Chapter-5
MEASURES OF CENTRAL TENDENCY

Points to Remember :-

*   A central tendency is a single figure that represents the whole mass of data.
*   Arithmetic mean or 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 than it is called simple arithmetical mean and when different items of a series are given different weights according with their relative importance is known weighted arithmetic mean.
*   Median is the middle value of the series when arranged in ascending order.
*   When a series is divided into more than two parts, the dividing values are called partition values.
*   If a statistical series is divided into four equal parts, the end value of each part is called a quartile and denoted by 'Q'.
*   The first quantile or lower quartile (Q1) is that value which divides the first half of an orderly arranged series into two equal parts.
*   Third quartile or upper quartile (Q3) is that value which divides the latter half of an ascending orderly arrenged series into two equal parts.
*   Mode is the value which occurs most frequently in the series, that is modal value has the highest frequency in the series.

*   Main purposes and functions of averages.
    (i)   To represent a brief picture of data.
    (ii) Comparison.

(iii)   Formulation of policies.

(iv)   Basis of statistical analysis.

(v)   One value for all the group or series.

*   Essentials of a good average.

(i)   Easy to understand.

(ii)   Easy to compute

(iii)   Rigidly defined.

(iv)   Based on all the items of series.

(v)   Certain in character

(vi)   Least effect of a change in the sample.

(vii)   Capable of algebraic treatment.

*   Merits of Arithmatic mean

(i)   Simplicity

(ii)   Certainty

(iii)   Based on all values.

(iv)   Algebraic treatment possible.

(v)   Basis of comparision.

(vi)   Accuracy test possible.

*   Demerits of Arithmatic mean.

(i)   Effect of extreme values.

(ii)   Mean value may not figure in the series

(iii)   unsuitability.

(iv)   Misleading conclusions.

(v)   Can not be used in case of qualitative phenomenon.

*   Merits of Median

(i)   Simple measure of central tendency.

(ii)   It is not affected by extreame observations.

(iii)   Possible even when data is incomplete.

(iv)   Median can be determined by graphic presentation of data.

(v)   It has a definite value.

*   Demerits of median.

(i)   Not based on all the items in the series.

(ii)   Not suitable for algebraic treatment.

(iii)   Arranging the data in ascending order takes much time.

(iv)   Affected by fluctuations of items.

*   Merits of mode

(i)   Simple and popular measure of central tendency.

(ii)   It can be located graphically with the help of histogram.

(iii)   Less effect of marginal values.

(iv)   No need of knowing all the items of series.

(v)   It is the most representative value in the given series.

*   Demerits of mode

(i)   It is an uncertain measure

(ii)   It is not capable of algebrate treatment.

(iii)   Procedure of grouping is complex.

(iv)   It is not based on all observations.

*   Relation among mean, median and mode

         Mode = 3 median - 2 mean

*   Location of median by graph -

         (i)   By 'Less than' or 'More than' ogives method a frequency distribution series is first converted into a less than or more than cummulative series as in the case of ogives, data are presented graphically to make a 'less than' or 'more than' ogive N/2 item of the series is determined and from this print (on the y-axis of the

graph) a perpendicular is drawn to the right to cut the cummulative frequency curve. The median value is the one where cummulative frequency curve cuts corresponding to x-axis.

(ii)　　Less than and more than ogive curve method present the data graphically in the form of 'less than' and 'more than' ogives simultamously. The two ogives are superimposed upon each other to determine the median value.　Mark the point where the ogive curve cut each other, draw a perpendicular from that point on x-axis, the corresponding value on the x-axis would be the median value.

* 　　Graphic representation of mode -

Prepare a histogram from the given data find out the ractangle whose hight is the highest. This will be the modal class. Draw two lines - one joining the top right point of the ractangle preceding the modal class with top right point of the modal class. The other joining the top left point of the modal class with the top left point of the post modal class. From the point of intersection of these two diagonal lines, draw a perpendicular on horizontal axis i.e. x-axis the point where this perpendicular line meets x-axis, gives us the value of mode.

* 　　Formulae of calculating arithmatic mean -

Types of series	Direct Method	Shortcut Method	Step deviation method
Individual Series	$\overline{X} = \dfrac{\sum X}{N}$	$\overline{X} = A + \dfrac{\sum d}{N}$	$\overline{X} = A + \dfrac{\sum d'}{N} \times C$
Discrete Series	$\overline{X} = \dfrac{\sum fx}{N}$	$\overline{X} = A + \dfrac{\sum fd}{N}$	$\overline{X} = A + \dfrac{\sum fd'}{N} \times C$
Continuous Series	$\overline{X} = \dfrac{\sum fm}{N}$	$\overline{X} = A + \dfrac{\sum fd}{N}$	$\overline{X} = A + \dfrac{\sum fd'}{N} \times C$

*   Weighted mean - $\bar{X} = \dfrac{\sum W X}{\sum W}$

*   Formulae of calculating median and partition values -

Measure	Individual Series	Discrece Series	Continuous Series	
	Size of item	Size of item	Size of item	Formula
Median	$\dfrac{N+1}{2}^{th}$ = item	$\dfrac{N+1}{2}^{th}$ = item	$\dfrac{N}{2}$	$L_1 + \left(\dfrac{\frac{N}{2} - cf}{f}\right) \times c$
First Quartile Q_1	$\dfrac{N+1}{4}^{th}$ = item	$\dfrac{N+1}{4}^{th}$ = item	$\dfrac{N}{4}$	$L_1 + \left(\dfrac{\frac{N}{4} - cf}{f}\right) \times c$
Third Quartile Q_3	$\dfrac{3(N+1)}{4}^{th}$ = item	$\dfrac{3(N+1)}{4}^{th}$ = item	$\dfrac{3(N)}{4}$	$L_1 + \left(\dfrac{3\frac{N}{4} - cf}{f}\right) \times c$
Decile D_6	$\dfrac{6(N+1)}{10}^{th}$ = item	$\dfrac{6(N+1)}{10}^{th}$ = item	$\dfrac{6(N)}{10}$	$L_1 + \left(\dfrac{\frac{N}{10} - cf}{f}\right) \times c$
Percentile P_{65}	$\dfrac{65(N+1)}{100}^{th}$ = item	$\dfrac{65(N+1)}{100}^{th}$ = item	$\dfrac{65(N)}{100}$	$L_1 + \left(\dfrac{\frac{N}{100} - cf}{f}\right) \times c$

