Measure of Dispersion

① Variance
② Standard Deviation

} → [spread of Data]

*** Variance :**

It is a measure that tells about spread of data. It is nothing but the square of standard deviation.

Population (N)

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

Sample (n)

$$s^2 = \sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n-1}$$

$(n-1) \longrightarrow$ Bessel's correction
Degree of freedom

Eg :

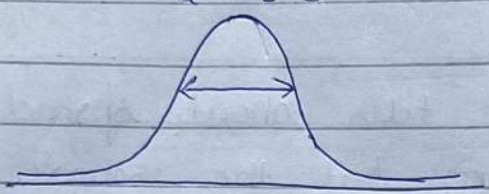
x_i	$\bar{x}$	$(x_i - \bar{x})$	$(x_i - \bar{x})^2$
1	3	-2	4
2	3	-1	1
3	3	0	0
4	3	1	1
5	3	2	4
$\bar{x} = 3$			$\Sigma(x_i - \bar{x})^2 = 10$

$$\therefore \; s^2 = \sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n-1} = \frac{10}{4} = 2.5$$

Note: Spread of data when:

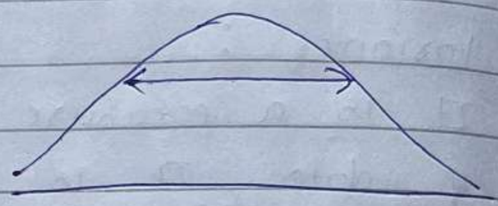
<u>variance is small</u>

$s^2 = 2.5$



<u>variance is large</u>

$S^2 = 20$



Q why we divide sample variance by n-1 ?

A It is used to create an unbiased estimator of population variance.

* <u>Standard Deviation</u> :

It tells us how far the value is away from the mean. It is nothing but the square root of variance.

<u>Population (N)</u>

$\sigma = \sqrt{\text{variance}}$

$\sigma = \sqrt{\sigma^2}$

<u>Sample (n)</u>

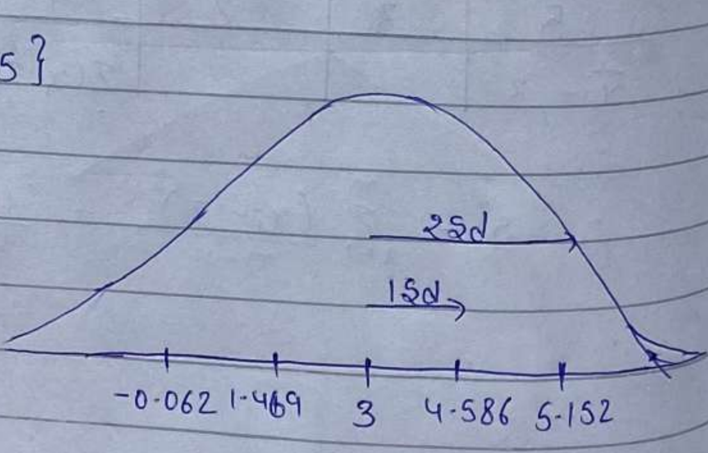
$s = \sqrt{\text{variance}}$

$s = \sqrt{s^2}$

Eg: $x : \{1, 2, 3, 4, 5\}$

$\bar{x} = 3$

$s = 1.531$



INTERPRET:

we can get how much far it is away from mean.

Eg: 5.152 is 2SD away from mean (3) and
1.419 is 1 SD away from mean (3).