2 MEASURES OF CENTRAL TENDENCY

INTRODUCTION

A frequency distribution, in general, shows clustering of the data around some central value. Finding of this central value or the average is of importance, as it gives the most representative value of the whole group. Different methods give different averages which are known as the measures of central tendency. The commonly used measures of central values are mean, median, mode, geometric mean and harmonic mean.

There are two main objectives of the study of averages.

(i) To get single value that describes the characteristic of the entire group. Measures of central value, by condensing the mass of data in one single value, enable us to get a bird's-eye view of the the entire data.

(ii) To facilitate comparison, measures of central value, by reducing the mass of data to one single figure, enable comparison to be made. Comparison can be made either at a point of time or over a period of time. For example, we can compare the percentage results of the students of different colleges in a certain examination.

Since an average is a single value representing a group of values, it is desired that the value satisfies the following properties:

(i) Easy to understand

(ii) Simple to compute

(iii) Based on all the items

(iv) Not be undully affected by extreme observations

(v) Capable of further algebraic treatment

(vi) Sampling stability

Definition A numerical expression which is used to present a whole series should neither have the lowest value nor the heighest value in the series, but a value somewhere between these two limits, possibly in the centre, where most of the items of the series cluster, such figures are called *measures of central tendency* or measures of locations or averages.

$$GM = [(x_1)^{f_1}\ (x_2)^{f_2} \ldots (xn)^{f_n}]^{\frac{1}{n}}$$

$$\therefore \quad \log GM = \frac{1}{n}[f_1 \log x_1 + f_2 \log x_2 + \ldots f_n \log x_n]$$

$$\therefore \quad GM = \text{Antilog}\left(\frac{\Sigma f_i \log x_i}{n}\right)$$

Harmonic Mean

If $x_1, x_2, x_3 \ldots x_n$ be a set of n observations then the harmonic mean is defined as the reciprocal of the (arithmetic) mean of the reciproculs of the quantities.

Thus,
$$HM = \frac{1}{\frac{1}{n}\left(\frac{1}{x_1} + \frac{1}{x_2} + \ldots + \frac{1}{x_n}\right)}$$

In a frequency distribution harmonic mean is given by

$$HM = \frac{1}{\frac{1}{N}\left(\frac{f_1}{x_1} + \frac{f_2}{x_2} + \ldots + \frac{f_n}{x_n}\right)}$$

where $N = \Sigma f_i$

MEDIAN

If the values of the variable are arranged in the ascending or descending order of magnitude, the median is the middle item if the number is odd and is the mean of the two middle items if the number is even. Thus, the median is equal to the mid-value i.e. the value which divides the total frequency into two equal parts.

For computation of median, it is necessary that the items be arranged in ascending order.

1. Ungrouped frequency distribution:

   Arrange the n values of the variate in ascending or descending order.

   (a) When n is odd, the middle value, i.e. $\left(\frac{n+1}{2}\right)$th value gives the median.

   (b) When n is even, there are two middle values $\frac{n}{2}$th and $\left(\frac{n}{2}+1\right)$th. The arithmetic mean of these two values gives the median.

2. For grouped frequency distribution

$$\text{Median} = l + \frac{\left(\frac{N}{2} - C\right)}{f} \times h$$

where l is the lower limit of the median class
N is the total frequency
f is the frequency of this class
h is the width of the class and
C is the cumulative frequency upto the class preceding the median class.

52.5-60.5	5	56.5	3	15
60.5-68.5	8	64.5	4	32
68.5-76.5	2	72.5	5	10
	$\Sigma f_i = 90$			$\Sigma f_i u_i = -13$

Here $h = 8 \quad A = 32.5$

$$\text{Mean} = A + \frac{h\Sigma f_i u_i}{\Sigma f_i}$$

$$= 32.5 + \frac{8 \times -13}{90}$$

$$= 31.35$$

Example 4 The mean of 200 items was 50. Later on, it was found that two items were read as 92 and 8 instead of 192 and 88. Find the correct mean.

Solution Here $n = 200$ and incorrect value of $\bar{x} = 50$

Since $\bar{x} = \frac{\Sigma x}{n}$ $\therefore$ $\Sigma x = n\bar{x}$

$\therefore$ Incorrect total $= 200 \times 50 = 10{,}000$

$\therefore$ Correct total $= 10{,}000 - (92 + 8) + (192 + 88)$

$= 10180$

$\therefore$ Correct mean $= \frac{10180}{200} = 50.9$

Example 5 Find the missing frequency from the following data.

