

Measure of Dispersion

Range

➤ For Ungrouped Data

- **Definition:**

Range is the difference between the maximum and minimum value •

- **Formula:**

Range = Maximum value – Minimum value

$$R = X_m - X_o$$

- **Steps involving to find the range:**

1. Arrange the series in ascending or descending order.
2. Find the Maximum value in the data. (X_m)
3. Find the Minimum value in the data. (X_o)
4. Subtract the minimum value from the maximum value.

- **Example:**

The marks of a student in 5 tests of the chapter statistics are (out of 20)

11, 14, 16, 13 and 18.

Arranging them in ascending order 18, 16, 14, 13 and 11.

So Maximum Value (X_m) is 18 and Minimum Value (X_o) is 11.

So Range = $X_m - X_o$

$$R = 18 - 11$$

$$R = 7.$$

The range of the data is 7.

➤ **For Grouped Data:**

- **Definition:**

In the case of **grouped data**, the **range** is the difference between the upper boundary of the highest class and the lower boundary of the lowest class.

It is also calculated by using the difference between the mid points of the highest class and the lowest class.

It is the simplest measure of dispersion.

- **Formula:**

Range = Maximum value – Minimum value

$$R = X_m - X_o$$

- **Example:**

Classes	Frequency	Class Boundary	Mid Points
65 - 84	9	64.5 – 84.5	74.5

85 - 104	10	84.5 – 104.5	94.5
105 - 124	17	104.5 – 124.5	114.5
125 - 144	5	124.5 – 144.5	134.5

- **According to Classes:**

Upper boundary of the highest class = $X_m = 144.5$

Lower boundary of the lowest class = $X_o = 64.5$

Range = $X_m - X_o$

$R = 144.5 - 64.5$

R = 80

The range of the data is 80.

- **According to Mid Points:**

Highest Mid-Point = $X_m = 134.5$

Lowest Mid-Point = $X_o = 74.5$

Range = $X_m - X_o$

$R = 134.5 - 74.5$

R = 60

The range of the data is 60.

- **Advantages of Range:**

1. Range is easy to Compute.
2. Range is easy to Understand.

- **Disadvantages of Range:**

1. The range is Inefficient.
2. It only uses the extreme value.
3. It ignores all the other available data.
4. Value depends only on 2 Scores.

- **Uses of Range:**

1. The range is used when you have original data.
2. You are presenting your results to people with little or no knowledge of statistics.
3. Two very different sets of data can have the same range.

1, 1, 1, 1, 9 VS 1, 3, 5, 7, 9

Coefficient of Range:

➤ **For Ungrouped Data:**

- **Definition:**

The relative measure of the distribution based on the range of any given data set, which is the difference between the maximum and minimum value in the given set.

It is also known as range coefficient.

It is calculated when range is divided by the sum of the largest and smallest value in the data.

Coefficient of range is denoted by “S”.

- **Formula:**

$$S = \frac{X_m - X_o}{X_m + X_o}$$

- **Example:**

The marks of a student in 5 tests of the chapter statistics are (out of 20)

11, 14, 16, 13 and 18.

Arranging them in ascending order 18, 16, 14, 13 and 11.

So Maximum Value (X_m) is 18 and Minimum Value (X_o) is 11.

$$S = \frac{X_m - X_o}{X_m + X_o}$$

$$S = \frac{18 - 11}{18 + 11}$$

$$S = \frac{7}{29}$$

$$S = 0.24$$

Coefficient of range is 0.24

➤ **For Grouped Data:**

- **Definition:**

When the difference between the upper boundary of the highest class and the lower boundary of the lowest class or the difference between the mid points of the highest class and the lowest class is divided by the sum of the upper boundary of the highest class and the lower boundary of the lowest class or the sum of the mid points of the highest class and the lowest class.

Coefficient of range is denoted by “S”.

