Chapter 5: Measures of Central Tendency

Important Term and Concepts:

1. Average: It is a value which is typical or representative of a set of data.
   Averages are also called Measures of Central Tendency.
2. Functions of Average:
   i] Presents complex data in a simple form.
   ii] Facilitates comparison.
   iii] Helps government to form policies.
   iv] Useful in Economic analysis.
3. Essentials of a good Average:
   i. Simple to calculate.
   ii. It should be easy to understand.
   iii. Rigidly defined.
   iv. Based on all items of observation.
   v. Least affected by extreme values.
   vi. Capable of further algebraic treatment.
   vii. Least affected by sampling fluctuation.
   viii. Graphic measurement possible.
4. Types of Averages:
   i. Arithmetic Mean
   ii. Median
   iii. Mode
   iv. Quartiles
5. Arithmetic Mean (X)
   It is the most common type of measures of central tendency.
   It is obtained by dividing the sum of all observation in a series by the total number of observation.
6. Calculation of Arithmetic Mean:

Direct Method	$X = \frac{\sum X}{N}$	$X = \frac{\sum fx}{\sum f}$
Assumed Mean Method	$X = A + \frac{\sum X}{N}$	$X = A + \frac{\sum fd}{\sum f}$
Step Deviation Method	$X = A + \frac{\sum d'}{N} \times i$	$X = A + \frac{\sum fd'}{\sum f} \times i$

7. Merits of Arithmetic Mean:

1] Easy to calculate
2] Simple to understand
3] Based on all observations
4] Capable of further mathematical calculations.

Demerits :

1] Affected by extreme values.
2] Cannot be calculated in open-end series.
3] Cannot be graphically ascertained.
4] Sometimes misleading or absurd result.

8. Weighted Arithmetic Mean:

Values to be arranged are given varying importance.

$$XW = \frac{\sum WX}{\sum W}$$

Where Xw = Weighted Arithmetic Mean
W = Weight
X = Values of the variables

9. Median (M)

It is defined as the middle value of the series, when the data is arranged in ascending or descending order.

Calculation of Median

For Individual & Discrete Series

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

Continuous series

Median Item = size of $(N/2)^{th}$ item.

$$M = L_1 + \frac{N/2 - c.f}{f} \times i$$

Merits

1. Easy to understand and easy to compute.
2. Not underly affected by extreme observation.
3. It can be located graphically.
4. Appropriate average in case of open end classes.

Demerits:

1. Not based on all observations.
2. It requires arrangement of data.
3. Not capable o further algebraic treatment.

10. Quartiles:

It divides the data into four equal parts.

There are three Quartiles – Q_1, Q_2, Q_3

Q_2 is called Median.

Calculation of Quartiles:

Individual and Discrete Series

$$Q_1 = \text{size of } \frac{(n+1)^{th}}{4} \text{ item}$$

$$Q_3 = \text{size of } 3\,\frac{(n+1)^{th}}{4} \text{ item}$$

Continuous Series:

Q_1, item = size of $(N/4)^{th}$ item

$$Q_1 = L_1 + \frac{N/4 - c.f.}{f} \times i$$

Q_3 item = size of $3(n/4)^{th}$ item

$$Q_3 = L_1 + \frac{3(N/4) - c.f}{f} \times i$$

11. Mode (Z)

It is the value which occurs the most frequently in a series.

Calculation of Mode

i. Individual Series :

ii. By observation identify the value that occurs most frequently in a series.

iii. By conversion into discrete series and then identify the value corresponding to which there is highest frequency.

Discrete Series:

i. By Inspection Method.

ii. Grouping Method: By preparing Grouping Table and then preparing Analysis table.

Continuous Series:

i. Determination of Modal class by Inspection Method or Grouping table and Analysis table.

ii. Applying the formula

$$Z = L_1 + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

OR

$$Z = L1 + \frac{D_1}{D_1 + D_2} \times i$$

Merits of Mode

i. It is easy to understand and simple to calculate.
ii. Not affected by extreme values.
iii. Can be located graphically.
iv. Easily calculated in case of open-end classes.

Demerits of Mode

i. Not rigidly defined.
ii. If mode is ill defined, mathematical calculation is complicated.
iii. Not based on all items.
iv. Not suited to algebraic treatment.

12. Relationship between Mean Median and Mode

i. In case of symmetrical distribution

Mean = Median = Mode

ii. In case of asymmetrical distribution

Mode = 3 Median – 2 Mean

1 mark questions:

1. Define an average.
2. Define mode.
3. Age of 5 students is 22, 24, 26, 21, 20. Find the modal age.
4. What is the relationship of Mean, Median and Mode in an asymmetrical distribution?

3 marks questions:

1. Calculate the Mean & Median from the following data :

	-	-	-			-

2. Calculate Mode from the following data.

No. of Students	2	5	8	10	8	5	2

4 mark questions:

1. Mention any 2 Merits and Demerits each of Arithmetic Mean.
2. What are the requisites of a good average?