SNS COLLEGE OF TECHNOLOGY



(An Autonomous Institution)

Coimbatore – 35

DEPARTMENT OF MATHEMATICS



UNIT - V DESIGN OF EXPERIMENTS

Problem.

An experiment was designed to study the performance of a different detergents for cleaning of injectors.

The following "Cleanliness" seadings were obtained with specially designed equipment for 12 tanks of gas distributed over 3 different models of engines.

Engine 1	Engine 2	Engine 3	Total			
45	43	51	139			
47	46	52	145			
48	50	55	153			
42	37	49	128			
182	176	207	565			
	45 47 48 42	45 43 47 46 48 50 42 37	45 43 51 47 46 52 48 50 55 42 37 49			

Perform the ANOVA test at 0.01 level of significance whether there are differences in the detergents or in the engines.

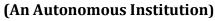
Solution:

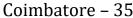
Fix origin = 50. Subtract each element

from 50 .

Engine	×,	X ₂	×3	Total	x,2	X22	X3
A (4,)	-5	-7	+1	-11	25	49	1
B (y2)	- 3	-4	2	-5	9	16	4
c (y3)	-2	o	5	3	4	0	25
D (94)	-8	-13	-1	-22	64	169	1
Total	- 18	- 24	7	- 35	102	234	31

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Step 1: Null hypothesis Ho: There is no Significant

difference between engines and detengents.

Alternative hypothesis H, : There is a significant

difference between engines and detergents

Step 3: SST =
$$\Sigma \chi_1^2 + \Sigma \chi_2^2 + \Sigma \chi_3^2 - C.F$$

= $102 + 234 + 31 - 102.08$

$$SSC = \frac{\left(\frac{5\chi_{1}}{c_{1}}\right)^{2} + \left(\frac{5\chi_{2}}{c_{2}}\right)^{2} + \left(\frac{5\chi_{3}}{c_{3}}\right)^{2} - C \cdot F}{c_{1}}$$

$$= \frac{\left(-18\right)^{2} + \left(-24\right)^{2} + \frac{7^{2}}{4} - 102.08}{4}$$

$$SSR = \frac{(\Sigma y_1)^2 + (\Sigma y_2)^2 + (\Sigma y_3)^2 + (\Sigma y_4)^2 - C.F}{\gamma_1}$$

$$= \frac{(-11)^2 + (-5)^2 + 3^2 + (-22)^2 - 102.08}{3}$$

Stepy: ANOVA table:

Source of Vasiation	Degree of	Sum of Squares	Mean Sum of Squares	Variance	at 14 ites
Between Columns	(-1 = 3-1 = 2	SSC = 135.17	MSC = SSC C-1 = 67.585	Fc = MSC	Fa(2,6) = 10.92
Between Yous	7-1=4-1 =3	SSR = 110.91	MSR - SSR	FR = MSR	F_ (316)
Between esgors	(C-1)(T-1)	SSE = 18.84	MSE - 55E - 3.4	e 11.77	± 9.78

Steps: Decision: Since For Fa and FR > Fa, Ho is Sciented

23MAT20 ... There is a significant difference between engines and detergents