



Measures of Dispersion:-

A measure of location only describes the center of the data, it does not tell us anything about the spread of the data because only two data sets with different variability may have same central tendency.

Data set I

8, 7, 8, 6

$\bar{X} = 6.8$

Less variation or dispersion

Data set II

1, 4, 7, 10, 12

$\bar{X} = 6.8$

More variation or dispersion

A numerical quantity that describes the spread of the value in a dataset is called measures of dispersion/variability.

Range:-

It is the difference b/w the largest and the smallest value in a data set.

$$\text{Range} = \text{largest value} - \text{Smallest value}$$

Merits of Range:-

- It is easy to calculate.
- It is easy to understand.

Demerits of Range:-

It is not based on all values.

It depends only upon extreme values (i.e. largest & smallest)

Example:-

48, 49, 50, 51, 52.

$$\text{Range} = 52 - 48 = 4.$$

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". It is another absolute measure of dispersion.

The variance is also denoted by $\text{Var}(X)$.

Formulas:- For Ungrouped Data.

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

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

For Grouped Data.

$$S^2 = \frac{\sum fx^2}{n} - \left(\frac{\sum fxi}{n} \right)^2 \quad \text{Sample.}$$

Standard Deviation.

It is the most commonly used measure of dispersion. It is a measure of spread of data about the mean.

S.D is a number that measures how far away each number in a set of data from their mean.

S.D is the square root of variance.

Formulas:- For Ungrouped Data.

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

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$$S = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum xi}{n}\right)^2} \text{ Sample.}$$

For Grouped Data

$$S = \sqrt{\frac{\sum fx^2}{n} - \left(\frac{\sum fxi}{n}\right)^2} \text{ Sample.}$$

$$\text{Coefficient of variation} = \frac{S}{\bar{X}}$$

Example:-

Solution:-

<u>X</u>	<u>X²</u>
7	49
8	64
10	100
13	169
14	196
19	361
20	400
25	625
26	676
28	784
Σ 170	3424

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

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

$$= \sigma^2 = 53.4$$

$$\sigma = \sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum xi}{N}\right)^2} = \sqrt{53.4}$$

$$\sigma = 7.31 \text{ Answer}$$