Answer on question 39513 – Math – Statistics

Test the significance of variation of the retail prices of the commudity in three principle cities; Bombay, Kolkata and Delhi. The four shops were chosen at random in each city and prices observed in rupees were as follows.
Bombay 16 8 12 14
Kolkatta 14 10 10 6
Delhi 4 10 8 8
Do the data indicate the prices in the three cities are significantly different?
Solution

H_0: $\mu_1 = \mu_2 = \mu\_3$, i.e., the mean prices in the three cities are the same.

In order to simplify the calculation, subtract 10 from each observation. The deviations and their squares as follow:

Bombay		Kolkata		Delhi	
X_1	X_1^2	X_2	X_2^2	X_3	X_3^2
6	36	4	16	-6	36
-2	4	0	0	0	0
2	4	0	0	-2	4
4	16	-4	16	-2	4
$\sum X_1 = 10$	$\sum X_1^2 = 60$	$\sum X_2 = 0$	$\sum X_2^2 = 32$	$\sum X_3 = -10$	$\sum X_3^2 = 44$

$$T = \sum X_1 + \sum X_2 + \sum X_3 = 10 + 0 - 10 = 0$$

$$C.F. = \frac{T^2}{N} = \frac{0^2}{12} = 0$$

TSS=Total sum of squares= $\sum X_1^2 + \sum X_2^2 + \sum X_3^2 - C.F. = 60 + 32 + 44 - 0 = 136$

$$SSB = \left[\frac{(\sum X_1)^2}{n_1} + \frac{(\sum X_2)^2}{n_2} + \frac{(\sum X_3)^2}{n_3}\right] - C.F. = \left[\frac{(10)^2}{4} + \frac{(0)^2}{4} + \frac{(-10)^2}{4}\right] - 0 = 50$$

SSW=SST-SSB=136-50=86.

The various sum of squares (S.S.) along with the degrees of freedom (d.f.) are shown in the following table

Source of variation	Sum of square	Degrees of freedom	Mean sum of squares	F-Radio
Between city	50	3-1=2	25	$F = \frac{25}{9 * 556} = 2 * 616$
Within city	86	9	9*556	
Total	136	12-1=11		

For $v_1 = 2$ and $v_2 = 9$, the table value of F at 5% l.o.s.=4*261

Since the calculated value of F is less than the table value of F the null hypothesis is accepted. We thus conclude that the mean prices in the three cities is not significantly different.