Mathematical and Positional Measures Of Central Tendency: Practical Significance

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Introduction:

- In statistics, a central tendency is a central value for a distribution.
- It is occasionally called an average or just the center of the distribution.
- The most common measures of central tendency are the arithmetic mean, the median and the mode.
- Measures of central tendency are defined for a population(large set of objects of a similar nature) and for a sample (portion of the elements of a population).

Some Definitions

- **Simpson and Kafka** defined it as " A measure of central tendency is a typical value around which other figures gather."

  Waugh has expressed "An average stands for the whole group of which it forms a part yet represents the whole".
- **In layman's term,** a measure of central tendency is an AVERAGE. It is a single number of value which can be considered typical in a set of data as a whole.

Different Measures of Central Tendency (MCT)

1. **Mathematical Average**
   - ❖ Arithmetic Mean Simply Mean
   - ❖ Geometric Mean
   - ❖ Harmonic Mean
2. **Positional Average**
   - ❖ Median
   - ❖ Mode
3. **Mean, Median and Mode are the Most Commonly used MCT**

Characteristics of an Ideal MCT

1. It should be rigidly defined so that different persons may not interpret it differently.
2. It should be easy to understand and easy to calculate.
3. It should be based on all the observations of the data.
4. It should be easily subjected to further mathematical treatment.
5. It should be least affected by the sampling fluctuation .
6. It should not be unduly affected by the extreme values.
7. It should be easy to calculate in open end classes.
8. It should be calculated by graphic method also.

Importance Of Central Tendency

- To find representative value
- To give brief description
- To provide help in further statistical analysis
- To know structure of an economy
- To compare different economies
- To study economic problems
- To formulate economic policies

Arithmetic Mean

- **Mean of a variable is defined as sum of the different values of a variable divided by number of the values.**

- **Mean = $\frac{X1 + X2 + X3 + X4 + \ldots\ldots\ldots + Xn}{n}$**

$$\bar{X} = \frac{\Sigma X}{N}$$

Arithmetic Mean for Ungrouped data

- If we get the mean of the sample, we call it the sample mean and it is denoted by (read "x bar").

$$\text{Sample mean} = \frac{\text{Sum of all the values in the sample}}{\text{Number of values in the sample}}$$

- If we compute the mean of the population, we call it the parametric or population mean, denoted by μ (read "mu").

$$\text{Population mean} = \frac{\text{Sum of all the values in the population}}{\text{Number of values in the population}}$$

Arithmetic Mean for grouped data:

- **Direct method :**

$$\overline{X} = \frac{\sum fm}{N}$$

- **Short cut method :**

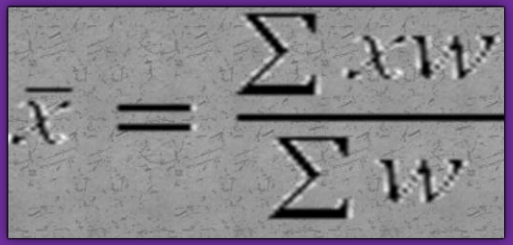
$$\overline{X} = A + \frac{\sum fd}{N}$$

- **Step deviation Method :**

$$\overline{X} = A + \frac{\sum fd}{N} \times i$$

Weighted Mean

- **Weighted mean** is the mean of a set of values wherein each value or measurement has a different weight or degree of importance.



where

- x = measurement or value
- w = weight of measurements

Merits of Mean

1. It can be easily calculated.
2. Its calculation is based on all the observations.
3. It is easy to understand.
4. It is rigidly defined by the mathematical formula.
5. It is least affected by sampling fluctuations.
6. It is the best measure to compare two or more series of data.
7. It does not depend upon any position.
8. It is capable of further algebraic treatment.

Demerits of Mean

1. It may not be present in actual data so it is theoretical.
2. It is highly affected by extreme values.
3. It can not be calculated if all the observations are not known.
4. It can not be used for qualitative data i.e. beauty , honesty, etc.
5. It cannot be calculated in the case of open end classes.
6. It cannot be determined graphically.

Median

- The **MEDIAN,** denoted by M, is the middle value of the sample when the data are ranked in order according to size.
- Connor has defined as " The median is that value of the variable which divides the group into two equal parts, one part comprising of all values greater, and the other, all values less than median"
- For Ungrouped data median is calculated as:

$$Median(M) = Size\ of \left(\frac{N+1}{2}\right) th\ item$$

- For Grouped Data:

$$Median(M) = L1 + \frac{\frac{N}{2} - cf}{f} \times i$$

Merits of Median

- Median can be calculated in open end class intervals.
- Median can be understood even by common people.
- Median is rigidly defined.
- Median can be ascertained even with the extreme items.
- It can be located graphically.
- It is most useful dealing with qualitative data.

