

- ① In a company there are 100k employees. If the company wants to give T-shirts to all of the employees, then on Average how many XL and L size T-shirts have to buy,

For Sample Size of 500 employees 300 of them are for XL and 200 are for L size. Calculate with 95% CI.

Ans Sample Size (n) = 500

For XL - size $X = 300$

$$\therefore \hat{p} = \frac{X}{n} = \frac{300}{500} = 0.6 = 60\%$$

$$\hat{q} = \frac{500 - 300}{500} = \frac{200}{500} = 0.4 = 40\%$$

$$\alpha = .05$$

$$\frac{\alpha}{2} = .025 \quad \therefore Z_{\alpha/2} = 1.96$$

The interval range

$$\hat{p} \pm Z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$\hat{p} = 0.6, \hat{q} = 0.4, n = 500, z_{\alpha/2} = 1.96$$

upper bound

$$\hat{p} + z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$= 0.6 + 1.96 \sqrt{\frac{0.6 \times 0.4}{500}}$$

$$= 0.64$$

$$= 64\%$$

Lower bound

$$\hat{p} - z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$= 0.6 - 1.96 \sqrt{\frac{0.6 \times 0.4}{500}}$$

$$= 0.56 = 56\%$$

we can say with 95% confidence that the percentage of employees who needs XL-Size T-shirts are the range of 56% to 64%.

For L-Size

$$\hat{p} = \frac{200}{500} = 40\% = .4$$

$$\hat{q} = \frac{300}{500} = 60\% = .6$$

$$z_{\alpha/2} = 1.96, \quad n = 500$$

upper bound

$$\hat{p} + z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$= .4 + 1.96 \sqrt{\frac{.4 \times .6}{500}}$$

$$= .44$$

$$= 44\%$$

Lower bound

$$\hat{p} - z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$= .4 - 1.96 \sqrt{\frac{.4 \times .6}{500}}$$

$$= .36$$

$$= 36\%$$

So with 95% confidence we can say that
36% to 44% of employees needs
L Size T-shirts.

(2) A car company believes that the percentage of residents in city ABC that owns a vehicle is 60% or less. A sales manager disagrees with this. He conducts a hypothesis testing surveying that ~~1250~~²⁵⁰ residents and found that 170 responded yes to owning a vehicle.

(a) State the null and alternate hypothesis.

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

Ans :-

$H_0 = \text{proportion} \leq 60\%$

$H_a = \text{proportion} > 60\%$

This is one tail test.

$$P_0 = 60\% = .6$$

$$q_0 = 1 - .6 = .4 = 40\%$$

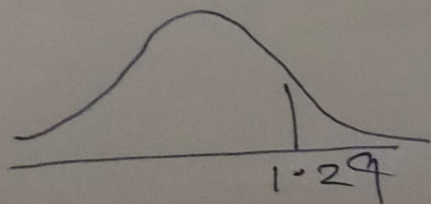
$$n = 250, \quad x = 170$$

$$\therefore \hat{p} = \frac{170}{250} = .68$$

$$\alpha = 10\% = .1$$

$$\therefore (1 - .1) = .9$$

from z table $z_{\alpha} = 1.29$



$$\therefore z_{\text{test}} = \frac{\hat{p} - P_0}{\sqrt{\frac{P_0 q_0}{n}}}$$

$$= \frac{.68 - .6}{\sqrt{\frac{.6 \times .4}{250}}} = 2.582$$

$2.582 > 1.29$, so it is in rejected area.

So we have to reject the null hypothesis.