Assignment No:- 5

Name:- Ayush Kumar
Roll No:- 03014803120
group:- 4I2

① Ans:- H0 : There is no significant diff. b/w $\bar{x}$ & μ.
H1: statement is false

$$|z| = \left|\frac{\bar{x}-\mu}{\sigma/\sqrt{n}}\right| = \left|\frac{6.75-6.8}{1.5/\sqrt{400}}\right|$$

$$= \left|\frac{-0.05}{1.5/20}\right| = \left|\frac{-1}{1.5}\right| \simeq +0.67$$

$|z| = 0.67 < 1.96$ at 5% significant level. so H0 is accepted
i.e. there is no significant difference b/w $\bar{x}$ & μ.

② Ans. $\bar{x}_1 = 67.5$, $\bar{x}_2 = 68$ $n_1 = 1000$, $n_2 = 2000$

Step 1:.
Null Hypothesis (H0) : $\mu_1 = \mu_2$ Alternative Hypothesis
$(H_\infty) = \mu_1 \neq \mu_2$

Test static :- $\bar{x}_1 - \bar{x}_2 = 67.5 - 68.0 = -0.5$

since s.d. of the population is known

$$S.E.S = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

$$= \sigma\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} = \sqrt{\frac{1}{1000} + \frac{1}{2000}}$$

$$= 0.097$$

$$\therefore z = \frac{\bar{x}_1 - \bar{x}_2}{s} = \frac{-0.5}{0.097} = -5.15$$

$$|z| = 5.15$$

level of significance $\alpha = 0.27\%$

critical value
The value of z_α at 0.27% level of significance from table n 3
since the computed value of $|z| = 5.15$ is greater than critical
value $z_\alpha = 3$ the hypothesis is rejected

$\therefore$ The sample cannot be regarded as drawn from same population

③ Ans: The following null & alternative hypothesis need to be tested

H0 : $\mu = 0.700$
H1 : $\mu \neq 0.700$

This corresponds to a two tailed test for which a t-test for one mean, with unknown population standard deviation, using the sample standard deviation, will be used

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} = \frac{0.742 - 0.700}{0.040/\sqrt{10}} \simeq 3.3204$$

So yes the work is inferior

4) Ans:-

Nine items of a sample - 45, 47, 50, 52, 48, 47, 49, 53, 51

$$\text{Mean} = \frac{(\text{sum of observation})}{\text{Total no. of observation}}$$

$$= \frac{45+47+50+52+48+47+49+53+51}{9}$$

$$= 442/9 = 49.11$$

Assumed mean = 47.5

The ~~mean~~ difference

= Mean − assumed normal mean

= 49.11 − 47.5

= 1.61

Thus, both the mean differ significanny by 1.61

5) Ans: Here $n_1 = 200$, $n_2 = 100$

$$p_1 = \frac{x_1}{n_1} = \frac{46}{200},\ n_2 = \frac{19}{100}$$

P = proportion of premium tea brand in population = 0.1

Q = 1 − P = 0.99

Null hypothesis ; Ho ; The manufacturer claim is accepted

Alternative Hypothesis H1 : $P \neq 0.1$

under Ho,
$$z = \frac{p_1 - p_2}{\sqrt{PQ\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} = \frac{0.04}{\sqrt{0.01 \times 0.99 \times \frac{3}{200}}} = 26.9$$

conclusion; since the calculated value of $|z| > 1.645$ & also $|z| > 2.33$.

Hence Ho is rejected 5% and 1% level of significance

6) Ans X² test

Ho: the experimental results support the theory

Ha: the experimental results do not support the theory

(6) Ans:- Null Hypothesis Ho: The experimental result support the theory i.e. there is no significant difference b/w the observed and theoretical frequency under Ho, the theoretical frequency

$$E(A) = \frac{1600 \times 9}{16} = 300, \quad E(B) = \frac{1600 \times 3}{16} = 300$$

$$E(C) = \frac{1600 \times 3}{16} = 300, \quad E(D) = \frac{1600 \times 1}{16} = 100.$$

Observed frequency O_i	882	313	287	118
Expected frequency E_i	900	300	300	100
$\frac{(O_i - E_i)^2}{E_i}$	0.36	0.5633	0.5633	3.24

$$\chi^2 = \frac{\sum (O_i - E_i)^2}{E_i} = 4.7266$$

Conclusion: Table value of χ^2 at 5% level of significance for 3 d.f is 7.815. Since the calculated value of χ^2 is less than the tabulated value. Hence Ho is accepted i.e. the experimental result supports the theory.

(7) Ans: Null Hypothesis: (Ho) :- $\sigma_x^2 = \sigma_y^2$ (sample are drawn from same population).

Alternate Hypothesis (H1) :- $\sigma_x^2 \neq \sigma_y^2$ (i.e. Samples are not drawn from the same population)

LOS = 5% (two tailed test)

Degree of freedom = $n_1 + n_2 - 2 = 9 + 8 - 2 = 15$.

$m = 9, n = 8$

$\Sigma (x_i - \bar{x})^2 = 160, \Sigma (y_i - \bar{y})^2 = 91$

level of significance

$a = 0.05$

Test statistics

$$F = \frac{S_1^2/\sigma_1^2}{S_2^2/\sigma_2^2} = \frac{S_1^2}{S_2^2} \text{ under Ho}$$

$$S_x^2 = \frac{1}{m-1} \Sigma (x_i - \bar{x})^2 = \frac{160}{8} = 20.$$

$$S_y^2 = \frac{1}{n-1} \Sigma (y_i - \bar{y})^2 = \frac{91}{7} = 13.$$

$$F_0 = \frac{S_x^2}{S_y^2} = \frac{20}{13} = 1.54$$

Step 6: critical value
Since H_1 is a two sided alternative hypothesis the corresponding critical values are:
critical value for 15 degree of freedom = ± 2.1314

Since $f_{(8.7)0.95} = -2.314 < F_0 = 1.54 < f_{(8.7)0.05} = 2.1314$
the null hypothesis is not rejected and we conclude that samples are drawn from same population.

(8) Ans:- Null Hypothesis H_0: The data are consistent with the hypothesis of equal.
Probability for male and female births i.e. $p = q = \frac{1}{2}$.
We use binomial distribution to calculate theoretical frequency

$$N(r) = N \times {}^{n}C_r\, p^r q^{n-r}$$

where N is total frequency, N(r) is the number of family with r male children, P & q are possibilites of male and female birth respectively, n is the no. of children.

$$N(0) = 800 \times {}^4C_0 \left(\tfrac{1}{2}\right)^4 = 50,\ N(1) = 200,\ N(2) = 300,$$
$$N(3) = 200,\ N(4) = 50$$

Observed frequency O_i	32	178	290	236	64
Expected frequency E_i	50	200	300	200	50
$(O_i - E_i)^2$	324	484	100	1296	196
$\frac{(O_i - E_i)^2}{E_i}$	6.48	2.42	0.333	6.48	3.92

$$\chi^2 = \Sigma\left[\frac{(O_i - E_i)^2}{E_i}\right] = 19.633$$

Tabulated value of χ^2 at 5% level of significance for $5-1 = 4$ degrees of freedom $= 9.49$.

Conclusion: since the calculated value of χ^2 is greater than tabulated value, H_0 is rejected i.e. the data are not consistent with the hypothesis that the binomial law holds & that the chance of a male birth is not equal of that of a female birth.