

STATISTICS ASSIGNMENT

Que 1:- plot a histogram.

10, 13, 18, 22, 27, 32, 38, 40, 45, 51, 56, 57, 88, 90, 92, 94, 99.

Que 2:- In a Quant test of the CAT exam, the population standard deviation is known to be 100. A sample of 25 test taken has a mean of 520. Construct an 80% CI about the mean.

Que 3:- A car^{company} believes that the percentage of citizens in city ABC that owns a vehicle is 60% or less. A sales manager disagrees with this. He conducted a hypothesis testing surveying 250 residents & found that 170 residents responded Yes to owning a vehicle.

(a) state the null & alternate hypothesis.

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

Que 4:- What is the value of the 99 percentile?

2, 2, 3, 4, 5, 5, 5, 6, 7, 8, 8, 8, 8, 8, 9, 9, 10, 11, 11, 12.

Que 5:- In left and right - Skewed data, what is the relationship b/w Mean, Median & Mode? Draw the graph to represent the same.

Solutions:-

1st Sol:- Given

{ 10, 13, 18, 22, 27, 32, 38, 40, 45, 51, 56, 57, 88, 90, 92, 94, 99 }

Lets Consider Bins = 5.

$$\Rightarrow \text{Bin size} = \frac{100}{5} = 20.$$

\therefore No. of Bins = 5 ; Bin Size = 20.

Given data is already in Ascending order.

Histogram:-

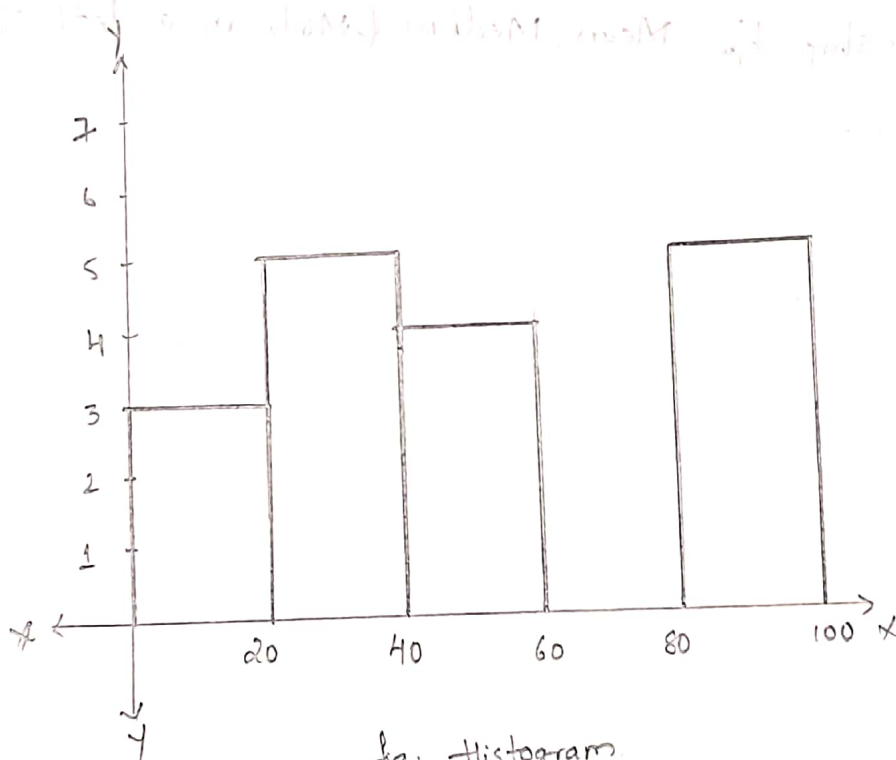


fig:- Histogram.

4th Sol:- Given

2, 2, 3, 4, 5, 5, 5, 6, 7, 8, 8, 8, 8, 8, 9, 9, 10, 11, 11, 12.

99 percentile = ?

Let us consider 99 percentile = x .

then we have

$$x = \frac{\text{Percentile}}{100} \times (n+1)$$

$$\Rightarrow x = \frac{99}{100} \times (20+1) \quad [n=20]$$

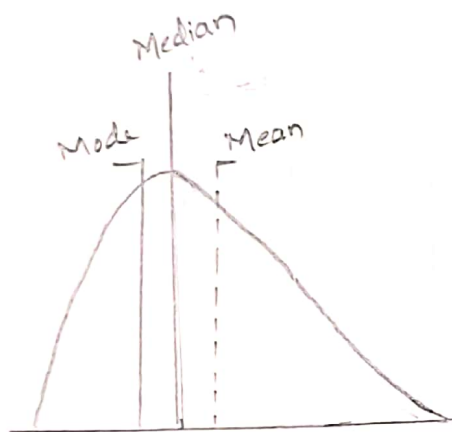
$$\Rightarrow \frac{99}{100} \times 21$$

