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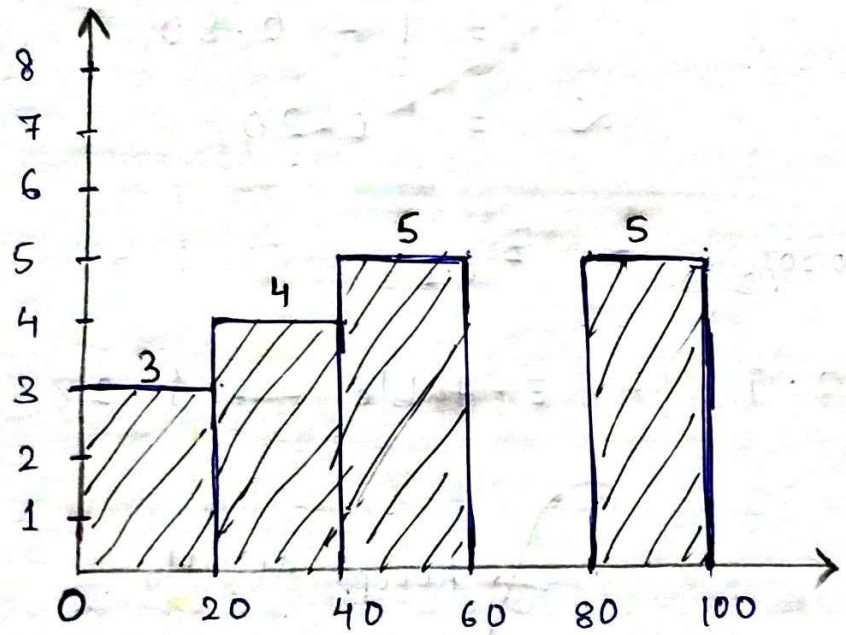
FSDA (Statistics Assignment)

Ques 1) Plot a histogram,

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

Soln) Let, No. of bins = 5

$\therefore$ Bins size = $\frac{100}{5} = 20$



Class Intervals → (i) 0 - 20 → 10, 13, 18

(ii) 20 - 40 → 22, 27, 32, 38

iii) 40 - 60 → 40, 45, 51, 56, 57

iv) 60 - 80 → Null

v) 80 - 100 → 88, 90, 92, 94, 99

Ques 2) In a quant test of the CAT Exam, the population standard deviation is known to be 100. A sample of 25 tests taken has a mean of 520. Construct an 80% C.I about the mean.

Sol:) Standard deviation $(\sigma) = 100$

No. of sample $(n) = 25$

Sample mean $(\bar{x}) = 520$

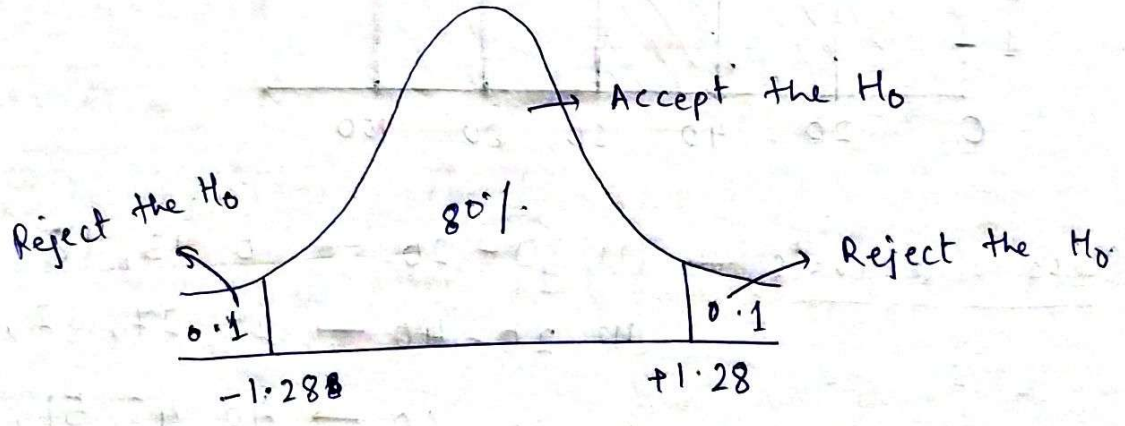
Significance value $(\alpha) = 1 - C.I$

$= 1 - 0.80$

$\alpha = 0.20$

$Z_{\alpha/2} = Z_{0.20/2} = Z_{0.1}$

$1 - 0.1 = 0.9 \rightarrow$ z-table $\rightarrow 1.28$



Now, Lower fence $= \bar{x} - Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

