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Final Assignment-03

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Section: O

10.2/ We need to test $H_0 : P_1 = P_2 = P_3 = P_4$ vs H_1: At least one of them doesn't hold test static.

Test static,

$$\chi^2 = \sum \frac{O_i^2}{E_i} - n$$

$$E_i = \frac{n}{K} = \frac{206}{4} = 51.5$$

$$= \frac{\{(50)^2 + (42)^2 + (32)^2 + (82)^2\}}{51.5} - 206$$

$$= 27.25$$

Since, $\chi^2 > \chi^2_{(K-1)=3}$, So, H_0 is not accepted. Hence, the propotions of road accidents in various highways of Bangladesh is not similar.

10.4// We need to test $H_0: P_1 = P_2 = P_3 = P_4$ vs H_1: at least one of the female student doesn't hold the test static.

Test static,

$$\chi^2 = \sum \frac{O_i^2}{E_i} - n$$

$E_i = \frac{n}{k}$

$= \frac{1000}{4}$

$= 250$

$$= \frac{\{(250)^2 + (450)^2 + (150)^2 + (150)^2\}}{250} - 1000$$

$$= 240$$

$\therefore$ Since, $\chi^2 > \chi^2_{(k-1)=3} = \chi^2_3 = 7.815$, H_0 is not accepted.

Hence, the propotions of female students in varians department is not similar.

10.5// Let, $x \sim N(\mu, \sigma^2)$, σ^2 is unknown

We need to test, $H_0: \mu = \mu_0 = 21$ vs $H_1: \mu \neq \mu_0$

$$\therefore \bar{x} = \frac{1}{n} \sum x = \frac{1}{36} \times 761.6 = 21.15$$

$$s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right] = \frac{1}{36-1}\left[16125.5 - \frac{580034.56}{36}\right]$$

$$= 0.39$$

$\therefore s = 0.63$

Test statistic: $$z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{21.15 - 21}{0.63/\sqrt{36}} = 1.42$$

Since, $z < z_{(0,1)}$, so, H_0 is accepted. Hence, we can consider the population mean as 21. (Ans.)

10.7 We need to test, $H_0 : P = P_0 = 0.40$ vs $H_1 = P \neq P_0$

Now, $p = \frac{a}{n} = \frac{8}{25} = 0.32$

$Q_0 = 1 - P_0 = 1 - 0.40 = 0.60$

Test statistic : $|Z| = \left| \frac{p - P_0}{\sqrt{\frac{P_0 Q_0}{n}}} \right|$

$= \left| \frac{0.32 - 0.40}{\sqrt{\frac{0.40 \times 0.60}{25}}} \right|$

$= |-0.81| = 0.81$

Since, $|Z| < 1.96$, H_0 is accepted. It can be considered that 0.40 is the overall proportions of female students in AIUB.

10.9 We need to test $H_0 : P_1 = P_2$ vs $H_1 : P_1 \neq P_2$

Test statistic, $z = \dfrac{p_1 - p_2}{\sqrt{PQ\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \sim N(0, 1)$

$$P = \frac{25 + 18}{100 + 125} = 0.19$$

$$Q = 1 - P = 1 - 0.19 = 0.81$$

$$p_1 = \frac{25}{100} \quad ; \quad p_2 = \frac{18}{125}$$

$$= 0.25 \qquad\qquad = 0.14$$

$$\therefore |z| = \left| \frac{0.25 - 0.14}{\sqrt{(0.19)(0.81)\left(\frac{1}{100} + \frac{1}{125}\right)}} \right|$$

$$= |2.09|$$

$\therefore$ ~~Since, $|z| >$~~

$\therefore$ Since, $|z| > 1.96$, H_0 is rejected. We can consider that the probation problem is not same for boys and girls at AIUB.

10.11 H_0: High blood pressure associated with heart problem

H_1: High blood pressure is not associated with heart problem

Test statistic: $\chi^2 = \dfrac{n(ad-bc)^2}{(a+b)(a+c)(b+d)(c+d)}$

$(a+c) = (150+122) = 272$

$(b+d) = (120+158) = 278$

$(a+b) = (150+120) = 270$

$(c+d) = (122+158) = 280$

$n = 150$

$= \dfrac{150\{(150\times158)-(120\times122)\}^2}{270\times272\times278\times280}$

$= 2.16$

$\therefore \chi^2 < \chi^2_{(k-1)=1} = 3.84$, H_0 is accepted. So, it can be considered as high blood pressure associated with heart problem.

10.12 H_0: Association does exist between origin and full attention

H_1: Association doesn't exist between origin and full attention

Test statistic : $\chi^2 = \dfrac{n(ad-bc)^2}{(a+b)(a+c)(b+d)(c+d)}$

$a+c = 202$

$b+d = 148$

$a+b = 202$

$c+d = 148$

$n = 350$

$ad = 138 \times 84 = 11592$

$bc = 64 \times 64 = 4096$

$$= \frac{350\,(11592 - 4096)^2}{202 \times 202 \times 148 \times 148}$$

$$= 22.00$$

Since, $\chi^2 > \chi^2_{(K-1)=1} = 3.84$, H_0 is not accepted.

Hence, association doesn't exist between origin and full attention.

END