Question

a) In one sample of observations, the sum of the squares of the observations of the sample values from sample mean was 120 and in the other sample of 12 observations it was 314. Test whether the difference is significant at 5% level of significance.

Solution

Given that $n_1 = 10, n_2 = 12, \sum(x_1 - X_1)^2 = 120, \sum(x_2 - X_2)^2 = 314$.

Let us take the null hypothesis that the two samples are drawn from the same normal population of equal variance

$$H_0 : \sigma_1^2 = \sigma_2^2$$
$$H_1 : \sigma_1^2 \neq \sigma_2^2$$

Applying F test

$$F = \frac{s_1^2}{s_2^2} = \frac{\dfrac{\sum(x_1 - X_1)^2}{n_1 - 1}}{\dfrac{\sum(x_2 - X_2)^2}{n_2 - 1}} = \frac{\dfrac{120}{9}}{\dfrac{314}{11}} = \frac{13.333}{28.545}$$

Since the numerator should be greater than denominator

$$\tilde{F} = \frac{28.545}{13.333} = 2.14 = \frac{s_2^2}{s_1^2}.$$

The critical value of F at 5% level for $v_1 = 11$, $v_2 = 9$ d.f is 3.1.

Since F $< F_{0.05}$ we accept H_0.

The samples may have been drawn from the two populations having the same variances. The difference is not significant at 5% level of significance.

Answer: The difference is not significant at 5% level of significance.