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	5	15	20	–	20	10

Given AM is 34 marks.

Solution Let f_1 be the missing frequency.

Now, $\text{AM} = \bar{x} = 34$

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$\therefore \quad 34 = \frac{2200 + 35f_1}{70 + f_1}$$

$$\therefore \quad 34\,(70 + f_1) = 2200 + 35\,f_1$$

$$\therefore \quad f_i = 180$$

Example 6 Calculate the missing frequency from the following data.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	4	7	12	–	22	11	3

Given AM is 37

Solution Let f_i be the missing frequency.

Now AM $\bar{x} = 37$

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$37 = \frac{2955 + 35f_1}{59 + f_1}$$

$$\therefore \quad 37(59 + f_i) = 2955 + 35f_i$$

$$\therefore \quad 37f_i - 35f_i = 2955 - 37 \times 59$$

$$\therefore \quad 2f_i = 772$$

$$\therefore \quad f_i = 386$$

Example 7 Daily income of ten families of a particular place is given below. Find geometric mean. 85, 70, 15, 75, 500, 8, 45, 250, 40, 60.

Solution To find GM first, we calculate log x as follows.

x	85	70	15	75	500	2	45	250	40	36
log x	1.9294	1.8457	1.1761	1.8757	2.6990	0.9030	1.6532	2.3979	1.6021	1.5563

$$\therefore \quad \Sigma \log x = 17.6373$$

$$\therefore \quad \text{GM} = \text{Antilog}\left(\frac{\Sigma \log x}{n}\right)$$

$$= \text{Antilog}\left(\frac{17.6373}{10}\right) = 58.03.$$

Example 8 Calculate the geometric mean from the following data.

x 125, 1462, 38, 7, 0.22, 0.08, 12.75, 0.5

Solution First find log x

x	125	1462	38	7	0.22	0.08	12.75	0.5
log x	2.0969	3.1650	1.5798	0.8451	$\bar{1}.3424$	$\bar{2}.9031$	1.1055	$\bar{1}.6990$

$$\therefore \quad \Sigma x = 10.7368 \text{ and } n = 8$$

$$\therefore \quad \text{GM} = \text{Antilog}\left(\frac{\Sigma \log x}{n}\right) = \text{Antilog}\left(\frac{10.7368}{10}\right)$$

$$= 6.952$$

Example 9 Find the geometric mean for the following data given below.

Marks	4-8	8-12	12-16	16-20	20-24	24-28	28-32	32-36	36-40
Frequency	6	10	18	30	15	12	10	6	2

Solution To find GM, we form the table as follows.

Class	Midpoint m	f	$\log m$	$f \times \log m$
4-8	6	6	0.7782	4.6692
8-12	10	10	1.0000	10.0000
12-16	14	18	1.1461	20.6298
16-20	18	30	1.2553	37.6590
20-24	22	15	1.3224	20.1360
24-28	26	12	1.4150	16.9800
28-32	30	10	1.4771	14.7710
32-36	34	6	1.5315	9.1890
36-40	38	2	1.5798	3.1596
		$N = 109$		$\Sigma f \times \log m = 137.1936$

$$\therefore \quad \text{GM} = \text{Antilog}\left(\frac{\Sigma f \times \log m}{N}\right)$$

$$= \text{Antilog}\left(\frac{137.1936}{109}\right) = \text{Antilog}\ (1.2587)$$

$$= 18.14$$

Example 10 Find the harmonic mean from the following data.

x	2574	475	75	5	0.8	0.08	0.005	0.0009

Solution To find harmonic mean, calculate $\frac{1}{x}$.

x	2574	475	75	5	0.8	0.08	0.005	0.0009
$\frac{1}{x}$	0.0004	0.0021	0.0133	0.2000	1.2500	12.500	200.00	1111.1111

Here $n = 8$ $\quad \text{HM} = \dfrac{N}{\Sigma\frac{1}{x}} = \dfrac{8}{1325.0769}$

$$= 0.006.$$

Example 11 From the following data, compare the harmonic mean.

Marks	10	20	25	40	50
Students	20	30	50	15	5

Solution To find HM we form the table as follows.

Marks (x)	10	20	25	40	50
Students (f)	20	30	50	15	5
f/x	2.00	1.500	2.00	0.375	0.100

Here $N = 120$ and $\Sigma f/x = 5.975$

$$\therefore \quad \text{HM} = \frac{N}{\Sigma f/x} = \frac{120}{5.975} = 20.08.$$

Example 12 Compute the harmonic mean from the following data.