- **Formula:**

$$S = \frac{X_m - X_o}{X_m + X_o}$$

- **Example:**

Classes	Frequency	Class Boundary	Mid Points
65 - 84	9	64.5 – 84.5	74.5
85 - 104	10	84.5 – 104.5	94.5
105 - 124	17	104.5 – 124.5	114.5
125 - 144	5	124.5 – 144.5	134.5

- **According to Classes:**

Upper boundary of the highest class = $X_m = 144.5$

Lower boundary of the lowest class = $X_o = 64.5$

$$S = \frac{X_m - X_o}{X_m + X_o}$$

$$S = 144.5 - 64.5 / 144.5 + 64.5$$

$$S = 80 / 209$$

$$S = 0.38$$

Coefficient of range is 0.38.

- **According to Mid Points:**

$$\text{Highest Mid-Point} = X_m = 134.5$$

$$\text{Lowest Mid-Point} = X_o = 74.5$$

$$S = X_m - X_o / X_m + X_o$$

$$S = 134.5 - 74.5 / 134.5 + 74.5$$

$$S = 60 / 209$$

$$S = 0.29.$$

Coefficient of range is 0.29.

- **Advantages of Coefficient of Range:**

1. Range is easy to Compute.
2. Range is easy to Understand.

- **Disadvantages of Coefficient of Range:**

1. The range is Inefficient.
2. It only uses the extreme value.

3. It ignores all the other available data.

4. Value depends only on 2 Scores.

Mid-Range

➤ For Ungrouped Data:

- **Definition:**

The mid-range or mid-extreme of a set of statistical data values is the arithmetic mean of the maximum and minimum values in a data set.

Or

The mid-range is the mid-point of the range; as such, it is a measure of central tendency.

- **Formula:**

$$\text{Mid} = \text{Range} (X_m - X_o) / 2$$

- **Example:**

The marks of a student in 5 tests of the chapter statistics are (out of 20)

11, 14, 16, 13 and 18.

Arranging them in ascending order 18, 16, 14, 13 and 11.

So Maximum Value (X_m) is 18 and Minimum Value (X_o) is 11.

$$\text{Mid} = X_m - X_o / 2$$

$$\text{Mid} = 18 - 11 / 2$$

$$\text{Mid} = 7 / 2$$

$$\text{Mid} = 3.5.$$

Mid-range of the data is 3.5

➤ **For Grouped Data:**

- **Definition:**

The mid-range or mid-extreme of a set of statistical data values is the arithmetic mean of the upper boundary of the highest class and the lower boundary of the lowest class or the arithmetic mean of the mid points of the highest class and the lowest class

Or

The mid-range is the mid-point of the range; as such, it is a measure of central tendency.

- **Formula:**

$$\text{Mid} = \text{Range} (X_m - X_o) / 2$$

- **Example:**

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- **According to Classes:**

Upper boundary of the highest class = $X_m = 144.5$

Lower boundary of the lowest class = $X_o = 64.5$

$$\text{Mid} = X_m - X_o / 2$$

$$\text{Mid} = 144.5 - 64.5 / 2$$

$$\text{Mid} = 80 / 2$$

Mid = 40.

Mid-range of the data is 40.

- **According to Mid Points:**

Highest Mid-Point = $X_m = 134.5$

Lowest Mid-Point = $X_o = 74.5$

$$\text{Mid} = X_m - X_o / 2$$

$$\text{Mid} = 134.5 - 74.5 / 2$$

$$\text{Mid} = 60 / 2$$

Mid = 30.

Mid-range of the data is 30.

- **Advantages of Mid-range:**

1. Mid-range is easily obtained.
2. Mid-range is quickly obtained.
3. Mid-range is used to obtain the rough idea about the average of the set of the observations.
4. Mid-range is used to obtain the quick idea about the average of the set of the observations.

- **Disadvantages of Mid-range:**

1. The Mid-range is a rough measure of central tendency.
2. It neglects all intermediate observations.
3. The Mid-range is seriously affected by extreme observations.
4. Mid-range can be only with Quantitative Variables.
5. It cannot be used with Qualitative Variables.
6. Mid-range cannot be computed for Open Ended tables.
7. It cannot be used in Statistical Analysis.

-----Thank You-----