Anavo

```
Anova is used for Analysis of Variance

There are two types of Anova:
          * One
          * Two
          * Three
```

Type *Markdown* and LaTeX: α^2

```
The below mentioned data shows a sample of the employee under normal two and lay off time.
```

	S1	S2	S3
1	2	10	10
2	3	8	13
3	7	7	14
4	2	5	13
5	6	10	15

```
S1 = Normal Time
S2 = After announced lay off
S3 = During lay off

Steps to calculate ANOVA:
      1.  Sum of square within group
      2.  Sum of square between group
      3.  Total Sum of squares (1) + (2)
```

(1) Calculate mean of sample data:

$\overline{S_1} = \frac{2+3+7+2+6}{5}$

$= 20/5 = 4$

$\overline{S_2} = \frac{10+8+7+5+10}{5}$

$= 40/5 = 8$

$\overline{S_3} = \frac{10+13+14+13+15}{5}$

$= 13.$

(2) Sum of square ~~between~~ within group:

(S_1) Observation	Mean $(\overline{S_1})$	Square within group.
2	4	$(2-4)^2 = 4$
3	4	$(3-4)^2 = 1$

$\Sigma S_1 = 22$

(S_3) Observation	Mean ($\bar{S}_3$)	Square within group
10	13	9
13	13	0
14	13	1
13	13	0
15	13	4
		14

$\sum S_3 = 14$

$\Rightarrow 22 + 18 + 14$

$\Rightarrow \cancel{58}\ 54.$

(2) Sum of square between group:

total sum of square = Sum of square within groups + Sum of square between groups.

Sum of square between groups = total sum of square − Sum of square within groups.

~~Observation~~

$\Rightarrow 257.35 - 54$

$\Rightarrow 203.35.$

Saathi

Date ___/___/___

Tot sum of sq = sum of sq within group + sum of square between o group

Observation	Mean	(Obs - Mean)^2
2	8.3	2 - 8.3 = 39.69
3	8.3	3 - 8.3 = 28.09
7	8.3	7 - 8.3 = 1.3
2	8.3	2 - 8.3 = 39.69
6	8.3	6 - 8.3 = 5.29
10	8.3	10 - 8.3 = 2.89
8	8.3	0.3 = 0.09
7	8.3	1.3 = 1.69
5	8.3	3.3 = 10.89
10	8.3	1.7 = 2.89
10	8.3	1.7 = 2.89
13	8.3	4.7 = 22.09
14	8.3	5.7 = 32.49
13	8.3	4.7 = 22.09
15	8.3	6.7 = 44.89
tss		203.35

~~257.35~~ 3L

257.35 - 54

= 203.35

⇒ 54.

Sum of square between group:

total sum of square = Sum of square within groups + Sum of square between groups

Sum of square between groups = total sum of square − Sum of square within groups.

Observation

⇒ 257.35 − 54

⇒ 203.35.

$$\text{eqn (1)} = \frac{\text{Sum of square between groups}}{\text{degree of freedom.}}$$

degree of freedom = 3-1 = 2.

$$\text{Eqn (1)} = \frac{203.35}{2}$$

$$= 101.65.$$

$$\text{eqn}(2) = \frac{\text{Sum of square within group}}{\text{degree of freedom}}$$

degree of freedom = total observation - total group

$= 15 - 3$

$= 12$

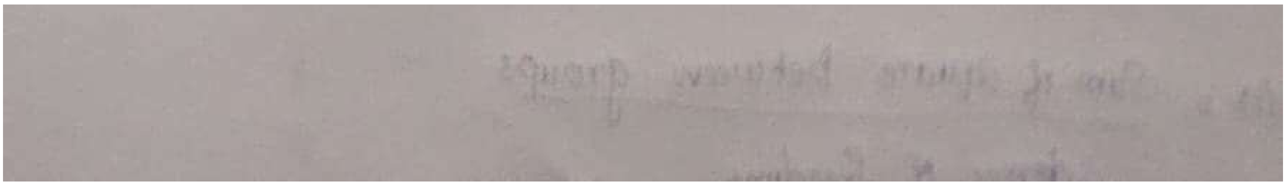
$$\text{eqn}(2) = 54/12$$

$= 4.5$

(3) $\dfrac{\text{eqn}(1)}{\text{eqn}(2)} = \dfrac{101.675}{4.5}$

$\Rightarrow 22.59$

degree of freedom $(2, 12) = 3.8857$.



