CLASS XI ECONOMICS NOTES

Measures of Central Tendency

Key Notes and Important Questions with Answers

Unit - 3
STATISTICAL TOOLS AND INTERPRETATION
MEASURES OF CENTRAL TENDENCY

- A central tendency is a single figure that represents the whole mass of data.

1. **Mean :-** The mean is the average of a set of numbers of data.

   - Arithmetic mean is the number which is obtained by adding the values of all the items of a series and dividing the total by the number of items.

   - When all items of a series are given equal importance then it is called simple mean and when different items of a series are given different weight according to their relative importance is known as weighted arithmetic mean .

- **The Merits of mean**
   1. It is simple to compute and understand
   2. It is rigidly defined
   3. Based on all values
   4. Easy to comparison

- **The demerit of mean**
   1. It is affected by unduly extreme values
   2. Mean value may not exist in the series
   3. Misleading conclusion
   4. It can not be estimated with graph

2. **Median –** The Median is the middle value of the series when data are arranged in ascending order or in descending order.

- Quartile – If a series is divided into four equal parts, the end value of each part is called a quartile.

- **Merits of Median**
   1. It is not affected by extreme value
   2. It can be determined by graphical method
   3. It can be measured even when data is incomplete

- **Demerits of Median**
   1. It is not based on all items.

2. In arranging the data in ascending or in descending order it takes much time.
3. Not suitable for algebraic treatment.
4. Affected by fluctuations of items.

3. **Mode** - Mode is the value which occurs most frequently in the series.

- **The Merits of Mode**
  1. It is easy to calculate.
  2. It is not affected by the extreme values.
  3. It can be located on graph.
  4. It is the most representative value in the given series.

- **The Demerits of Mode**
  1. It is not based on all the values.
  2. It is not suitable for statistical treatment.
  3. Procedure of grouping is complicated.
  4. It is an uncertain measure.

- **Main purposes and functions of Central Tendencies**
  1. Comparisons
  2. Formulations of policies
  3. To represent a brief picture of data.
  4. One value for all the group.

- **Relation among Mean, Median and Mode**

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

- <u>**Formulae of calculating mean**</u>

Types of series	Direct Method	Shortcut Method	Step Deriation Method
Individual	$\bar{x} = \dfrac{\Sigma x}{N}$	$\bar{x} = A + \dfrac{\Sigma d}{N}$	$\bar{x} = A + \dfrac{\Sigma d'}{N} \times C$
Discrete	$\bar{x} = \dfrac{\Sigma fx}{N}$	$\bar{x} = A + \dfrac{\Sigma fd}{N}$	$\bar{x} = A + \dfrac{\Sigma fd'}{N} \times C$
Continuous	$\bar{x} = \dfrac{\Sigma fm}{N}$	$\bar{x} = A + \dfrac{\Sigma fd}{N}$	$\bar{x} = A + \dfrac{\Sigma fd'}{N} \times C$

- Combined Mean

$$\boxed{\bar{X}_c = \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2}}$$

- Weighted Mean

$$\boxed{\bar{X}_w = \frac{\Sigma WX}{\Sigma W}}$$

- ## **Formulae of calculating median and Quartile Deviation**

Measures	Individual Series	Discrete Series	Continuous Series	
	Size of item	Size of item	size of items	Formula
Median (Q_2)	$\left(\dfrac{N+1}{2}\right)^{th}$ term	$\left(\dfrac{N+1}{2}\right)^{th}$ term	$\dfrac{N}{2}$	$L_1 + \dfrac{\dfrac{N}{2} - CF}{f} \times i$
First (Q_1) Quartile	$\left(\dfrac{N+1}{4}\right)^{th}$ term	$\left(\dfrac{N+1}{4}\right)^{th}$ term	$\dfrac{N}{4}$	$L_1 + \dfrac{\dfrac{N}{4} - CF}{f} \times i$
Third $(Q_3)_3$ Quartile	$\left(\dfrac{N+1}{4}\right)^{th}$ term	$3\left(\dfrac{N+1}{4}\right)^{th}$ term	$3\left(\dfrac{N}{4}\right)$	$L_1 + \dfrac{\dfrac{3N}{4} - CF}{f} \times i$

- ## **Formula of Calculating Mode**

(i) $\quad Z = L_1 + \dfrac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$

