



DEPARTMENT OF MATHEMATICS
UNIT - II DESIGN OF EXPERIMENTS

RANDOMISED BLOCK DESIGN (RBD) (or) TWO WAY CLASSIFICATION

Three varieties A, B, C, of a crop are tested in a randomized block design with four replications. The plot yields in pounds are as follows:

A	6	C	5	A	8	B	7
C	8	A	4	B	6	C	9
B	7	B	6	C	10	A	6

Experimental yield and state your conclusion. Analyse the

soln:

Varieties	Yields			
A	6	4	8	6
B	7	6	6	9
C	8	5	10	9

	n_1	n_2	n_3	n_4	Total	n_1^2	n_2^2	n_3^2	n_4^2
y_1	6	4	8	6	24 Σy_1	36	16	64	36
y_2	7	6	6	9	28 Σy_2	49	36	36	81
y_3	8	5	10	9	32 Σy_3	64	25	100	81
	$\frac{21}{\Sigma n_1}$	$\frac{15}{\Sigma n_2}$	$\frac{24}{\Sigma n_3}$	$\frac{24}{\Sigma n_4}$	$\frac{84}{\Sigma y_4}$	$\frac{149}{\Sigma n_1^2}$	$\frac{77}{\Sigma n_2^2}$	$\frac{200}{\Sigma n_3^2}$	$\frac{198}{\Sigma n_4^2}$

step 1: Formulating H_0 and H_1

H_0 : There is no significant difference between yields and varieties.
 H_1 : There is significant difference between yields and varieties.



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Step 2: To find N & T

$$N = n_1 + n_2 + n_3 + n_4 \\ = 3 + 3 + 3 + 3 = 12$$

$$T = \sum x_{11} + \sum x_{12} + \sum x_{13} + \sum x_{14} \\ = 21 + 15 + 24 + 24 \\ = 84$$

Step 3: Correction factor, $C.F.$

$$C.F. = \frac{T^2}{N} = \frac{84^2}{12} = 588$$

$$\text{Step 4: } TSS = \sum x_1^2 + \sum x_2^2 + \sum x_3^2 + \sum x_4^2 - C.F. \\ = 149 + 77 + 200 + 198 - 588 \\ = 36$$

$$\text{Step 5: } SSC = \frac{(\sum x_1)^2}{n_1} + \frac{(\sum x_2)^2}{n_2} + \frac{(\sum x_3)^2}{n_3} + \frac{(\sum x_4)^2}{n_4} - C.F. \\ = \frac{21^2}{3} + \frac{15^2}{3} + \frac{24^2}{3} + \frac{24^2}{3} - 588 \\ = 18$$

$$SSR = \frac{(\sum y_1)^2}{n_{1'}} + \frac{(\sum y_2)^2}{n_{2'}} + \frac{(\sum y_3)^2}{n_{3'}} - C.F. \\ = \frac{24^2}{4} + \frac{28^2}{4} + \frac{32^2}{4} - 588 \\ = 8$$

$$\text{Step 6: } SSE = TSS - SSC - SSR \\ = 36 - 18 - 8 \\ = 10$$



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Step 7: Anova table

Source of Variation	Sum of squares	Degrees of freedom	mean sum of squares	F-Ratio
Column	SSC : 18	$c-1: 4-1 = 3$	$MSC: 18/3 = 6$	$F_c = \frac{6}{1.6} = 3.75$ $F_{\alpha}(3,6) = 4.76$
Row	SSR : 8	$r-1: 3-1 = 2$	$MSR = 8/2 = 4$	$F_R = \frac{4}{1.6} = 2.5$
Error	SSF : 10	$(r-1)(c-1): 3 \times 2 = 6$	$MSE = 10/6 = 1.6$	$F_{\alpha}(2,6) = 5.14$

Step 8: Conclusion:

$$F_c = 3.75 < 4.76 = F_{\alpha}, H_0 \text{ is accepted}$$

$$F_R = 2.5 < 5.14 = F_{\alpha}, H_0 \text{ is accepted}$$

∴ There is no significant difference between yields & varieties.