$= 520 - 1.28 \left(\frac{100}{\sqrt{25}}\right)$

$= 520 - 1.28 \times 20$

$= 520 - 25.6$

$= 494.4$

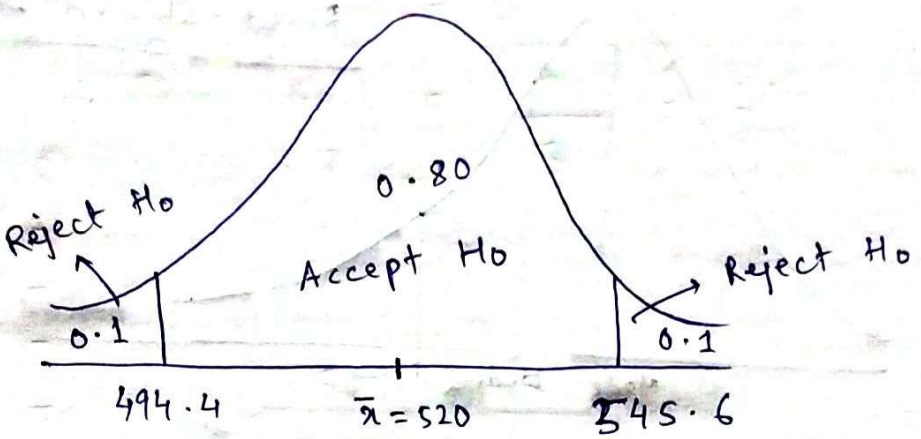
Higher Fence $= \bar{x} + Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$

$= 520 + 1.28 \left(\frac{100}{\sqrt{25}}\right)$

$= 520 + 1.28 \times 20$

$= 520 + 25.6$

$= 545.6$



Ques 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 and 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.

Soln/(a) Null Hypothesis (H_0) : $P_0 \leq 60\%$

Alternate Hypothesis (H_1) : $P_0 \neq 60\%$ or $P_0 > 60\%$

↓ One-tail test

Given, $n = 250$

$x = 170$

$\therefore \hat{p} = \frac{x}{n} = \frac{170}{250} = 0.68$

Now, $p_0 = 60\% = 0.6$

$\therefore q_0 = 1 - p_0 = 1 - 0.6$

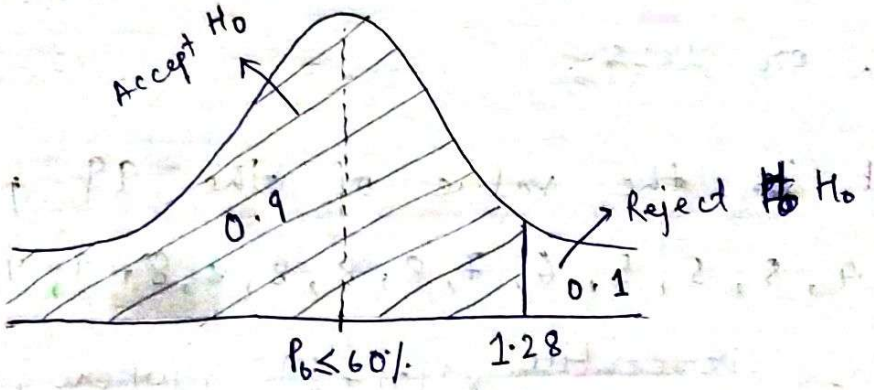
$= 0.4$

(b) $\alpha = 10\% = 0.1$

Confidence Interval (C.I.) $= 1 - 0.1$

$= 0.9$

$= 90\%$.



By doing z-test proportion calculation,

$$z\text{-test} = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0 q_0}{n}}} = \frac{0.68 - 0.60}{\sqrt{\frac{0.60 \times 0.40}{250}}}$$

$$= \frac{0.08}{\sqrt{0.00096}}$$

$$\boxed{z\text{-test} = 2.66}$$

Here, $2.66 > 1.28$, we reject the Null Hypothesis.

