Measure of Variation

The measure of dispersion indicates the scattering of data. It explains the disparity of data from one another delivering a precise view of the distribution of data. The measure of dispersion displays and gives us an idea about the variation and central value of an individual item.

In other words, Dispersion is the extent to which values in a distribution differ from the average of the distribution. It gives us an idea about the extent to which individual items vary from one another and from the central value.

Measures of dispersion can be sub-divided in to two categories. These are as follows:

1. **Absolute Measures:**

Absolute measures of dispersion are expressed in the unit of Variable itself. Like, Kilograms, Rupees, Centimeters, Marks etc. Following are some of the absolute measures of dispersion-

1. Range – It is the simplest method of measurement of dispersion and defines the difference between the largest and the smallest item in a given distribution. Suppose, If Y max and Y min are the two ultimate items then

Range = Maximum value of Y – Minimum Value of Y.

1. Quartile Deviation – It is known as Semi-Inter-Quartile Range i.e. half of the difference between the upper quartile and lower quartile. The first quartile is derived as (Q), the middle digit (Q1) connects the least number with the median of the data. The median of a data set is the (Q2) second quartile. Lastly, the number connecting the largest number and the median is the third quartile (Q3). Quartile deviation can be calculated by

Q = ½ × (Q3 – Q1)

1. Mean Deviation-Mean deviation is the arithmetic mean (average) of deviations **⎜**D**⎜**of observations from a central value {Mean or Median}.

Mean deviation can be evaluated by using the formula:

A = 1⁄n [∑i|xi – A|]

1. Standard Deviation- Standard deviation is the Square Root of the Arithmetic Average of the squared of the deviations measured from the mean. The standard deviation is given as

σ = [(Σi (yi – ȳ) ⁄ n] ½ = [(Σ i yi 2 ⁄ n) – ȳ 2] ½

1. **Relative Measures:**

Relative measures of dispersion are obtained as ratios or percentages of the average. These are also known as ‘Coefficient of dispersion’. These are pure numbers or percentages totally independent of the units of measurements. Following are the relative measures of dispersion-

1. Coefficient of Range :

It refers to the ratio of the difference between two extreme items of the distribution to their sum.

**Coefficient of Range=**$\frac{Largest Value-Smallest value}{Largest value+Smallest Value}$

1. Coefficient of Quartile Deviation:

It refers to the ratio of the difference between Upper Quartile and Lower Quartile of a distribution to their sum.

Coefficient of Quartile Deviation=$\frac{Q3-Q1}{Q3+Q1}$

1. Coefficient of Mean Deviation:

Mean deviation is an absolute measure of dispersion. In order to transform it into a relative measure, it is divided by the particular average, from which it has been calculated. It is then known as the Coefficient of Mean Deviation.

Coefficient of Mean Deviation from Mean**=** $\frac{\begin{array}{c}MD-\\ X\end{array}}{\begin{array}{c}-\\X\end{array}}$

Coefficient of Mean Deviation from Median=$\frac{\begin{array}{c}MD \\ M\\ e\\ \end{array}}{\begin{array}{c}M\\ e\end{array}}$

1. Coefficient of Standard Deviation:

 It is calculated by dividing the standard deviation (σ) by the mean ($\overbar{x}$)of the data.

 Coefficient of Standard Deviation =$\frac{σ}{\begin{array}{c}-\\x\end{array}}$

1. Coefficient of Variation

It is used to compare two data with respect to stability (or uniformity or consistency or homogeneity). It indicates the relationship between the standard deviation and the arithmetic mean expressed in terms of percentage.

Coefficient of Variation= $\frac{Standard Deviation}{Arithmetic Mean}$ x 100

Characteristics of good measure of dispersion:

1. It should be easy to calculate & simple to understand.
2. It should be based on all the observations of the series.
3. It should be rigidly defined.
4. It should not be affected by extreme values
5. It should not be unduly affected by sampling fluctuations.
6. It should be capable of further mathematical treatment and statistical analysis.