Demerits of Median

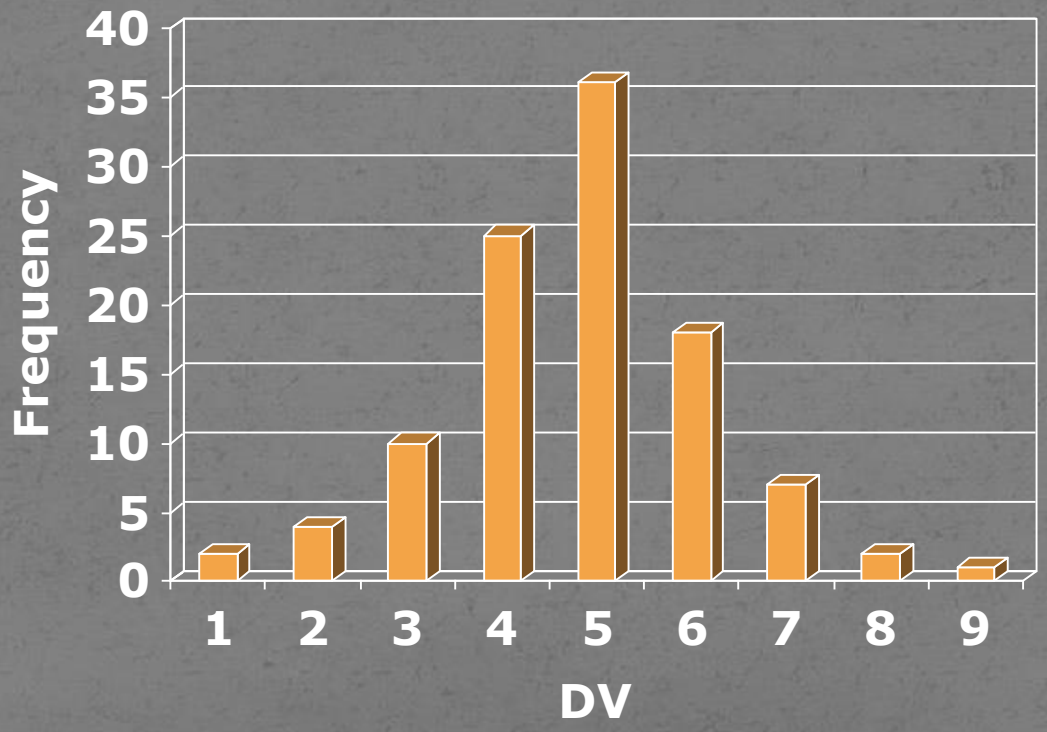
- It is not based on all the values.
- It is not capable of further mathematical treatment.
- It is affected by fluctuation of sampling.
- In case of even no. of values it may not be the value from the data.
- It becomes difficult to arrange huge data.

Mode

- The MODE, denoted by Z, is the value which occurs most frequently in a set of values. In other words, it is the most popular value in a given set.

- Croxton and Cowden defined it as “The mode may be regarded as the most typical of a series of value.”

- Mode = most frequently occurring data point



Merits of mode

- Mode is readily comprehensible and easy to calculate.
- It is not affected by extreme values.
- Mode can be calculated in case of open end classes
- It can be used in case of qualitative data.
- It can be calculated by graphic method.
- All frequencies are not needed for its calculation.

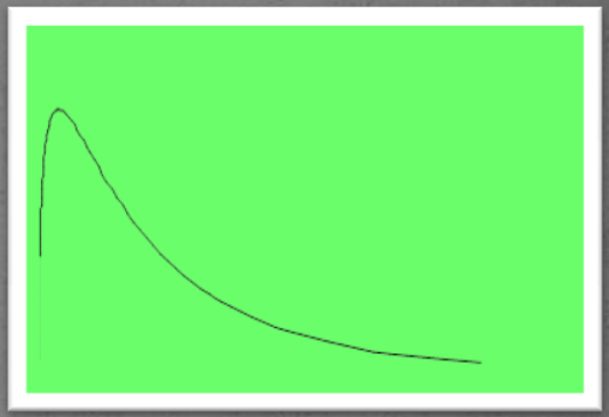
Demerits of Mode

- Mode is ill-defined. Not always possible to find a clearly defined mode.
- 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.
- When data sets contain two, three, or many modes, they are difficult to interpret and compare.

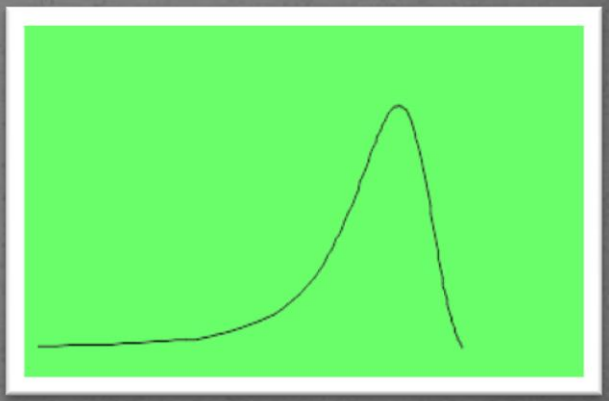
Relation Between the Measures of Central Tendency

- In symmetrical distributions,

  mean = median = mode
- In positively skewed distributions, the mean is greater than the median and mode



- In negatively skewed distributions, the mean is smaller than the median and mode



Conclusion

- A measure of central tendency is a measure that tells us where the middle of a bunch of data lies.
- Mean is the most common measure of central tendency. It is simply the sum of the numbers divided by the number of numbers in a set of data. This is also known as average.
- Median is the number present in the middle when the numbers in a set of data are arranged in ascending or descending order.
- Mode is the value that occurs most frequently in a set of data.

Questions

- Research on effect of a new antibiotic on patients?
- Mathematical measures
- Research on satisfaction level of new students in an institution?
- Mathematical measures
- Research on comparative analysis of electronic goods in India & China?
- Mathematical measures

Questions

- Research on consumption pattern of middle class families in a city?
- Positional measures
- Research on study of problems of people due to income inequalities?
- Positional measures
- Research on preferences of people among fast food joints?
- Positional measures