

▷ VARIANCE:

The variance of a set of observation is defined as "the mean of the squares of the deviation of all the observations from their mean."

- Variance is another absolute measure of dispersion.
- The variance is also denoted by $\text{Var}(X)$

Formulas:

(For ungrouped data)

$$\sigma^2 = \frac{\sum x^2}{N} - \left(\frac{\sum x_i}{N} \right)^2 \quad \text{Population}$$

$$S^2 = \frac{\sum x^2}{n} - \left(\frac{\sum x_i}{n} \right)^2 \quad \text{Sample}$$

(For grouped data)

$$S^2 = \frac{\sum f x^2}{n} - \left(\frac{\sum f x_i}{n} \right)^2 \quad \text{Sample}$$

STANDARD DEVIATION:

- Standard deviation (S.D) is the most commonly used measure of dispersion. It is a measure of spread of data about the mean.
- Standard deviation is a number that measures how far away each number in a set of data from their mean.
- Standard deviation is the square root of the variance

Formulas:

(For Ungrouped data)

$$\sigma = \sqrt{\frac{\sum x^2 - \left(\frac{\sum x_i}{N}\right)^2}{N}}$$

Population

$$S = \sqrt{\frac{\sum x^2 - \left(\frac{\sum x_i}{n}\right)^2}{n}}$$

Sample

(For Grouped data)

$$S = \sqrt{\frac{\sum fx^2 - \left(\frac{\sum fx_i}{n}\right)^2}{n}}$$

Sample.

$$\text{Coefficients of variation} = \frac{S}{\bar{x}}$$

→ Example: A population of $N=10$ has the observation 7, 8, 10, 13, 14, 19, 20, 25, 26, 28

Find the variance & standard deviation for ungrouped data.

Solution:

<u>X</u>	<u>X²</u>	
7	49	
8	64	
10	100	$\mu = \frac{\sum x_i}{N} = \frac{170}{10}$
13	169	
14	196	$= 17$
19	361	
20	400	
25	625	
26	676	
28	784	
<u>Σ</u>	<u>170</u>	<u>3424</u>

$$\sigma^2 = \frac{\sum x^2}{N} - \left(\frac{\sum x_i}{N} \right)^2$$

$$= \frac{3424}{10} - \left(\frac{170}{10} \right)^2 = 342.4 - 289$$

$$\sigma^2 = 53.4$$

$$\sigma = \sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum x_i}{N}\right)^2}$$

$$= \sqrt{53.4}$$

$$\sigma = 7.31$$

→ Example:

Calculate variance & standard deviation for ungrouped data. 45, 32, 37, 46, 39, 36, 41, 48, 36

Solution:

<u>X</u>	<u>X²</u>
45	2025
32	1024
37	1369
46	2116
39	1521
36	1296
41	1681
48	2304
36	1296
Σ 360	<u>14632</u>

$$\bar{x} = \frac{\sum x_i}{n} = \frac{360}{9} = 40$$

$$S^2 = \frac{\sum x^2}{n} - \left(\frac{\sum x_i}{n} \right)^2$$

$$= \frac{14632}{9} - \left(\frac{360}{9} \right)^2$$

$$S^2 = 25.78$$

$$S = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x_i}{n} \right)^2}$$

$$S = \sqrt{25.78}$$

$$S = 5.08$$