$$\Rightarrow 20.79 \Rightarrow \text{Index}$$

from given data the value of 20.79 index is 12

$$\therefore \boxed{99\text{ percentile} = 12}$$

5 Sol:- Relationship b/w Mean, Median & Mode in a left skewed & right skewed data:-



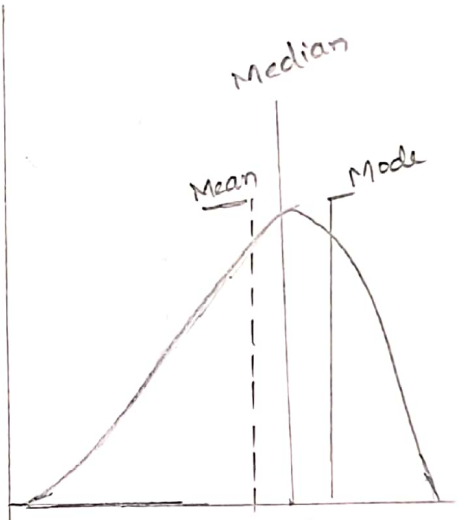
Positive skew
(or)
Right skewed

Eg:- Wealth distribution



Symmetrical
(or)
Normal
distribution

Eg:- Age,
Weight



Negative sk.
(or)
left skewed

Eg:- Life span of
human.

Relationship b/w Mean, Median & Mode.

$$\text{Mean} > \text{Median} > \text{Mode};$$

$$\text{Mean} \approx \text{Median} \approx \text{Mode};$$

$$\text{Mode} > \text{Median} > \text{Mean}.$$

Q Sol₁ - Given $\sigma = 100$; $n = 25$; $\bar{x} = 520$.

Construct 80% C.I about the mean.

\Rightarrow point estimate \pm Margin of error.

$$\Rightarrow \boxed{\bar{x} \pm Z_{\frac{\alpha}{2}} \left(\frac{\sigma}{\sqrt{n}} \right)}$$

$$\left[\text{Where } \alpha = 1 - \text{C.I.} \right. \\ \left. = 1 - 0.80 \right. \\ \left. = 0.20 \right] \quad \left| \quad Z_{\frac{\alpha}{2}} = Z_{0.20} \right. \\ \left. = Z_{0.10} \right. \\ \left. \text{from Z-table} \right. \\ \left. Z_{0.10} = 1.29 \right.$$

Now:-

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

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

$$= 520 - 1.29 \left(\frac{100}{5} \right)$$

$$= 520 - 1.29(20)$$

$$= 520 - 25.8$$

$$\text{L.F} = \underline{\underline{494.2}}$$

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

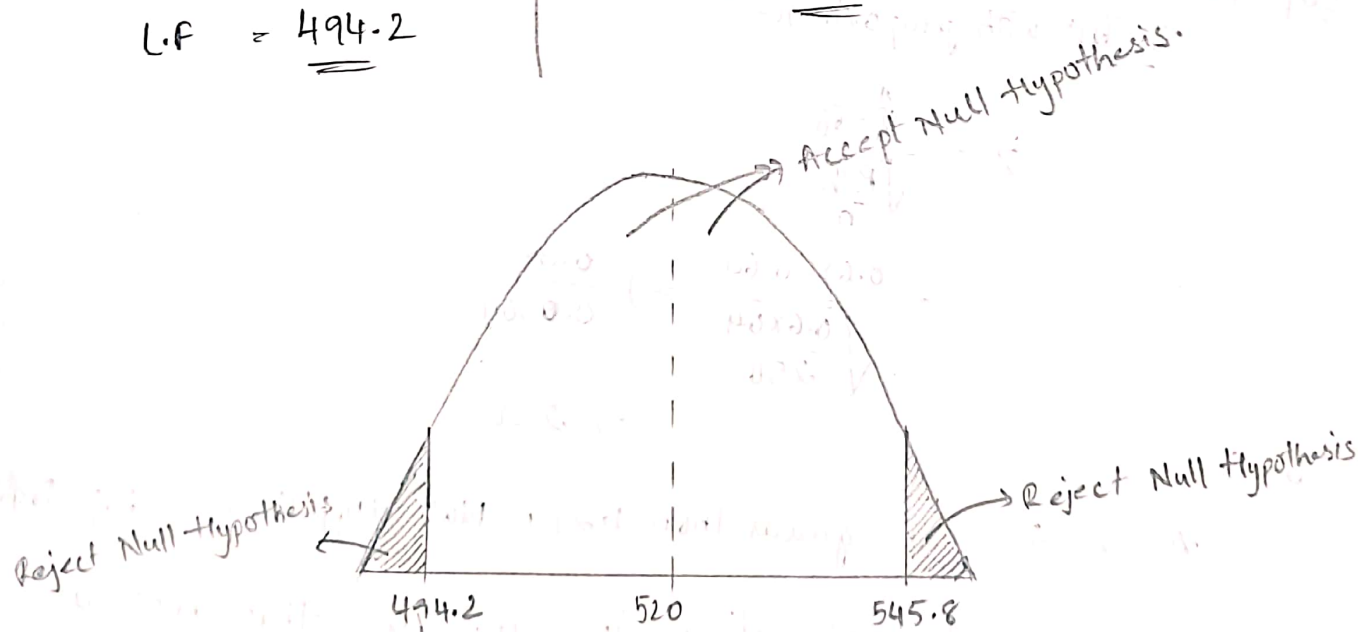
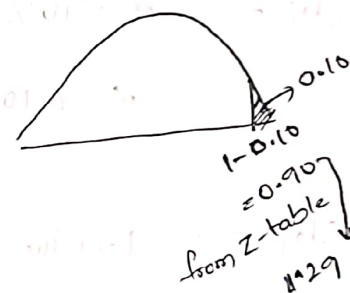
$$= 520 + 1.29 \left(\frac{100}{\sqrt{25}} \right)$$

