612e-01 |
| IN | 7. 017742e -O1 | -â.67B693e+00 | -6.422248e-01 | -2tâ5097e+00 | 1.066370e+01 |
| 14 | 6. 348024e-00 | â.924223e+00 | -2.397641e+00 | -2182J97e+00 | -5.962131e+00 |
| IS | -6. 096975e-00 | -1.17BJ99e-01 | -4.976808e+00 | -1.311764e+00 | 4.206286e+00 |
| 16 | 1. 2937l9e-O1 | 1.747964e+01 | -2.107264e+01 | -2.08371Be+01 | -1.79J463e+01 |
| IN | 3. 3676O8e-OO | -1.904l10e+00 | -2.307225e+00 | -3.842641e-01 | -1.121714e+00 |
| 16 | -2. 681142 e-OO | -3.741099e-01 | 1.660602e+00 | -1.808014e+00 | 4.3lZ4S2e+00 |
| 19 | -3. 891142 e-OO | -Z.10J777e+00 | -2.346808e+00 | 2.Z344B6e+00 | 2.667452e+00 |
| 20 | 2. 884274e—O0 | 1.9554 3e+00 | 1.448586e-01 | -1.143260e+01 | -4.411714e+00 |
| 21 | 3. l7SlO8e—00 | 7.920057e+00 | -6.007225e+00 | 2.8G5319e+00 | 3.934119e+00 |
| 22 | 3. 317l91e—00 | 4. 530890e+00 | 1.04O85Oe+00 | 1.2G9859e-01 | l.66’022e-01 |
| 23 | 5. 7S8024e—00 | -3.997860e+00 | -1.058475e+00 | -1.325931e+00 | 3.636286e+00 |
| 24 | 1. 74SlO8e—00 | -3.950360e+00 | -9.’16808e+00 | -1.909307e-01 | -3.649631e+00 |
| 25 | —1. 033739e—01 | -1.185360e+00 | 1.207775e+00 | -1.431764e+00 | 3635.’86e+00 |
| 2B | 3.O46O09e-01 | -3.429110e+00 | 1.924442e+00 | 1. 195319e+00 | -1. 356612e-01 |
| 2’ | 6.037608e-00 | 6. 330890e+00 | 2.254025e+00 | -4.609681e+00 | 2.040369e+00 |

```
$figure
 [1]  0.05655909 -0. 0 5 714 013    0.  092 2 2477  -0.  253532 51    0. 1 062 976 3  - 0.  0978 7005
 [7]  0.15296631 -0.  1 5 67 8931  - 0. 019618 61   -0.  1  3394 331    0.  2 6 5 662 96  0. 0 S 508 32 3

Itype
[lj  ”additive”

att r ( , " cl ass "
 §1§ " de c onJpos ed . ts "
```

> I Sf ) gui- e
1§ 0. 056 5 3 909 —0. 05 714 013 0. 092 2 2477 —0. 2 C3 C3 2 C1 0.1062 9 6 3 — 0. 0978700 C 0. 13 2 9 6631 — 0. 1 56 69 31 —0. 019C18 C1
ION —0. 13 3943 31 0. 26 5 882 98 0. 05 508 32 5

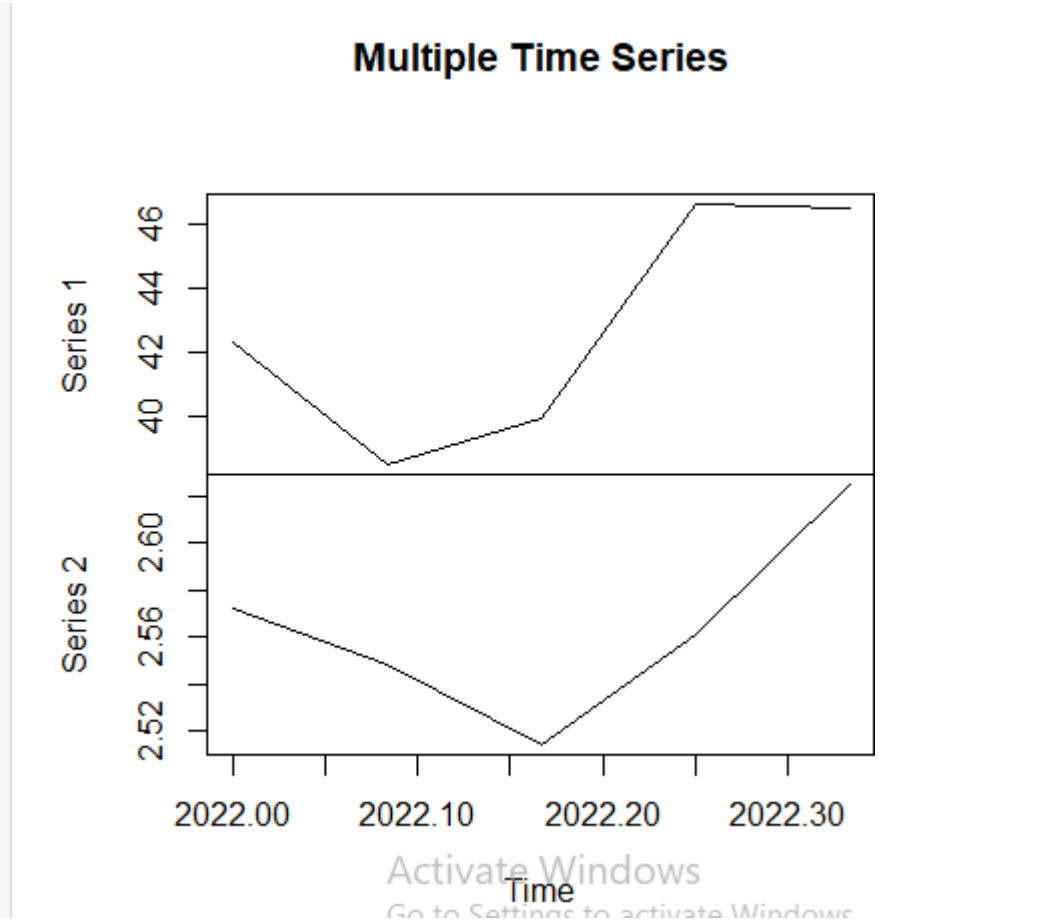





**MULTIPLE TIME SERIES:**

```
temp<- c(42.31,38.51,39.93,46.63,46.50)

fue <- c(2.572,2.548,2.514,2.561,2.625)


com <- matrix(c(temp,fue),nrow = 5)

com.timeseries <- ts(com,start = c(2022,1),frequency = 12)

print(com.timeseries)


plot(com.timeseries, main = "Multiple Time Series")
```

```
> plot(com.timeseries, main = "Multiple Time Series")
> temp<- c(42.31,38.51,39.93,46.63,46.50)
> fue <- c(2.572,2.548,2.514,2.561,2.625)
> com <-  matrix(c(temp,fue),nrow = 5)
> com.timeseries <- ts(com,start = c(2022,1),frequency = 12)
> print(com.timeseries)
         Series 1 Series 2
Jan 2022    42.31    2.572
Feb 2022    38.51    2.548
Mar 2022    39.93    2.514
Apr 2022    46.63    2.561
May 2022    46.50    2.625
> plot(com.timeseries, main = "Multiple Time Series")
>
```




**Conclusion:**

The extracted data of features is been analyzed using RStudio. From this project we went through different statistical methods which we learnt in R-lab sessions and tried to implement the same on "Features" dataset and plotted some graphs for better analysis.