MASIHULLA - (1604-21-748-054) AIML

MATHS ASSIGNMENT -

(1) Define Null Hypothesis and Alternative Hypothesis.

Ans:-

Null Hypothesis: The hypothesis formulated for the purpose of ~~the~~ it's rejection under the assumption that it is true is called null hypothesis.

→ It is denoted by H_0.

Alternative Hypothesis: Any hypothesis which is complementary to the null hypothesis is called an alternative hypothesis.

→ It is denoted by H_1.

(2) The values in two random samples are given below

Sample 1	15	25	16	20	22	24	21	17	19	23		
Sample 2	35	31	25	38	26	29	32	34	33	27	29	31

Can we conclude that the two samples are drawn from the same population? Test at 5% level of significance.

Sol:- Let,

Sample 1 = x

Sample 2 = y.

$(x)\ n = 10$

n for $y = 12$.

So, $\bar{x} = \frac{\Sigma x}{n} = \frac{202}{10} = 20.2$

$\bar{y} = \frac{\Sigma y}{n} = \frac{370}{12} = 30.833$

x	$x-\bar{x}$	$(x-\bar{x})^2$	y	$y-\bar{y}$	$(y-\bar{y})^2$
15	-5.2	27.04	35	4.1667	17.3613
25	4.8	23.04	31	0.1667	0.0277
16	-4.2	17.64	25	-5.8333	34.0273
20	-0.2	0.04	38	7.1667	51.3615
22	1.8	3.24	26	-4.8333	23.3607
24	3.8	14.44	29	-1.8333	3.3609
21	0.8	0.64	32	1.1667	1.3611
17	-3.2	10.24	34	3.1667	10.0279
19	-1.2	1.44	33	2.1667	4.6945
23	2.8	7.84	27	-3.8333	14.6941
			29	-1.8333	3.3609
			31	0.1667	0.0277
202	0	105.6	370	0	163.6656

$$S_1^2 = \frac{\Sigma(x-\bar{x})^2}{n_1-1} = \frac{105.6}{9} = \underline{11.7333}.$$

$$S_2^2 = \frac{\Sigma(y-\bar{y})^2}{n_2-1} = \frac{163.6656}{11} = \underline{14.87869}.$$

$$F_{cal} = \frac{S_2^2}{S_1^2} = \frac{14.8786}{11.7333} = \underline{1.2680}.$$

$$F_{tab} = \underline{3.07}.$$

$\therefore$ As, $F_{tab} > F_{cal}$ so we can conclude that population have same variance.

(3) A dice is thrown 102 times and the following distribution is obtained:

x	1	2	3	4	5	6
f	15	25	16	20	12	14

Can we conclude that all faces are equally likely to occur? Test at 5% level of significance (given χ^2 at 5% = 11.07).

Sol:-

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

$$\chi^2 = \frac{(1-15)^2}{15} + \frac{(2-25)^2}{25} + \frac{(3-16)^2}{16} + \frac{(4-20)^2}{20} + \frac{(5-12)^2}{12} + \frac{(6-14)^2}{14}$$

$$= \frac{196}{15} + \frac{529}{25} + \frac{169}{16} + \frac{256}{20} + \frac{49}{12} + \frac{64}{14} = 66.2459$$

The table value = 11.07

as, $\chi^2_{cal} > \chi^2_{tab}$ i.e, we doesn't accept H_0 & we conclude that all face are unequally likely to occur.

A random sample of 10 boys had the IQ's 70, 120, 110, 101, 88, 83, 95, 98, 107 & 100. Do these data support the assumption of a population mean IQ of 160? Test at 5% level of significance.

Sol:- Given, $\mu = 160$, $n = 10$

$$t = \frac{\bar{x} - \mu}{\left(\frac{s}{\sqrt{n}}\right)} \qquad \bar{x} = \frac{972}{10} = 97.2.$$

x	$(x - \bar{x})$	$(x - \bar{x})^2$
70	-27.2	739.84
120	22.8	519.84
110	12.8	163.84
101	3.8	14.44
88	-9.2	84.64
83	-14.2	201.64
95	-2.2	4.84
98	0.8	0.64
107	9.8	96.04
100	2.8	7.84
$\Sigma x = 972$	$\Sigma(x - \bar{x}) = 0$	$\Sigma(x - \bar{x})^2 = 1833.6$

$$s = \sqrt{\frac{(x - \bar{x})^2}{n-1}} = \sqrt{\frac{1833.6}{9}} \Rightarrow \underline{s = 14.2735}.$$

$$t_{cal} = \frac{\bar{x} - \mu}{\left(\frac{s}{\sqrt{n}}\right)} = \frac{97.2 - 160}{\left(\frac{14.2735}{\sqrt{10}}\right)} = \frac{-62.8}{4.5136} = 13.9135$$

$t_{tab} = 1.833$

$t_{cal} > t_{tab}$

we conclude that the IQ's of boys cannot be equal to 160.

(5) Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favor of proposal. Test the hypothesis that proportions of men & women in favour of proposal are same at 5% level of significance.

Sol:- Given,

sample size $n_1 = 400$

$n_2 = 600$

Proportion of men $P_1 = \frac{200}{400} = 0.5$

Proportion of women $P_2 = \frac{325}{600} = 0.541$

$$P = \frac{n_1 P_1 + n_2 P_2}{n_1 + n_2} = \frac{(400)(0.5) + (600)(0.541)}{1000}$$

$$\boxed{P = 0.5246}$$

(1) Null hypothesis:

H_0: Assume that there is no significant difference b/w the option of men & women as far as proposal of flyover is concerned.

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i.e, $H_0 : P_1 = P_2 = P$.

(2) The Alternative hypothesis $H_1 : P_1 \neq P_2$

(3) The test significance $Z = \dfrac{P_1 - P_2}{\sqrt{PQ\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$

where,

$$P = \frac{n_1P_1 + n_2P_2}{n_1+n_2} \quad q = 1-P.$$

$\therefore Q = 1-P = 1.05246 = 0.475$

$$\therefore Z = \frac{P_1-P_2}{\sqrt{PQ\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = \frac{0.5-0.541}{\sqrt{(0.545)(0.475)\left(\frac{1}{400}+\frac{1}{600}\right)}} = -1.247$$

$\therefore |Z| = 1.247 < 1.96$ we accept H_0 & conclude that there is no significant difference b/w the option of men & women as far as proposal of flyover is concerned.