By using p-value,

$$z\text{-score} = 2.66$$

$$\downarrow$$

$$z\text{-table} \rightarrow 0.99609$$

$$p\text{-value} = 1 - 0.99609$$

$$= 0.00391$$

Here, $p\text{-value} < \alpha$

$0.00391 < 0.1 \rightarrow$ Reject Null Hypothesis

∴ The sales manager is correct. At a 10% significance level there is not enough evidence to support the idea that the vehicle in ABC city is 60% or less.

Ques 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

Soln) $\text{Value} = \frac{\text{Percentile}}{100} \times (n+1)$ [where, n = no. of obs.]

$$= \frac{99}{100} \times (20+1)$$

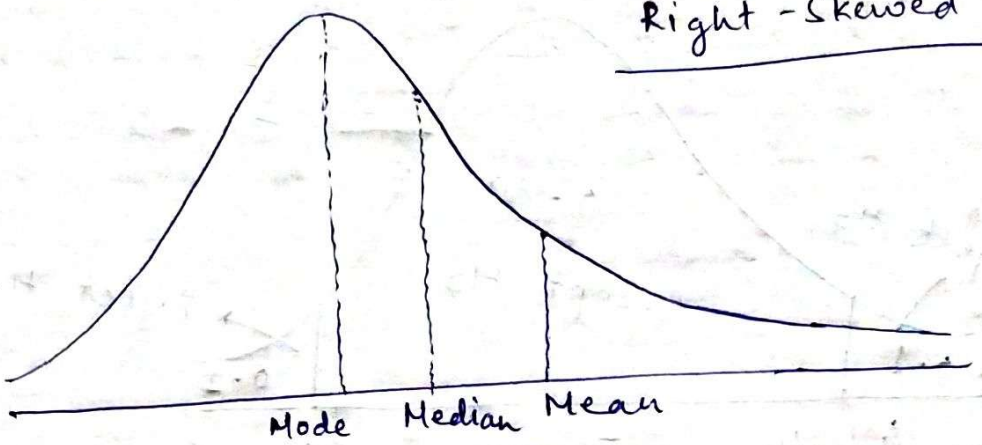
$$= 20.79 \quad (\text{Index position})$$

So, by the index position we will consider 12 as the 99 percentile.

Ques 5) In left & right-skewed data, what is the relationship between mean, median & mode? Draw the graph to represent the same.

Soln.)

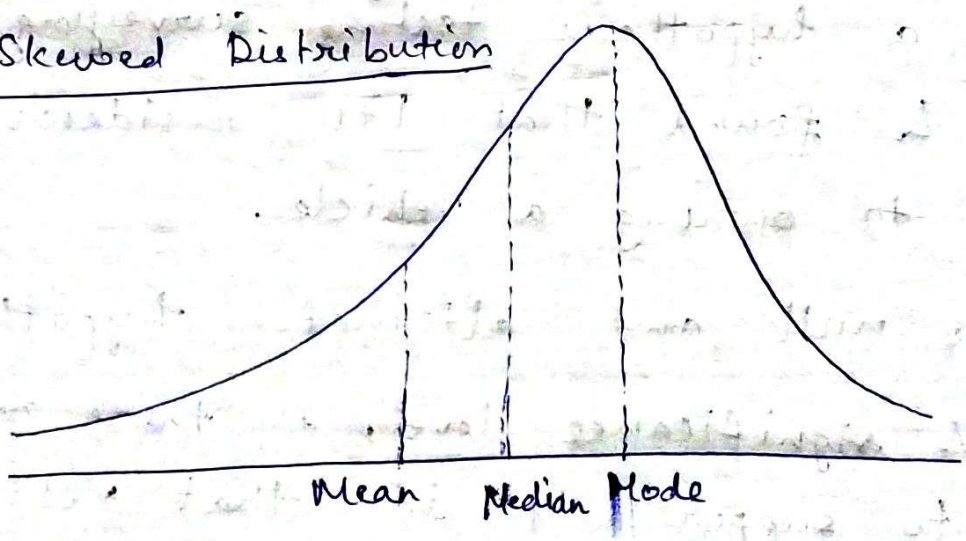
Right-Skewed Distribution



If the distribution of data is skewed to right (positive skewness), mean is larger than median and mode.

Here, Mean > Median > Mode

Left-Skewed Distribution



If the distribution of data is skewed to the left (negative skewness), mean is less than median and mode. Here, Mean < Median < Mode