

(a) A car company believes that the percentage of residents in city ABC that own a vehicle is 60% or less. A sales manager disagrees with this. He conducts a hypothesis testing surveying 250 residents and found that 170 responded yes to owning a vehicle.

(a) State the Null ( $H_0$ ) &  $H_1$ .

(b) At 10% significance level, ie there enough evidence to support the idea that vehicle ownership in city ABC is 60% or less?

$$\text{Ans) } H_0 = 60\% \text{ ; } H_1 \neq 60\% , n=250, x=170$$

$$P \Rightarrow \frac{x}{n} \Rightarrow \frac{170}{250} \Rightarrow 0.68$$

It is one-tail Z-test

$$\alpha_0 = 1 - P_0$$

$$\Rightarrow 1 - 0.6 \Rightarrow 0.4$$

$$\alpha = 0.10$$

$$\Rightarrow 1 - 0.10 \Rightarrow 0.90$$

0.90 from Z-table  $\Rightarrow 1.29$

Z-test with proportion:  $\frac{P - P_0}{\sqrt{\frac{P_0(1-P_0)}{n}}}$

$$\Rightarrow \frac{0.68 - 0.6}{\sqrt{\frac{0.6 \times 0.4}{250}}} \Rightarrow 2.58$$

$$2.58 > -1.29$$

Accept

~~Reject~~ the Null hypothesis. The evidence is good enough to conclude that the sales manager's disagreement is ~~not~~ incorrect.

Q) How many XL and L T-shirt you need to order

500 Data  $\rightarrow$  300 XL, 200 L

Random  
95% C.I.

(a)  $n = 500, x = 300$  for XL  
Population Proportion  $\Rightarrow \hat{P}_1 \Rightarrow \frac{x}{n}$

$$\Rightarrow \frac{300}{500} \Rightarrow 0.6$$

C.I. = 95%

$$\alpha = 0.05$$

$$\hat{q}_1 \Rightarrow 1 - \hat{P}_1 \Rightarrow 1 - 0.6 \Rightarrow 0.4$$

$$Z_{\alpha/2} \Rightarrow 0.025$$

$$\Rightarrow 1 - 0.025 \Rightarrow 0.975$$

0.975 from Z-table  $\Rightarrow 1.96$

Margin of error  $\Rightarrow Z_{\alpha/2} \sqrt{\frac{\hat{P}_1 \hat{q}_1}{n}}$

$$\Rightarrow 1.96 \times \sqrt{\frac{0.6 \times 0.4}{500}} \Rightarrow 0.043$$

XL T-shirts with 95% C.I.

$$\Rightarrow \bar{x} \pm 0.043$$

$$\Rightarrow 0.6 \pm 0.043$$

Upper limit  $\Rightarrow 0.6 + 0.043 \Rightarrow 0.643 \Rightarrow 64.3\%$

Lower limit  $\Rightarrow 0.6 - 0.043 \Rightarrow 0.557 \Rightarrow 55.7\%$

~~0.63~~  $\Rightarrow$  We can order XL t-shirts in the range of 55.7% to 64.3%.

For L-size T-shirts:-

Lower limit  $\Rightarrow 100 - 64.3 \Rightarrow 35.7\%$

Upper limit  $\Rightarrow 100 - 55.7 \Rightarrow 44.3\%$

We can order L-t-shirts range b/w 35.7% to 44.3%