

11th Standard - Mathematics

Statistics

Measure of Dispersion

The dispersion is the measure of variations in the values of the variable. It measures the degree of scatteredness of the observation in a distribution around the central value.

Range

The measure of dispersion which is easiest to understand and easiest to calculate is the range.

Range is defined as the difference between two extreme observation of the distribution.

Range of distribution = Largest observation – Smallest observation.

Mean Deviation

Mean deviation for ungrouped data

For n observations $x_1, x_2, x_3, \dots, x_n$, the mean deviation about their mean \bar{x} is given by

$$MD(\bar{x}) = \frac{\sum |x_i - \bar{x}|}{n}$$

Mean deviation about their median M is given by

$$MD(M) = \frac{\sum |x_i - M|}{n}$$

Mean deviation for discrete frequency distribution

Let the given data consist of discrete observations $x_1, x_2, x_3, \dots, x_n$ occurring with frequencies $f_1, f_2, f_3, \dots, f_n$ respectively in case

$$MD(\bar{x}) = \frac{\sum f_i |x_i - \bar{x}|}{\sum f_i} = \frac{\sum f_i |x_i - \bar{x}|}{N}$$

Mean deviation about their Median M is given by

$$MD(\bar{x}) = \frac{\sum f_i |x_i - \bar{x}|}{\sum f_i} = \frac{\sum f_i |x_i - \bar{x}|}{N}$$

Mean deviation for continuous frequency distribution

$$MD(\bar{x}) = \frac{\sum f_i |x_i - \bar{x}|}{N}$$

$$MD(M) = \frac{\sum f_i |x_i - M|}{N}$$

where x_i are the mid-points of the classes, \bar{x} and M are respectively, the mean and median of the distribution.

Variance

Variance is the arithmetic mean of the square of the deviation about mean \bar{x} .

Let x_1, x_2, \dots, x_n be n observations with \bar{x} as the mean, then the variance denoted by σ^2 , is given by

$$\sigma^2 = \frac{\sum (x_i - \bar{x})^2}{n}$$

Standard deviation

If σ^2 is the variance, then σ is called the standard deviation is given by

$$\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}}$$

Standard deviation of a discrete frequency distribution is given by

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

Standard deviation of a continuous frequency distribution is given by

$$\sigma = \frac{1}{N} \sqrt{N \sum f_i x_i^2 - (\sum f_i x_i)^2}$$

Another formula for standard deviation is by

$$\sigma = \frac{h}{N} \sqrt{N \sum f_i d_i^2 - (\sum f_i d_i)^2}$$

where h is the width of class-interval and

$d_i = \frac{x_i - A}{h}$ and A is assumed mean.

Coefficient of Variation

In order to compare two or more frequency distributions, we compare their coefficient of variations. The coefficient of variation is defined as

$$= \frac{\text{Standard deviation}}{\text{Mean}} \times 100$$

$$\text{i.e. CV} = \frac{\sigma}{\bar{x}} \times 100$$

Note: The distribution having a greater coefficient of variation has more variability around the central value, then the distribution having a smaller value of the coefficient of variation.