

# MEASURE OF CENTRAL TENDANCY

**MEDIAN**



The middle value of the data

**MEAN**



The average of the data

**MODE**



most commonly occurring value

# Mean (Average)

Mean locate the centre of distribution.

Also known as arithmetic mean

Most Common Measure

The mean is simply the sum of the values divided by the total number of items in the set.

Affected by Extreme Values

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n} = \frac{X_1 + X_2 + \dots + X_n}{n}$$

# Merits:

- It is easy to understand and easy to calculate
- It is based upon all the observations
- It is familiar to common man and rigidly defined
- It is capable of further mathematical treatment.
- It is affected by sampling fluctuations. Hence it is more stable.

# Demerits

- It cannot be determined by inspection.
- Arithmetic mean cannot be used if we are dealing with qualitative characteristics, which cannot be measured quantitatively like caste, religion, sex.
- Arithmetic mean cannot be obtained if a single observation is missing or lost
- Arithmetic mean is very much affected by extreme values.

# Median

1. Measure of Central Tendency.

2. The median is determined by sorting the data set from lowest to highest values and taking the data point in the middle of the sequence.

3. Middle Value In Ordered Sequence

- If Odd  $n$ , Middle Value of Sequence
- If Even  $n$ , Average of 2 Middle Value

4. Not Affected by Extreme Values

# Merits:

- It is rigidly defined
- It is easy to understand and easy to calculate.
- It is not at all affected by extreme values.
- It can be calculated for distributions with open-end classes.
- Median is the only average to be used while dealing with qualitative data.
- Can be determined graphically.

# Demerits:

- In case of even number of observations median cannot be determined exactly.
- It is not based on all the observations.
- It is not capable of further mathematical treatment

## For ungrouped data:-

### Step-1

Arranged data in ascending or descending order.

### Step:-2

If total no. of observations 'n' is **odd** then used the following formula for median

$$= \frac{n+1}{2} \text{th observation.}$$

### Step:-3

If total no. of observations 'n' is **even** then used the following formula for

median = arithmetic mean of two middle observations.

Calculate the median for the following series :-

2,3,5,1,4,5,8

1,2,3,4,5,5,8.

$$\text{Median} = \frac{n+1}{2} \text{th observation.}$$

$$= 7+1/2$$

$$= 4^{\text{th}} \text{ number}$$

## For Grouped data:-

Median:-

$$l + \frac{\left( \frac{n}{2} - c \right) h}{f}$$

$l$  = lower limit of class interval where the median occurs

$f$  = Frequency of the class where median occurs

$h$  = Width of the median class

$C$  = Cumulative frequency of the class preceding the median class (PCF)

# Mode

1. Measure of Central Tendency
2. The mode is the most frequently occurring value in the data set.
3. May Be No Mode or Several Modes

# Merits:

- Mode is readily comprehensible and easy to calculate.
- Mode is not at all affected by extreme values.
- Mode can be conveniently located even if the frequency distribution has class intervals of unequal magnitude
- Open-end classes also do not pose any problem in the location of mode.
- Mode is the average to be used to find the ideal size.

# Demerits:

- Mode is ill defined.
- It is not based upon all the observations.
- It is not capable of further mathematical treatment.
- As compared with mean, mode is affected to a great extent by fluctuations of sampling.

## Q. Find the Mode for group data

|                       |              |              |              |              |              |
|-----------------------|--------------|--------------|--------------|--------------|--------------|
| <b>Age group</b>      | <b>20-30</b> | <b>30-40</b> | <b>40-50</b> | <b>50-60</b> | <b>60-70</b> |
| <b>No. of persons</b> | <b>3</b>     | <b>20</b>    | <b>27</b>    | <b>15</b>    | <b>9</b>     |

|                  | <b>CI</b> | <b>FREQU. (F)</b> |                   |
|------------------|-----------|-------------------|-------------------|
|                  | 20 - 30   | 3                 |                   |
|                  | 30 - 40   | 20                | $\rightarrow F_1$ |
| $L_1 \leftarrow$ | 40 - 50   | 27                |                   |
|                  | 50 - 60   | 15                |                   |
|                  | 60 - 70   | 9                 |                   |
|                  |           |                   | $\rightarrow F_2$ |
|                  |           |                   | $\rightarrow F_m$ |

$$\text{Mode} = L_1 + \frac{F_m - F_1}{2F_m - F_1 - F_2} * c$$

$$\text{Mode} = 40 + \frac{27 - 20}{2 * 27 - 20 - 15} * 10 = 40 + \frac{70}{19}$$

$$\text{Mode} = 43.68$$

# Relationship between Mean, Median and Mode

$$\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$$

# Summary of Central Tendency Measures

| <b>Measure</b> | <b>Description</b>           |
|----------------|------------------------------|
| Mean           | Balance Point                |
| Median         | Middle Value<br>When Ordered |
| Mode           | Most Frequent                |