CBSE Class 11 Maths Notes Chapter 13 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 $x_1, x_2, x_3, \ldots, x_n$, the mean deviation about their mean $\bar{x}$ is given by

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

Mean deviation about their median M is given by

$$\text{MD}(M) = \frac{\Sigma |x_i - M|}{n}.$$

Mean deviation for discrete frequency distribution
Let the given data consist of discrete observations $x_1, x_2, x_3, \ldots\ldots, x_n$ occurring with frequencies $f_1, f_2, f_3, \ldots\ldots, f_n$ respectively in case

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

Mean deviation about their Median M is given by

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

Mean deviation for continuous frequency distribution

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

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

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

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

Standard deviation

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

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

Standard deviation of a discrete frequency distribution is given by

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

Standard deviation of a continuous frequency distribution is given by

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

Another formula for standard deviation is by

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

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

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

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 0f variation.