Where $\quad L_1 =$ Lower limit of modal class

$\qquad f_1 =$ Frequency of modal class

$\qquad f_0 =$ Frequency of pre modal class

$\qquad f_2 =$ Frequency of after modal class
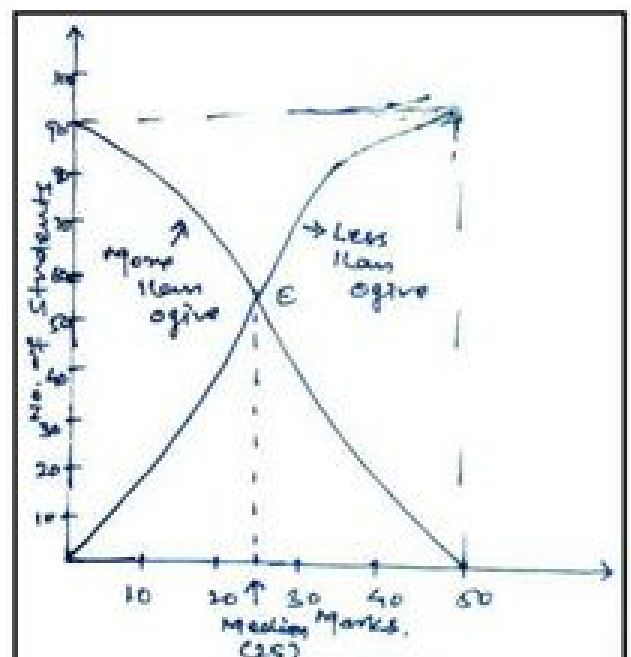
$\qquad L = L_2 - L_1 \quad$ Class interval of the modal class.

(ii) $\quad Z = 3M - 2X;\quad$ where $M =$ Median, $X =$ Mean
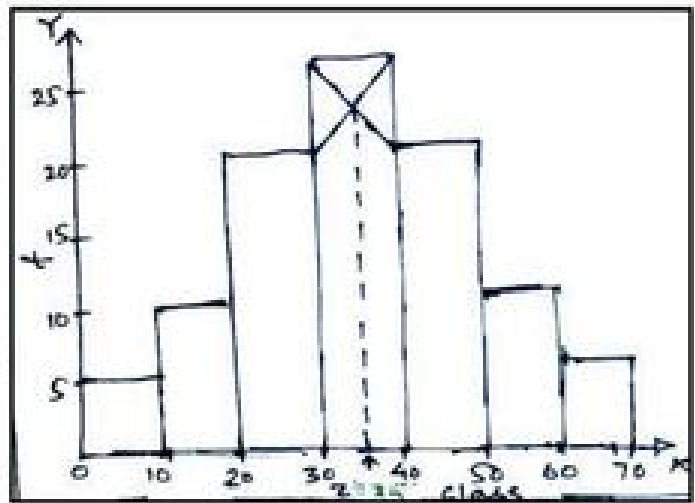
- ## **Graphical Method to Calculate the Median**

Median is calculated with the help of less than or more than ogive curve. Both intersects at point E. A perpendicular is drawn on X-axis from E, which touches at 25.

$\qquad$ So, Median is 25.

- **Graphical Method of Calculating Mode**

    Graphically mode is calculated by drawing histogram. The rectangle with the greatest height will be the modal class. By joining the top right point of the rectangle of the modal class with the top right point of the rectangle of the class preceding the modal class. Similarly with left point of the rectangle of modal class with the top left point of the rectangle of the class succeeding the modal class. Both line intersect each other. From intersection point draw a perpendicular on x-axis which cuts x-axis at 35. So mode is 35.

QUESTION BANK

ONE (1) MARK QUESTIONS :-

1) What is meant by mean?

2) Write two types of mean.

3) Write one merit of median.

4) Find mode 10, 5, 4, 6, 4, 5, 4, 12, 4, 15, 4

5) Write the formula of combined mean.

6) Define quartile.

7) Define median.

8) What is the relationship b/w mean, median and mode?

9) What is the sum of derivations taken from mean in a series?

10) State one objective of an average.

11) Name the most popular statistical average.

12) Find median of 4, 9, 10, 12, 14

13) State one disadvantage of mode.

14) How many columns are there in a grouping method ?

15) If mean is 40 and median is 48. Find mode.

THREE AND FOUR (3 & 4) MARKS QUESTIONS :-

1) Write two merits and demerits of median.

2) State three advantages of mode.

3) The average marks in statistics obtained by 30 students is 52. The average marks of top 6 students is 31. Calculate average marks of the remaining students.

   Ans. 57.25

4) The average marks of 100 students were found to be 40. Later on it was discovered that a score of 53 was misread as 83. Find the correct mean.