Class	10-20	20-30	30-40	40-50	50-60
Frequency	4	6	10	7	3

Solution To find the harmonic mean, we form the table as follows.

Class	Freq. f	Midpoint m	f/m
10-20	4	15	0.267
20-30	6	25	0.240
30-40	10	35	0.286
40-50	7	45	0.158
50-60	3	55	0.055
	$N = 30$		$\Sigma f/m = 1.004$

$$\therefore \quad \text{Harmonic mean} = \frac{N}{\Sigma f/m} = \frac{30}{1.004}$$

$$= 29.88.$$

Example 13 An incomplete frequency distribution is given below

Class	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	12	30	–	65	–	25	18

Given that the total frequency is 229 and median is 46. Find the missing frequencies.

Solution Let f_1 and f_2 be the missing frequencies of the classes 30-40 and 50-60 respectively.

Since the median lies in the class 40-50

$$\text{Median} = l + \frac{\left(\frac{N}{2} - C\right)}{f} \times h$$

$$46 = 40 + \frac{\left[\frac{229}{2} - (12 + 30 + f_1)\right]}{65} \times 10$$

$$\therefore \quad 46 - 40 = \frac{\left[\frac{229}{2} - (42 + f_1)\right]}{65} \times 10$$

$$\therefore \quad \frac{6 \times 65}{10} = \frac{229}{2} - 42 - f_1$$

$$\therefore \quad f_1 = \frac{229}{2} - \frac{390}{10} - 42$$

$$= 33.5 \simeq 34$$

$$\therefore \quad f_1 = 34$$

And $$f_2 = 229 - (12 + 30 + 34 + 65 + 25 + 18)$$

$$= 45$$

$\therefore$ Missing frequencies are $f_1 = 34$ and $f_2 = 45$

Example 14 Calculate median, the lower quartile, upper quartile, semi-interquartile range and the mode for the following data.

Class Marks	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45
Frequency	5	6	15	10	5	4	2	2

Solution We form the table as follows.

Class	Frequency	Cumulative frequency
5-10	5	5
10-15	6	11
15-20	15	26
20-25	10	36
25-30	5	41
30-35	4	45
35-40	2	47
40-45	2	49
	$N = 49$	

(1) Median $\left(\text{for } \frac{N}{2} = \frac{49}{2} = 24.5\right)$ falls in the class 15-20 and is given by

$$\text{Median} = l + \frac{\left(\frac{N}{2} - C\right)}{f} \times h$$

where $l = 15$, $N = 49$, $C = 11$, $h = 5$ and $f = 15$

$$\therefore \quad \text{Median} = 15 + \frac{\left(\frac{49}{2} - 11\right)}{15} \times 5 = 19.5 \text{ marks.}$$

(2) Lower quartile (Q_1) $\left(\text{for } \frac{N}{4} = 12.25\right)$ falls in the class 15-20

$$\therefore \quad Q_1 = l + \frac{\left(\frac{N}{4} - C\right)}{f} \times h$$

where $l = 15$, $N = 49$, $C = 11$, $h = 5$ and $f = 15$

$$\therefore \quad Q_1 = 15 + \frac{\left(\frac{49}{4} - 11\right)}{15} \times 5 = 15.4 \text{ marks}$$

(3) Upper quartile (Q_3) $\left(\text{for } \frac{3N}{4} = 36.75\right)$ falls in the class 25-30

$$Q_3 = l + \frac{\left(\frac{3N}{4} - C\right)}{f} \times h$$

where $l = 25$, $N = 49$, $C = 36$, $h = 5$ and $f = 5$

$$\therefore \qquad Q_3 = 25 + \left(3 \times \frac{49}{5} - 36\right) \times 5 = 25.75 \text{ marks}$$

(4) Semi-interquartile range

$$Q = \frac{1}{2}(Q_3 - Q_1) = \frac{1}{2}(25.75 - 15.4) = 5.175$$

(5) Mode: It is seen that the mode value falls in the class 15-20

$$\text{Mode} = l + \frac{f_m - f_1}{2f_m - f_1 - f_2} \times h$$

where $l = 15$, $f_m = 15$, $f_1 = 6$, $f_2 = 10$ and $h= 5$

$$= 15 + \frac{15 - 6}{2 \times 15 - 6 - 10} \times 5$$

$$= 18.2 \text{ marks}$$

Example 15 From the following marks find Q_1, Q_2 and Q_3 marks.