In [1]:

```
s1 = c(2,3,7,2,6)
s2 = c(10,8,7,5,10)
s3 = c(10,13,14,13,15)
combine = data.frame(cbind(s1,s2,s3))
```

In [2]:

```
combine
```

s1	s2	s3
2	10	10
3	8	13
7	7	14
2	5	13
6	10	15

In [5]:

```
stack_group = stack(combine)
```

In [6]:

```
a = aov(values~ind, data=stack_group)
```

In [8]:

```
summary(a)
```

```
            Df Sum Sq Mean Sq F value   Pr(>F)    
ind          2  203.3   101.7   22.59 8.54e-05 ***
Residuals   12   54.0     4.5                     
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Time series graph:

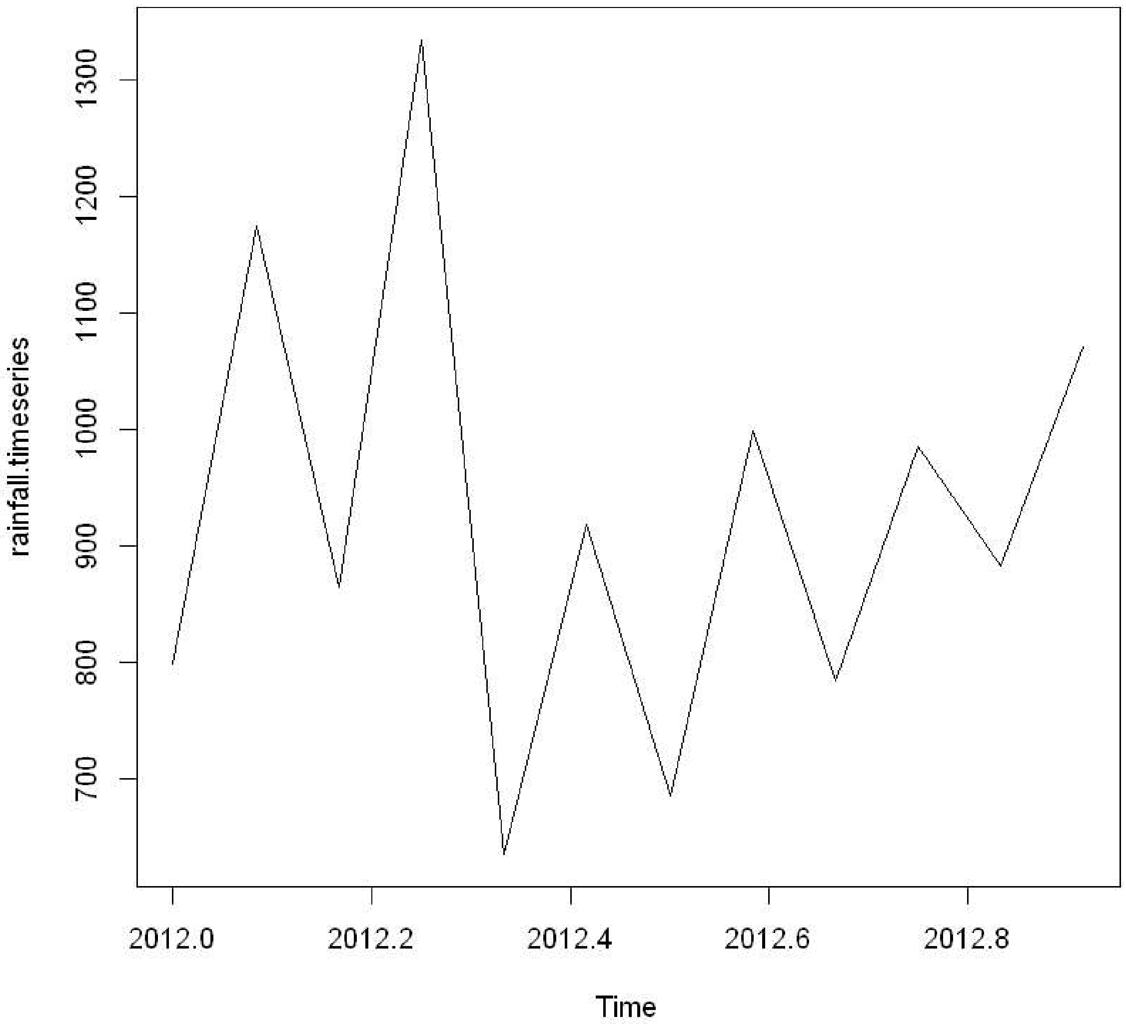
Single Time Series Graph:

```
frequency = 12 ->   gets the data points for every month of a year
frequency = 4  ->   gets the data points for every quarter of a year
frequency = 6  ->   gets the data points for every 10 minutes of an hour
frequency = 24*6 -> gets the data points for every 10 minutes of a day
```

In [10]:

```
# get the data points in form of a R vector
rainfall <- c(799, 1174.8, 865.1, 1334.6, 635.4, 918.5, 685.5, 998.6, 784.2, 985, 882.8, 1071 )

# convert it to a time series object.
rainfall.timeseries <- ts(rainfall,start=c(2012, 1), frequency = 12)

# print the timeseries data.
print(rainfall.timeseries)

# plot a graph of the time series.
plot(rainfall.timeseries)
```

```
        Jan    Feb    Mar    Apr    May    Jun    Jul    Aug    Sep    Oct
2012  799.0 1174.8  865.1 1334.6  635.4  918.5  685.5  998.6  784.2  985.0
        Nov    Dec
2012  882.8 1071.0
```

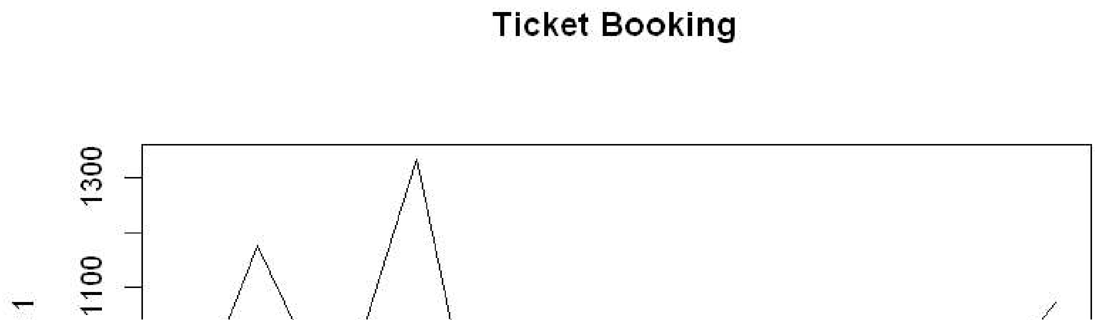


Multiple Time Series Graph:

In [15]:

```
# Get the data points in form of a R vector.
Varisu <- c(799,1174.8,865.1,1334.6,635.4,918.5,685.5,998.6,784.2,985,882.8,1071)
Thunivu <- c(655,1306.9,1323.4,1172.2,562.2,824,822.4,1265.5,799.6,1105.6,1106.7,1337.8)

# Convert them to a matrix.
combined.rainfall <-  matrix(c(Varisu, Thunivu),nrow = 12)

# Convert it to a time series object.
rainfall.timeseries <- ts(combined.rainfall,start = c(2012,1),frequency = 24*6)

# Print the timeseries data.
print(rainfall.timeseries)

# Plot a graph of the time series.
plot(rainfall.timeseries, main = "Ticket Booking")
```

```
Time Series:
Start = c(2012, 1)
End = c(2012, 12)
Frequency = 144
         Series 1 Series 2
2012.000    799.0    655.0
2012.007   1174.8   1306.9
2012.014    865.1   1323.4
2012.021   1334.6   1172.2
2012.028    635.4    562.2
2012.035    918.5    824.0
2012.042    685.5    822.4
2012.049    998.6   1265.5
2012.056    784.2    799.6
2012.062    985.0   1105.6
2012.069    882.8   1106.7
2012.076   1071.0   1337.8
```


Ticket Booking
1300
1100
1