   Ans. 39.7

5) Calculate Mean

Class	1-10	11-20	21-30	31-40	41-50
Freq.	4	10	20	13	3

   Ans. $\overline{X}$=25.7

6) Find out Q_1 and Q_3.

   6, 8, 10, 12, 18, 19, 23, 23, 24, 28, 37, 48, 49, 53, 56

   Ans. $Q_1 = 12$
   $Q_3 = 48$

7) Show that the sum of deviations of the observation from their arithmetic mean is zero with the help of suitable example.

SIX (6) MARKS QUESTIONS :-

1) If $\overline{X}$ = 52, find missing frequency.

Class	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Freq.	5	3	4	?	2	6	13

   Ans. 7

2) Calculate mean from following information by short-cut method.

Marks	0-10	10-20	20-30	30-40	40-50
No. of Students	4	6	10	20	10

   Ans. $\overline{X}$=30.2

3) Calculate mean by step derivation method.

Class	5-15	15-25	25-35	35-45	45-55	55-65
Freq.	8	12	6	14	7	3

   Ans. $\overline{X}$=31.8

4) Find out median.

Age(Yrs)	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
No. of Person	50	70	100	180	150	120	70	60

   Ans. 40 Year

5) Calculate the Mean.

Class	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Freq.	7	9	11	28	30	22	7	5

Ans. 21

6) Find out Q_1 and Q_3.

X	30-35	35-40	40-45	45-50	50-55	55-60	60-65
Freq.	14	16	18	23	18	8	3

Ans. $Q_1 = 38.43$, $Q_3 = 51.11$

7) Calculate Mean, Median and Mode.

Marks	10-19	20-29	30-39	40-49	50-59
No. of Students	3	5	9	3	2

Ans. $\overline{X} = 37.6$, M = 36.7, Z = 36

8) Graphically calculate Median.

Class	0-10	10-20	20-30	30-40	40-50	50-60
Freq.	6	11	20	12	6	5

Ans. M = 26.5

ANSWER OF ONE (1) MARK QUESTIONS

1) Mean is defined as the sum of all items divided by their numbers.

2) Two types of mean are

   (i) Simple mean (ii) Weighted mean

3) It can be determined by graphical method.

4) Mode = 4

5) $\overline{X}_c = \dfrac{N_1\overline{X}_1 + N_2\overline{X}_2}{N_1 + N_2}$

6) Quartile is a value which divide a series into four equal parts.

7) Median is a value which divide a series into two equal parts.

8) Mode = 3 median – 2 mean

9) Zero

10) It summarises huge data.

11) Mean

12) 10

13) It is not based on all the values.
14) six
15) $Z = 3M - 2\overline{X} = 3 \times 48 - 2 \times 40$
$$= 144 - 80 = 64$$

Exam Oriented Questions with Answers

1. Which average would be suitable in the following cases ?
    (a) Average production in factory per shift.
    (b) Average wages in an industrial concern.
    (c) In case of open ended frequency distribution
    (d) Average size of readymade garments.
    (e) Average intelligence of students in a class.

Ans. (a) Arithmetic Mean   (b) Arithmetic mean
      (c) Median.   (d) Mode   (e) Median

2. Write merits and demerits of mean or median.

Ans.

Mean	Median
Merits	**Merits**
a) No. need of arrangement of data	a) Definite value
b) Easy to calculate	b) Expressed/determined graphically.
c) Based on all values of series	c) Easy to calculate
Demerits	**Demerits**
a) Can't be located graphically	a) Arrangement of data is required
b) Calculation not possible if single item missing	b) Not suitable for algebraic treatment
c) Not used in case of qualitative measurement	c) Affected by fluctuations of items.

3.   What are the requisites of an ideal averages ?

Ans.   i)   Easy to understand.

ii)   Easy to compute.

iii)   Rigidly defined.

iv)   Based on all items of series.

v)   Capable of algebraic treatment

vi)   Least effect of fluctuation.

4.   Write main objectives and functions of averages.

Ans.   The main objectives and functions of averages are following.

1.   It establish relationship between different groups.

2.   It summarises huge data.

3.   It makes comparison easier.

4.   It helps in decision-making.

5.   Write properties of arithmetic mean.

Ans.   These are the following properties of arithmetic mean.

1.   The sum of deviation of the observations from their arithmetic mean is always zero.

2.   The sum of the square of the deviations of the items from their arithmetic mean is minimum.

3.   If each observation of a series is increased or decreased by a constant, say K, then the arithmetic mean of the new series will also get increased or decreased by K.

4.   If all the items in a series are multiplied or divided by a constant, then the mean of these observations also get multiplied or divided by it.