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Serial-16

10.2

Assignment-3

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;

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

Here,  $n = 206$ ;  $K = 4$

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

$$\therefore \chi^2 = \frac{1}{51.5} [(50)^2 + (42)^2 + (32)^2 + (82)^2] - 206$$

$$= 233.243 - 206$$

$$= 27.243$$

Since,  $\chi^2 > \chi_{K-1}^2 = \chi_3^2 = 7.815$ ,  $H_0$  is n't

accepted. Hence, the Proportions of road  
accidents are not similar in  $\rightarrow$

→ Various highways of Bangladesh.

Ans

10.4

We need to test  $H_0: P_1 = P_2 = P_3 = P_4$   
Vs  $H_1$ : At least one of them does  
hold 'Test statistic'.

$$\therefore \chi^2 \leq \frac{O_i^2}{E_i} - n$$

Here,

$$n = 1000, k = 4$$

$$E_i = \frac{n}{k} = \frac{1000}{4} = 250$$

$$\begin{aligned}\therefore \chi^2 &= \frac{1}{250} [(250)^2 + (450)^2 + (150)^2 + (150)^2] - 1000 \\ &= 1240 - 1000 \\ &= 240\end{aligned}$$

Since,  $\chi^2 > \chi^2_{3} = 7.81$ ,  $H_0$  is not accepted.  
Hence, the proportions of female  
students are not similar.

10.5

Let,  $X \sim N(\mu, \sigma^2)$

Let,  $X \sim N(\mu, \sigma^2)$ .  $\sigma$  is unknown.

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

Here,

$$\sum x = 761.6, \sum x^2 = 16125.5 \text{ and } n = 36$$

We know,

if,  $n \geq 30$ , we use test statistic is 'z'.

$$\therefore \text{Test statistic: } Z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

$$\therefore \bar{x} = \frac{1}{n} \sum x$$

$$= \frac{761.6}{36} = 21.16$$

$$\text{and, } s^2 = \frac{1}{n-1} \left[ \sum x^2 - \frac{(\sum x)^2}{n} \right]$$

$$= \frac{1}{35} (16125.5 - 16112.07)$$

$$\Rightarrow s^2 = 0.384$$

$$\therefore s = 0.62$$



Now,

$$\therefore \text{Test statistic; } Z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} \\ = \frac{21.16 - 21}{0.62/\sqrt{36}} \\ = 1.55$$

Since,  $|Z| < 1.96$ , so,  $H_0$  is accepted.

Hence, we can conclude that the population mean can be concluded as 21. Ans,

10.7

Here,

Given, Proportion of female student is 0.40

Total student = 25 (N)

And female students,  $n = 8$

We know, Proportion =  $\frac{n}{N} = \frac{8}{25} = 0.32$

So, the overall Proportion of female student is not 0.40 Ans.

10.9

We need to test  $H_0: P_1 = P_2$

vs  $H_1: P_1 \neq P_2$  test statistic

$$Z = \frac{P_1 - P_2}{\sqrt{PQ \left( \frac{1}{n_1} + \frac{1}{n_2} \right)}} \sim N(0,1)$$

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

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

$$P_1 = \frac{25}{100}; P_2 = \frac{18}{125}$$

$$\begin{aligned} |Z| &= \left| \frac{0.25 - 0.14}{\sqrt{(0.18)(0.81) \left( \frac{1}{100} + \frac{1}{125} \right)}} \right| \\ &= |2.09| \end{aligned}$$

Since,  $|Z| > 1.96$ ,  $H_0$  is rejected. we

can consider that Probation Problem  
is not same for boys and  
girls at A.I.U.B.

10.11

$H_0$ : Heart Problem doesn't depend on high blood pressure.

$H_1$ : High blood pressure and heart Problem are associated.

$$\begin{aligned}\therefore \text{Total statistic: } X^2 &= \frac{n(ad - bc)^2}{(a+b)(a+c)(b+d)(c+d)} \\ &= \frac{550(150 \times 158 - 120 \times 122)^2}{(150+120)(150+122)(120+158)(122+158)} \\ &= \frac{550 \times 82083600}{270 \times 172 \times 178 \times 186}\end{aligned}$$

$$\therefore X^2 = 30.34$$

$\therefore X^2 > X_{\alpha} = 30.34 > 3.84$ .  $H_0$  is rejected.

So, heart Problem ~~be~~ depends on high blood pressure. Ans



10.12

$H_0$ : Origin and full attention doesn't depend on the residential.

$H_1$ : origin and full attention depends on residential.

Residential Origin	Full attention		Total
	Yes	No	
Rural	116.59	85.42	202
Urban	85.42	62.58	148
Total	202	148	350

$$\therefore \text{Total statistic: } \chi^2 = \sum \sum \frac{O_{ij}^2}{E_{ij}} - n$$

$$\text{Hence, } E_{11} = \frac{R_{1.} \cdot C_{.1}}{n} = \frac{202 \times 202}{350} = 116.59$$

Now,

$$\text{Test Statistic: } X^2 = \frac{(138)^2}{116.59} + \frac{(84)^2}{62.58} - 350$$

$$= -73.91$$

$= -73.91$  [chi-square Value  
can't be negative]

Since,  $X^2 > X_{\alpha}^2 = 3.841$ ,  $H_0$  is rejected.

Hence, the origin and a full attention  
depends on residential.

Ans