$$= 520 + 1.29 \left(\frac{100}{5} \right)$$

$$= 520 + 1.29(20)$$

$$= 520 + 25.8$$

$$\text{H.F} = \underline{\underline{545.8}}$$



3rd Sol.:- Given:- $P_0 = 60\% = 0.6$; $q_0 = 1 - P_0 = 1 - 0.6$; $x = 170$; $n = 250$

$$\hat{p} = \frac{x}{n} = \frac{170}{250}$$

$$q_0 = 0.4.$$

$$\hat{p} = 0.68$$

Step 1 $H_0 = P_0 \leq 60\%$ [Null Hypothesis]

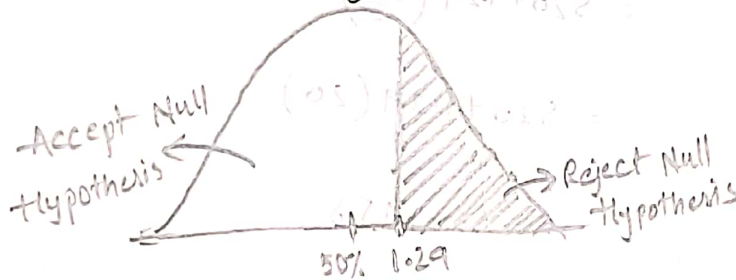
$H_1 = P_1 > 60\%$ [Alternate Hypothesis]

Step 2:- $\alpha = 10\%$ (significance)

$$\alpha = 0.10$$

[1 tail test]

Step 3:- Decision Boundary:-



$$\alpha = 1 - C.I$$

$$C.I = 1 - 0.10$$

$$C.I = 0.90$$

from Z-table

$$1.29$$

Step 4:- Z-test with proportion:-

$$Z = \frac{\hat{p} - P_0}{\sqrt{\frac{P_0 q_0}{n}}}$$

$$= \frac{0.68 - 0.60}{\sqrt{\frac{0.6 \times 0.4}{250}}} \Rightarrow \frac{0.08}{0.0309}$$

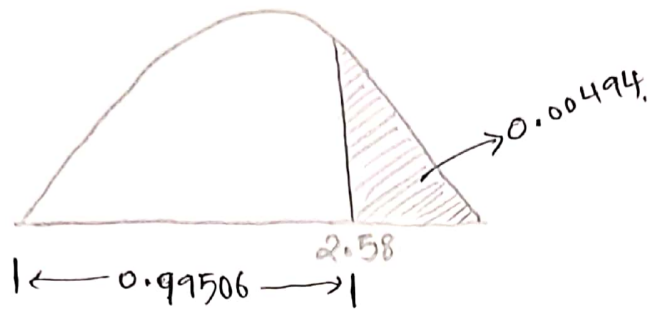
$$\Rightarrow 2.58$$

Step 5:-

As $Z = 2.58$ is greater than 1.29, Null hypothesis is Rejected.

\therefore The percentage of citizens in city ABC that owns a vehicle is greater than 60%.

P-value,



$$1 - 0.99506$$

$$= 0.00494$$

$$P \text{ value} = 0.00494 \quad [\because \text{1 tail test}]$$

$$\therefore P \text{ value} < \text{Significance value} \Rightarrow [0.00494 < 0.10]$$

\therefore Reject Null Hypothesis.

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