

ONE WAY ANOVA

Ques:-

①	②	③
1	2	2
2	4	3
5	2	4

Step 1:-

$H_0: \mu_1 = \mu_2 = \mu_3$

H_a : Atleast 1 difference among the means

$$\alpha = 0.05$$

Step 2:-

Numerator $\text{dof}_{\text{blw}} = K - 1 = 3 - 1 = 2$
 \hookrightarrow No. of groups / conditions

Denominator $\text{dof}_{\text{within}} = N - K$
 \hookrightarrow Total no. of scores we have
 $= 9 - 3 = 6$

$$\text{dof}_{\text{Total}} = 6 + 2 = 8$$

$$F_{\text{critical value}} = 5.14$$

Step 3 :-

$$\frac{1+2+5}{3}$$

$$\bar{x}_1 = 2.67,$$

$$\frac{2+4+2}{3}$$

$$\bar{x}_2 = 2.67,$$

$$\frac{2+3+4}{3}$$

$$\bar{x}_3 = 3.00,$$

$$\bar{\bar{x}} = \text{Grand mean } \frac{G}{N} = \frac{1+2+5+2+4+2+2+3+4}{9}$$

$$= \frac{25}{9} = 2.78$$

$$\text{Sum of squares Total} = \sum (x_i - \bar{\bar{x}})^2$$

$$= (1-2.78)^2 + (2-2.78)^2 + (5-2.78)^2 + (2-2.78)^2 + (4-2.78)^2 + (2-2.78)^2 + (2-2.78)^2 + (3-2.78)^2 + (4-2.78)^2$$

$$\boxed{SST = 13.6}$$

$$\text{Sum of square within} = \sum (x_1 - \bar{x}_1)^2 + (x_2 - \bar{x}_2)^2 + (x_3 - \bar{x}_3)^2$$

$$= (1-2.67)^2 + (2-2.67)^2 + (5-2.67)^2 + (2-2.67)^2 + (4-2.67)^2 + (2-2.67)^2 + (2-3)^2 + (3-3)^2 + (4-3)^2$$

Main Table		
①	②	③
1	2	2
2	4	3
5	2	4

$$\boxed{SS_{\text{within}} = 13.34}$$

$$SS_{\text{B/w}} = SST - SS_{\text{within}} \\ = 13.6 - 13.34$$

$$\boxed{SS_{\text{B/w}} = 0.23}$$

Step 4:-

Calculate Mean Square B/w / Variance B/w

$$MS_{\text{B/w}} = \frac{SS_{\text{B/w}}}{df_{\text{B/w}}} = \frac{0.23}{2} = 0.12$$

Calculate Mean Square within / Variance within

$$MS_{\text{within}} = \frac{SS_{\text{within}}}{dof_{\text{within}}} = \frac{13.34}{6} = 2.22$$

Step 5:- Calculating F statistic

$$F_{\text{stat}} = \frac{MS_{\text{B/w}}}{MS_{\text{w/m}}} = \frac{0.12}{2.22} = 0.05$$

We know, $F_{\text{crit}} = 5.14$

$F_{\text{stat}} < F_{\text{crit}} \quad \therefore \text{fail to reject } H_0$

Example 2:-

Set up an analysis of variance table for the following per acre production data for three variety of wheat, each grown on 4 plots and state if the variety differences are significant

Plot of land

1
2
3
4

Variety of wheat

A	B	C
6	5	5
7	5	4
3	3	3
8	7	4

$$\boxed{\text{dof total} = 2 + 9 = 11}$$

$$\bar{x}_1 = 6$$

$$\bar{x}_2 = 5$$

$$\bar{x}_3 = 4$$

$$\bar{\bar{x}} = 5$$

$$\boxed{\text{dof Blw} = 3 - 1 = 2}$$

$$\boxed{\text{dof within} = \cancel{12-3} = 12-3 = 9}$$

$$\boxed{SS_{\text{within}} = 24}$$

$$\boxed{SS_{\text{Total}} = 32}$$

$$\boxed{SS_{\text{Blw}} = 8}$$

$$MS_{\text{Blw}} = \frac{8}{2} = 4.00$$

$$MS_{\text{wim}} = \frac{24}{9} = 2.67$$

$$f = 4.00 / 2.67 = 1.5$$

$$\boxed{F_{\text{critical}} = 4.25}$$

The above table shows that the calculated value of F is 1.5 which is less than the table value of 4.25 at 5% level of significance, hence the analysis supports the null hypothesis of no difference in means. We may, therefore conclude that the difference in wheat output due to varieties is insignificant and is just a matter of chance.