*   Formula of calculating mode in continuous series -

Mode or Z - $L_1 + \dfrac{f1 - fo}{2f1 - fo - f2} \times c$

Where, L_1 =   Lower limit of modal class

         fo   =   Frequency of the group preceding the modal class

         f1   =   Frequency of the modal class.

         f2   =   Rrequency of the group succeeding the modal class

         c   =   Magnitude or class interval of the modal class

ONE MARK QUESTIONS

1.   What is meant by central tendency?.
2.   What are the types of mean?.
3.   Name any two partition values.
4.   Give the meaning of arithmatic average.
5.   Define mode.
6.   Pocket money of 8 students is Rs. 6,12,18, 24, 30, 36, 42 and 48, calculate mean.
7.   Write the formula for weighted mean.
8.   What is the relation among the mean, median and mode?
9.   Which partition value divide the total set of values into four equal parts.
10.   Give the meaning of combined mean.
11.   A shoes manufacturing company only manufactures shoes for adults. Company wants to know the most popular size. Which type of central tendency will be the most appropriate?
12.   Which diagram is used for finding the value of mode graphically?
13.   Mention one demerit of mode.
14.   If the values of mean and median are 40 and 48. Find out the most probable value of mode.
15.   Calculate mode from the following data 10, 8, 10, 6, 4, 12, 10, 8, 10, 18, 16, 10, 18, 10, 10.
16.   How is the value of median computed with the help of ogive curves?.
17.   What is positional average?
18.   What is the sum of deviations taken from mean in a series.

3/4 MARKS QUESTIONS

1. Give four objectives of statistical average.
2. Show that the sum of deviations of the values of the variable from their arithmatic mean is equal to zero.
3. Write the merits of median.
4. Calculate median from the following data

X	10	20	30	80	90	100
f	3	7	6	2	8	4

(Ans. 30)

5. State three advantages of mode.
6. What are four demerits of mean.
7. Average income of 50 families is Rs. 3000.
    Average income of 12 families is Rs. 18000.
    Find the average income of rest of the families   (Ans. 3378.95)
8. What are the essentials of a good average.
9. Mean marks obtained by a student in his five subjects are 15 in english he secures 8 marks, in economics 12, in mathematics 18 and in commerce 9, Find out the marks he secured in statisties.
10. What is meant by weighted arithmatic mean? How is it calculated?.
11. Name and define three statistical averages.
12. State any two reasons of difference between median and mode.
13. Explain the characterstics, merits and demerits of mean.

6 MARKS QUESTIONS

1. Explain the step deviation method of calculating arithmatic mean, taking an imaginary set of data.
2. Describe the objects and functions of measures of central tendency.
3. Why is the Arithmatic mean the most commonly used measure of central tendency?
4. What do you mean by mode? Discuss the methods of calculating it.
5. Explain the characterstics, merits and demerits of median
6. Rahul made the following runs in different matches.

Runs	5-15	15-25	25-35	35-45	45-55
Frequency	10	12	17	19	22

   Calculate the average mean of the runs by step deviation method. (Ans 33.87)

7. Find the missing frequency if the mean of following data is 44.8.

X	20	30	40	50	60	70
F	5	?	15	10	8	5

8. Find the median of the following data.

Marks	46-50	41-45	36-40	31-35	26-30	21-25	16-20	11-15
No. of Students.	3	11	22	35	26	13	10	7

   (Ans. 31.7)

9. From the following table find mode with the help of graphical representation and check your result with mathematical formula.

Expanditure	0-10	10-20	20-30	30-40	40-50
No. of Families	14	23	27	21	25

(Ans. 24)

10. From the following data find out the value of median graphically.

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of Student	6	11	20	12	6	5

(Ans. 26.5)

ANSWER OF ONE MARK QUESTIONS

1. A Single figure that represents the whole series is known as central tendency.

2. There are two types of mean - simple and weighted.

3. (i) Quartile   (ii) Decile   (iii) Percentile

4. When the sum of all items is divided by their number is known as arithmatic average.

5. The value which occurs most frequently in series is known as mode.

6. $$\overline{X} = \frac{X_1 + X_2 + X_3 + \text{---------} X_N}{N}$$
    $$= \frac{6+12+18+24+30+36+42+48}{8}$$
    $$= \frac{216}{8} = 27$$

7. $$\overline{X}_W = \frac{\sum W X}{\sum W}$$

8. Mode = 3 median - 2 mean

9. Quartile

10. When the mean of two or more than two series is computed collectively, it is known as combined mean.

11. Mode

12. Histogram

13. One demerit of mode is that it is not capable of algebraic treatment.

14. Mode = 3 median - 2 mean
    = (3x 48) - (2 x 40) = 144 - 80
    = 64

15.   Mode = 10

16.   The point of intersection where 'less than' ogive curve and 'more than' ogive curve intersect each other gives us the value of mediam.

17.   Those averages whose value is worked out on the basis of their position in the statistical series.

18.   Zero.