07/03/22 Assignment 3 (Inferential statistics).

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Q1 On the quant test of ~~CAT~~ exam, a population standard deviation is known to be 100. A sample of 25 test takers has a mean of 520. Construct a 80% C.I about the mean.

Solution

population standard deviation, $\sigma = 100$

Sample size, $n = 25$

Sample mean, $\bar{x} = 520$

$C.I = 80\%$

Using Z test, $\alpha = 1 - 0.80 = 0.2$

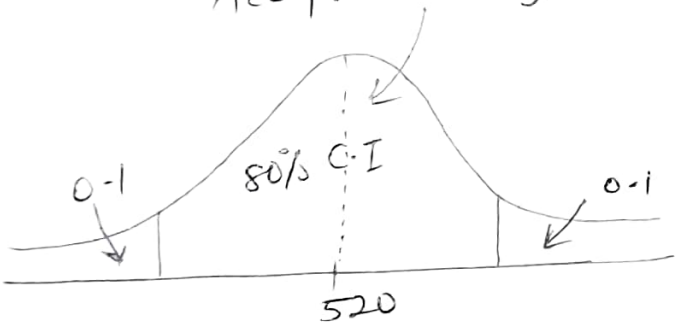
$Z_{\alpha/2} = Z_{0.2/2} = Z_{0.1}$

$= 1 - 0.1 = 0.90$

$Z_{\alpha/2} = 1.29$ [from Z-test table]

C.I = Point Estimate $\pm$ margin of error.

Accept null hypothesis



lower fence $= \bar{x} - Z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$

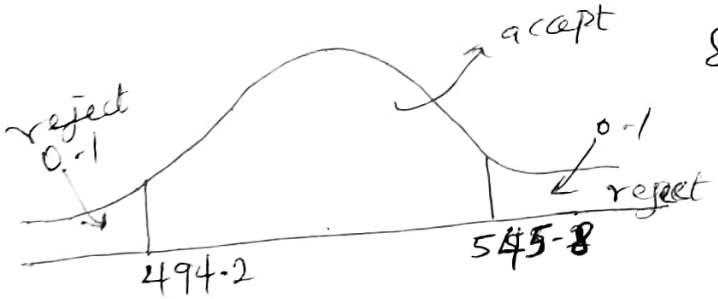
$= 520 - \left(1.29 \times \frac{100}{\sqrt{25}}\right)$

lower fence $= 520 - 25.8 = 494.2$

Upper Fence $= \bar{x} + Z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$

$= 520 + \left(1.29 + \frac{100}{\sqrt{25}}\right)$

Upper fence $= 520 + 25.8 = 545.8$



Since the observed/sample mean falls within C.I, accept null hypothesis.

(2) A Data Analyst Company where there are 100,000 employees. HR2 want to order some amount of t-shirt for the employees. How many XL and L-tshirts you need to order. Construct 95% C.I.

Assumptions – Hypothesis: Taken Sample size 500, and 300 will wear XL t-shirts, 200 wear L-tshirt

Take Sample size of 500 employees.

$n = 500$

Sample mean, $\bar{x} = 6240$

population Standard deviation, $\sigma = 900$

C.I 95%

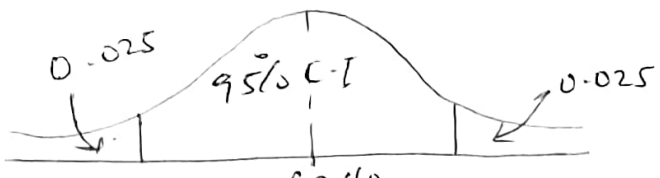
Z-test is used for testing because $n \geq 30$.

$$\text{Lower fence} = \bar{x} - Z_{\alpha/2}\left(\sigma/\sqrt{n}\right)$$

$$Z_{\alpha/2} = Z_{0.05/2} = Z_{0.025}$$

$$1 - 0.025 = 0.975$$

$$Z_{\alpha/2} = 1.96$$



$$\text{Lower fence} = 6240 - \left(1.96 \times \frac{90}{\sqrt{50}}\right)$$

$$L.F = 6240 - (1.96 \times 40.25)$$

$$L.F = 6240 - (78.89)$$

$$\text{Lower fence} = 6,161.11.$$

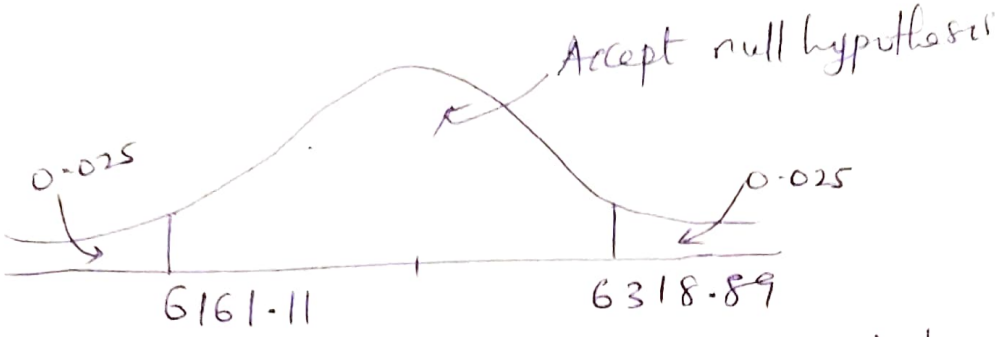
$$\text{Upper fence} = \bar{x} + Z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)$$

$$= 6240 + \left(1.96 \times \frac{900}{\sqrt{500}}\right)$$

$$= 6240 + 78.89 = 6318.89$$

$$\text{Upper fence} = 6318.89.$$

(2) Contd.



Justification: If different samples are taken and the population mean is calculated, this means that 95% of cases, the population mean should fall between 6161.11 and 6318.89.

Now from the sample size 500 from which 300 will wear XL t-shirts and 200 will wear L-tsh

So the mean falls within the C.I, then accept null hypothesis. Also projecting to the whole population, we can conclude that we will order 60,000 XL and 40,000 L - Tshirts.