



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

AN AUTONOMOUS INSTITUTION



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Topic: 2.11 – Latin Square Design

6. Find out the main effects and interactions in the following 2^2 – factorial experiment and write down the analysis of variance table:

	(1) 00	a 10	b 01	ab 11
Block I	64	25	30	6
II	75	14	50	33
III	76	12	41	17
IV	75	33	25	10

Solution : Taking deviation from $y = 37$,

Treatment combination	Blocks				Total	X_1^2	X_2^2	X_3^2	X_4^2
	I X_1	II X_2	III X_3	IV X_4					
(Y_1) (1)	27	38	39	38	142	729	1444	1521	1444
(Y_2) a	-12	-23	-25	-4	-64	144	529	625	16
(Y_3) b	-7	13	4	-12	-2	49	169	16	144
(Y_4) ab	-31	-4	-20	-27	-82	961	16	400	729
Total	-23	24	-2	-5	-6	1883	2158	2562	2333

$$\text{Step 1: } N = 16, T = -6, C.F = \frac{T^2}{N} = \frac{36}{16} = 2.25$$

$$\begin{aligned} \text{Step 2: TSS} &= \sum X_1^2 + \sum X_2^2 + \sum X_3^2 + \sum X_4^2 - \frac{T^2}{N} \\ &= 1883 + 2158 + 2562 + 2333 - 2.25 \\ &= 8933.75 \end{aligned}$$

$$\begin{aligned} \text{Step 3: SSC} &= \frac{(\sum X_1)^2}{N_1} + \frac{(\sum X_2)^2}{N_2} + \frac{(\sum X_3)^2}{N_3} + \frac{(\sum X_4)^2}{N_4} - \frac{T^2}{N} \\ N_1 &= \text{Number of elements in each column} \\ &= \frac{(-23)^2}{4} + \frac{(24)^2}{4} + \frac{(-2)^2}{4} + \frac{(-5)^2}{4} - 2.25 \\ &= 281.25 \end{aligned}$$



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$$\text{Step 4: SSR} = \frac{(\sum Y_1)^2}{N_1} + \frac{(\sum Y_2)^2}{N_2} + \frac{(\sum Y_3)^2}{N_3} + \frac{(\sum Y_4)^2}{N_4} - \frac{T^2}{N}$$

N_1 = Number of elements in each row

$$= \frac{(1)^2}{4} + \frac{(-6)^2}{4} + \frac{(-2)^2}{4} + \frac{(-8)^2}{4} - 2.25$$

$$= 7744.75$$

Step 5: SSE = TSS – SSC – SSR

$$= 8933K - 281\downarrow - 774475$$

$$= 907.75$$

For 2^2 experiment

$$SS_A = \frac{[a+a \quad -b-(1)]^2}{1}$$

$$= \frac{[-6 \quad -8 \quad +2-1]^2}{1}$$

$$= 5112.25$$

$$SS_B = \frac{[b+a \quad -a-(1)]^2}{1}$$

$$= \frac{[-2-8 \quad +6 \quad -1]^2}{1}$$

$$= 1640.25$$



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$$\begin{aligned}SS_{AB} &= \frac{[a + (1) - a - b]^2}{1} \\ &= \frac{[-8 + 1 + 6 + 2]^2}{1} \\ &= 992.25\end{aligned}$$