EXPERIMENT - 6

10 | 11 | 22

Aim: Testing the equality of two population variances.

Experiment:

Two samples are drawn from the two normal pop. from the data collected. Test whether the two samples have the same variance at 5% level of significance.

Sample 1 : 60, 65, 71, 74, 76, 82, 85, 87

Sample 2 : 61, 66, 67, 85, 78, 63, 85, 86, 88, 91

Theory: f-distribution is used for assertaining the equality of population variances.

$x_1, x_2 --- x_{n_1}$ be a sample of size n_1

$y_1, y_2 --- y_{n_2}$ be a sample of size n_2

from $N(\mu_1, \sigma_1^2)$ & $N(\mu_2, \sigma_2^2)$ resp.

Here, we test the $H_0 : \sigma_1^2 = \sigma_2^2$ & the

test statistic is $F = \frac{S_1^2}{S_2^2}$; $(S_1^2 > S_2^2)$ — I

where, $S_1^2 = \frac{1}{n_1 - 1} \sum_{i=1}^{m} (x_i - \bar{x})^2$

$S_2^2 = \frac{1}{n_2 - 1} \sum_{i=1}^{n_2} (y_i - \bar{y})^2$

The sampling dist. of F-statistic in I follows F-dist^N. with $V_1 = n_1 - 1$, $V_2 = n_2 - 1$ df

As we know, the larger variance is taken in the numerator of eq. I the df corresponding to this variance is $F = \frac{S_2^2}{S_1^2}$ $(\because S_2^2 > S_1^2)$

$\sim F_{V_1^2(n_2-1),\ V_2 = n_1 - 1} (\alpha\ \%)$

Calculation : $H_0 : \sigma_1^2 = \sigma_2^2$

$H_1 : \sigma_1^2 > \sigma_2^2$ to test the

Test statistic is

$F = \frac{S_1^2}{S_2^2}$ (if $S_1^2 > S_2^2$)

x_i	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
60	-15	225
65	-10	100
71	-4	16
74	-1	1
82	1	1
85	7	49
87	10	100
600		636

y_i	$y_i - \bar{y}$	$(y_i - \bar{y})^2$
61	-16	256
66	-11	121
67	-10	100
85	8	64
78	1	1
63	-14	196
85	8	64
86	9	81
88	11	121
91	14	196
770		1079

$\bar{x} = \frac{600}{8} = 75$

$S_1^2 = \frac{636}{7} = 90.85$

$\boxed{S_1^2 = 90.85}$

$\boxed{S_2^2 = 133.33}$

$\bar{y} = \frac{770}{10} = 770$

$S_2^2 = \frac{1}{9} \times 1079 = 133.33$

$F = S_2^2 / S_1^2 = 1.4676$

Tabulated Value $F_{n_1, n_2} = F_{9,7(0.05)} = 3.68$

$\begin{pmatrix} v_1 = 10-1 \\ v_2 = 8-1 \end{pmatrix}$

$\because$ Cal F < Tab $F_{9,7(0.05)}$

we may accept H_0 at 5% level of significance

Result :

Since calculated F < tabulated $F_{9,7(0.05)}$ therefore we may accept H_0 at 0.05 Level of significance conclude that two samples have the same variance.

14-11-22

EXPERIMENT - 07

Aim : Testing of significance of population proportion.

Experiment :

(1). In a sample of 1000 people in Maharashtra 540 are rice eaters. Can we assume that the rest wheat eaters and rice eaters are equally popular in the state at 1% LOS.

(2) 20 people were attacked by a disease and only 18 survived. will you reject the hypothesis that the survival rate, if attacked is 85% in favour of hypothesis that if is more at 5% LOS.

Theory :

i) In a sample of size n let x be the no. of persons possessing the given attribute then observed proportion of success $= \frac{x}{n}$

$$\text{So, } \hat{p} = E(p) = \frac{1}{n} E(X)$$

$$V(p) = \frac{p_0 q_0}{n} \qquad \left(\therefore \text{Standard error} = \sqrt{\frac{p_0 q_0}{n}} \right)$$

under $H_0 : p = p_0$
vs $H_0 : p \neq p_0$

$$Z = \frac{\hat{p}_1 - p_2}{\sqrt{\frac{p_0 q_0}{n}}}$$

(ii) To test the H_0, we draw a large sample of size n from the population. Let x be the number of persons or items possessing the attribute then the proportion of attribute in the sample will be $\frac{x}{n}$

for testing H_0 we calculate the test statistic,

$$Z = \frac{x - np_0}{\sqrt{np_0 q_0}} \sim N(0,1)$$

where $q_0 = 1 - p_0$

$$Z = \frac{x}{n} - p_0 \Big/ \sqrt{\frac{p_0 q_0}{n}} = \hat{p} - p_0 \Big/ \sqrt{\frac{p_0 q_0}{n}}$$

Calculation :

1) In a sample $n = 1000$

$\hat{p}$ = proportion of rice eaters

$= \frac{540}{1000} = 0.54$

$p_0 = \frac{1}{2}$, $q_0 = \frac{1}{2}$

$$Z = \frac{0.54 - 0.5}{\sqrt{\frac{(0.5)^2}{1000}}} = \frac{0.04}{0.5} \times 31.622$$

$\underline{Z = 2.529}$

The tabulated value of $Z_{\alpha/2} = Z_{0.005} = 2.575$

$\boxed{Z_{cal} < tab.\ Z_{\alpha/2}}$ at 1% LOS

$\therefore$ we may accept H_0

2) Here we test the null hypothesis

$H_0 : p = p_0 = 85\% = 0.85$

against $H_1 : p > p_0$

given, $n = 20$

$\hat{p}$ = proportion of injected people $= \frac{18}{20} = 0.9$

against $H_1 : p > p_0$

Test statistic, $Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}} = \frac{0.9 - 0.85}{\sqrt{\frac{0.15 \times 0.85}{20}}} = 0.63$

Tabulated value of $Z_\alpha = Z_{0.05} = 1.645$

$\therefore$ $\boxed{Cal\ Z < tab\ Z_{0.05}}$

$\therefore$ we may accept H_0

Result :

i) Since the Z_{cal} < tab $Z_{\alpha/2}$ at 1% LOS. ∴

we may accept H_0 and conclude that the wheat eaters & rice eacters are equally popular in the state.

ii) Since the Z_{cal} < tab $Z_{0.05}$ ∴ the Null hypothesis maybe accepted and hence we conclude that the survival rate is 85%