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10.2

Test statistic

$$\chi^2 = \sum \frac{O_i^2}{E_i^2} - n \qquad \left| \; E_i = \frac{n}{n} = \frac{206}{4} \right.$$

$$= \frac{1}{51.5} \times [50^2 \times 42^2 \times 32^2 \times 82^2] = 51.5$$

$$= 27.243$$

~~Decision~~

Since, $\chi^2 > \chi^2_{n-1} = \chi^2 > \chi^2_{4-1} = \chi^2 > \chi^2_3 = 7.815$

Ho is no accepted. The proportion of road accident are not similar in various highways of Bangladesh.

10.4) 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 statistic

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

$$= \frac{1}{150}\left[250^2 + 450^2 + 150^2 + 150^2\right] - 1000$$

$$= 240$$

Since $\chi^2 > \chi^2_{n-1} = \chi^2_3 = 7.815$

H_0 is rejected

Ans.

10.5

Sample size, $n = 36$

$\Sigma x = 761.6$

$\Sigma x^2 = 16125.5$

$\bar{x} = \frac{1}{n}\Sigma x = \frac{1}{36} \times 761.6 = 21.156$

$s^2 = \frac{1}{n-1}\left[\{x^2 - \frac{(\Sigma x)^2}{n}\}\right]$

$= \frac{1}{36-1} \times \left[16125 - \frac{(761.6)^2}{36}\right]$

$= 0.384$

$\Rightarrow s = \sqrt{0.384} = 0.6197$

$Z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} \sim N(0,1)$

$= \frac{21.156 - 21}{0.6197/\sqrt{36}}$

$= 1.5104$

$\therefore |Z| < 2$; Ho is accepted

ans.

10.7)

we need to test, $H_0: p = p_0 = 0.40$ vs

$H_1: p \neq p_0$

$p = \frac{q}{n} = \frac{8}{25} = 0.32$

Test statistic $z = \frac{p - p_0}{\sqrt{\frac{p_0 q_0}{n}}}$

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

$= -0.816$

Since $|z| < 1.96$ H_0 is accepted. It can be concluded overall proportion of female student 0.40 in AIUB.

10.7] Here $p_1 = \frac{25}{100} = 0.25$

$p_2 = \frac{18}{125} = 0.144$

$p = \frac{a_1 + a_2}{n_1 + n_2} = \frac{25 + 18}{100 + 125} = 0.191$

$q = 1 - p = 1 - 0.191 = 0.809$

Test statistic $= \frac{p_1 - p_2}{\sqrt{pq\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$

$= \frac{0.25 - 0.144}{\sqrt{0.191 \times 0.809 \times \left(\frac{1}{100} + \frac{1}{125}\right)}}$

$= 2$

Since $|z| > 1.96$, Ho is rejected

at 5%.

10.11

Blood pressure	Heart Problem	
	Yes	No
High	150	120
Not High	122	158

Now, ate = 150 + 122 = 272

a+b = 150+120 = 270

b+d = 120+158 = 278

c+d = 122+158 = 280

Now,

ad = 150×158 = 3700

be = 120×122

n = 150

Test statistic, $x^2 = \frac{n(ad-bc)}{(a+b)(a+c)(b+d)(c+d)}$

$$= \frac{150(23700-14640)^2}{270 \times 272 \times 278 \times 280}$$

$= 2.15$

since, $x^2 < x^2_{n-1}$; 30, H0 is accepted

10.12

Residential origin	Full Attention		Total
	Yes	No	
Rural	138	64	202
urban	64	84	148
total	202	148	350

Test statistic: $\chi^2 = \frac{n(ad-bc)^2}{202 \times 202 \times 148 \times 148}$

$= \frac{350(11592-4026)^2}{202 \times 202 \times 148 \times 148}$

$= 22.12$

Here

$ad = 138 \times 84$

$= 11592$

$bc = 64 \times 64$

$= 4096$

$n = 350$

Since, $\chi^2 > \chi^2_{(2-1)} : 5\%$, H_0 is not accepted