

Chapter 6: Measures of Dispersion

- 1. Dispersion refers to the variation of the items around an average.
- 2. <u>Objectives of Dispersion</u>
 - a) To determine the reliability of an average.
 - b) To compare the variability of two or more series.
 - c) It serves the basis of other statistical measures such as correlation etc.
 - d) It serves the basis of statistical quality control.

Properties of good measure of Dispersion

- a) It should be easy to understand.
- b) Easy to calculate.
- c) Rigidly defined
- d) Based on all observations.
- e) Should not be unduly affected by extreme values.

Measures of Dispersion may be either absolute measures or relative measure.

Absolute Measures of Dispersion are

- a) Range
- b) Quartile Deviation
- c) Mean Deviation
- d) Standard Deviation

Relative Measures of Dispersion are

- a) Coefficient of Range
- b) Coefficient of Quartile Deviation
- c) Coefficient of Mean Deviation
- d) Coefficient of Variation

Graphical method of dispersion

Lorenz Curve

Range

It is the difference between the largest and smallest value of distribution.

Computation of Range

Range = L - S

Coefficient of Range = $\frac{L-S}{L+S}$

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Merits of Range

1. It is simple to understand and easy to calculate.

2. It is widely used in statistical quality control.

Demerits of Range

- 1. It is affected by extreme values in the series.
- 2. It cannot be calculated in case of open end series.
- 3. It is not based on all items.

Inter quartile range and quartile deviation

Inter quartile range is the difference between Upper Quartile (Q_3) and Lower Quartile Q_1 .

Quartile deviation is half of inter quartile range.

Computation of Inter quartile range and quartile deviation

Inter quartile Range = $Q3 - Q_1$

Quartile Deviation Q.D = $Q_3 - Q_1$

Coefficient of Q.D =
$$\frac{Q_3 - Q_1}{Q_3 + Q_1}$$

Merits of Q.D

- 1. Easy to compute
- 2. Less affected by extreme values.
- 3. Can be computed in open ended series.

Demerits of Q.D

- 1. Not based on all observations
- 2. It is influenced by change in sample and suffers from instability.

Mean Deviation

Mean Deviation is defined as the arithmetic average of the absolute deviations [ignoring signs] of various items from Mean or Median.

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Computation of Mean Deviation

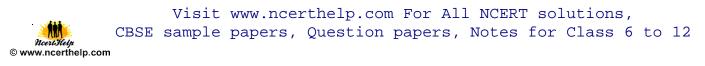
Individual Series

$$M.D = \frac{\Sigma \mid D \mid}{N}$$

Discrete/Continuous Series

$$M.D = \frac{\Sigma f \mid D \mid}{\Sigma f}$$

Coefficient of M.D = $\frac{M.D}{\overline{X} \text{ or Median}}$



Merits of Mean Deviation

- 1. Based on all observations.
- 2. It is less affected by extreme values.
- 3. Simple to understand and easy to calculate.

Demerits of Mean Deviation

- 1. It ignores \pm signs in deviations.
- 2. It is difficult to compute when deviations comes in fractions.

<u>Standard Deviation:</u> (σ)

It is defined as the root mean square deviation.

Features of Standard Deviation:

- 1. Value of its deviation is taken from Arithmetic Mean.
- 2. + and signs of deviations taken from mean are not ignored.

Related Measures of Standard Deviation

Standard deviation = σ

Coefficient of standard deviation: $\frac{\sigma}{x}$

Variance = σ^2

Coefficient of variation = $\frac{\sigma}{\overline{X}} \times 100$

Computation of σ

Individual Series

1.
$$\sigma = \sqrt{\frac{\Sigma x^2}{N}}$$

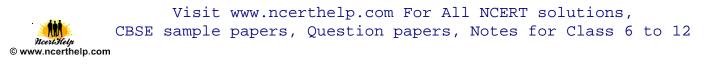
2. $x = X \frac{\overline{X}}{\sqrt{\frac{\Sigma d^2}{N} - \left(\frac{\Sigma d}{N}\right)^2}}$

Assumed Mean Method

Discrete / Continuous Series:

i.
$$\sigma = \sqrt{\frac{\Sigma f x^2}{\Sigma f}}$$
 Actual Mean Method
 $x = X - \overline{X}$
ii. $\sigma = \sqrt{\frac{\Sigma f d^2}{\Sigma f} - \left(\frac{\Sigma f d}{\Sigma f}\right)^2}$ Assumed Mean Method
iii. $\sigma = \sqrt{\frac{\Sigma f d^{12}}{\Sigma f} - \left(\frac{\Sigma f d^1}{\Sigma f}\right)^2}$ Step Deviation Method

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Merits of Standard Deviation

- i. Rigidly defined
- ii. Based on all observations
- iii. Takes Algebraic signs in consideration
- iv. Amenable to further Algebraic treatment

Demerits

- i. Difficult to understand and compute.
- ii. Affected by extreme items.

Lorenz Curve

It is a graphical method of studying dispersion.

Lorenz curve is a cumulative percentage curve in which the percentage of frequency is combined with percentage of other items such as profit, income etc.

1 mark questions

- 1. What is range?
- 2. What is coefficient of variation?
- 3. What is Lorenz curve?

3 marks question

1. Mention any two merit and demerits each of Mean Deviation.

4 marks questions

1. Find out range and coefficient of range of the following series.

Size	5-10	10-15	15-20	20-25	25-30
Frequency	4	9	15	8	5

2. Find out Standard deviation (6) from the following data:

Class Interval	0-10	10-20	20-30	30-40	40-50
Frequency	10	03	02	01	04