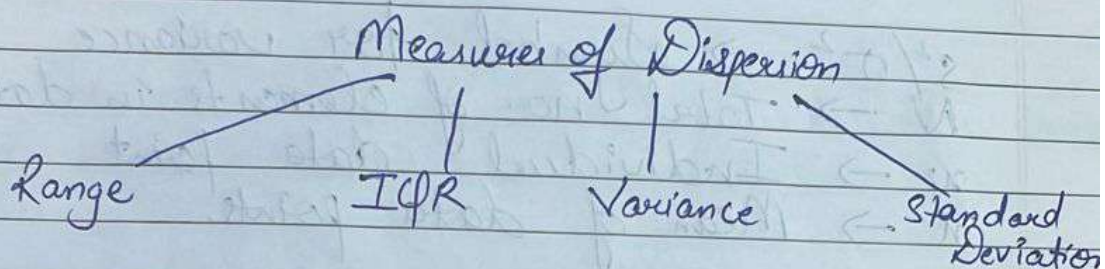# MEASURES OF DISPERSION.

→ Are statistical tools used to describe the spread or variability of a dataset.

→ They give insight into how much the values in a dataset differ from the mean or median.

Measures of Dispersion

Range   IQR   Variance   Standard Deviation

data = [70, 80, 85, 90, 95].

⨍ RANGE :- The difference between the maximum & minimum values.

→ Maximum value = 95   [Max (xi)]

→ Minimum value = 70   [Min (xi)].

→ Range = Max (xi) - Min (xi).

$$= 95 - 70$$

$$= \boxed{25}$$

The range of data is $\boxed{25}$.

VARIANCE $\left(s^2 / \sigma^2\right)$

The average of the squared sum from the mean.

$$s^2 / \sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{N} \quad \left(\text{Sum of squared differences}\right)$$

$s^2 / \sigma^2 \rightarrow$ Symbol for variance
$N \rightarrow$ Total no. of elements in dataset.
$x_i \rightarrow$ Individual data point.
$\bar{x} \rightarrow$ Mean of data points.

x_i	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
70	$70-84 = -14$	$(-14)^2 = 196$
80	$80-84 = -4$	$(-4)^2 = 16$
85	$85-84 = 1$	$(1)^2 = 1$
90	$90-84 = 6$	$(6)^2 = 36$
95	$95-84 = 11$	$(11)^2 = 121$
		$370 \leftarrow \sum(x_i - \bar{x})^2$

$\bar{x} \rightarrow$

$$\frac{70+80+85+90+95}{5}$$

$$= \frac{420}{5} = \boxed{84}$$

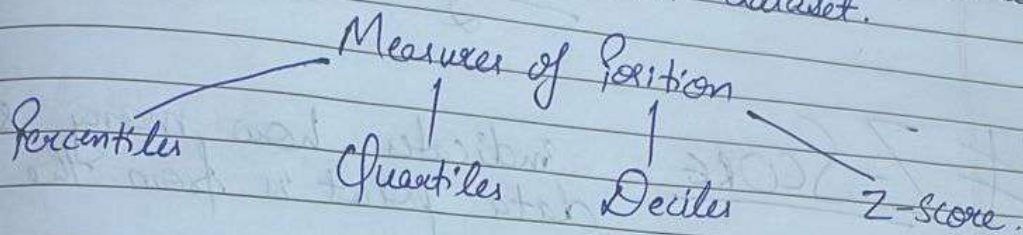$$\sigma^2 = \frac{370}{5} = \boxed{74.}$$

STANDARD DEVIATION (σ)

The square root of variance, it from a measure of the average distance of each data point from the mean.

$$\sigma = \sqrt{\sigma^2} = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \bar{x})^2}{N}}$$

$$= \sqrt{74} = \boxed{8.6023}$$

MEASURES OF POSITION

→ Are used to describe the relative location of a data point within a dataset.

Measures of Position

Percentiles   Quartiles   Deciles   Z-score.

$$data = [55, 60, 65, 70, 75, 80, 85, 90, 95, 100]$$

PERCENTILES → are values that divide a dataset into 100 equal parts.

Sort the data (already sorted).

(Same as Quartiles to find

    P25 (25th Percentile)

    Median (50th Percentile).

    P75 (75th Percentile).

DECILES — divides dataset into 10 equal parts.

(always upto D9)

1st Decile (D1) → Value below 10% of data.

i.e between 1st & 2nd data point

$$\frac{50+60}{2} = \boxed{55}$$

9th Decile (D9) = 90% below.

$$\frac{9^{th}+10^{th}}{2} = \frac{95+100}{2} = \boxed{97.5}$$

Z-SCORE — indicates how many std a data point is from the mean.

Step-1 ⇒ Mean

$$\Rightarrow \frac{55+60+65+ \underline{\quad\quad} +100}{10}$$

$$= 80.$$

Step-2 ⇒ Standard deviation (σ).

$$\sigma = ?$$

Z-score for 55 (x_i)

$$\Rightarrow \frac{55(x_i) - \overline{x}}{\sigma}$$

- A Z-score of '0' means the value is exactly at mean.
- A Z-score of '+1' means the value is one std above mean.
- A Z-score of '-1' means the value is one std below mean.