23, 48, 34, 68, 15, 36, 24, 54, 65, 75, 92, 10, 70, 61, 20, 47, 83, 19, 77

Solution Let us first arrange the given data in the ascending order.

SN	1	2	3	4	5	6	7	8	9	10
x	10	15	19	20	23	24	35	36	47	48
SN	11	12	13	14	15	16	17	18	19	
x	54	61	65	68	70	75	77	83	92	

Here $n = 19$

(i) Q_1 is the size of $\left(\frac{n+1}{4}\right)$th item $= \left(\frac{19+1}{4}\right)$th item

$= 5$th item

$= 23$

(ii) Q_2 is the size of $\left(\frac{n+1}{2}\right)$th item $\left(\frac{19+1}{2}\right)$th item

$= 10$th item $= 48$

(iii) Q_3 is size of $3\left(\frac{n+1}{4}\right)$th item $= 3\left(\frac{19+1}{4}\right) = 15$th item

$= 70$

Example 16 Find the median value of the follwing data.

43, 62, 15, 80, 56, 72, 34, 8, 25

Solution Arrange the data in an array form with serial numbers

S. No.	1	2	3	4	5	6	7	8	9
x	8	15	25	34	43	56	62	72	80

Median is the size of $\left(\frac{n+1}{2}\right)$th item

$$= \left(\frac{9+1}{2}\right)\text{th}$$

∴ median = 43

Example 17 Find the median value of the following.

36, 5, 19, 26, 6, 28, 56, 18, 63, 4

Solution Arrange the data in an array form with serial numbers

S. No.	1	2	3	4	5	6	7	8	9	10
x	4	5	6	18	19	26	28	36	56	63

Median is the size of $\left(\frac{n+1}{2}\right)$th item

$$= \frac{10+1}{2} = 5.5\text{th item}$$

The item lies in between 5th and 6th item.

$$\therefore \quad \text{Median} = \frac{19+26}{2} = \frac{45}{2} = 22.5$$

Example 18 Locate median and quartiles from the following data.

Size of shoes	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0
Frequency	20	36	44	50	80	30	30	16	14

Solution

x	f	CF
4.0	20	20
4.5	36	56
5.0	44	100
5.5	50	150
6.0	80	230
6.5	30	260
7.0	30	290
7.5	16	306
8.0	14	320

(1) Q_1 is the size of $\left(\frac{n+1}{4}\right)$th item

$$= \frac{320+1}{4} = 80.25\text{th item (lies in 100 CF).}$$

Against 100 CF, the value is 5.0

$$\therefore \quad Q_1 = 5.$$

(2) Median $Q_2 = \left(\frac{n+1}{2}\right)$th item

$= 160.50$th item (lies in 230 CF).

Against 230 CF the value is 6 $\therefore Q_2 = 6$

(3) Q_3 is the size of $\frac{3(n+1)}{4}$ th item = 240.75th item (lies in 260 CF)

Against 260 CF, the value is 6.5

$\therefore$ $Q_3 = 6.5$

Example 19 The mean height of 25 male workers in a factory is 61 inches and the mean height of 35 female workers in the same factory is 58. Find the combined mean of 60 workers in the factory.

Solution Given $n_1 = 25$, $\bar{x}_1 = 61$, $n_2 = 35$ and $\bar{x}_2 = 58$

The combined mean is given by

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2x_2}{n_1 + n_2}$$

$$= \frac{25 \times 61 + 35 \times 58}{25 + 35} = 3555/60$$

$$= 59.25$$

Thus, the combined mean height is 59.25 inches.

Example 20 Compute mean, median and mode for the following data.

Class	1-10	11-20	21-30	31-40	41-50	51-60
Freq	3	6	26	31	16	8

Solution Form the table as follows

Class	Freq f	Mid values x_i	$d_i = \frac{x_i - A}{h}$	f_id_i	CF
1-10	3	5.5	– 2	– 6	3
11-20	6	15.5	– 1	– 6	9
21-30	26	25.5 A	0	0	35
31-40	31	35.5	1	31	66
41-50	16	45.5	2	32	82
51-60	8	55.5	3	24	90
	90			75	

Here $\Sigma f = 90 = N$ $\Sigma f_id_i = 75$ $h = 10$

(1) $$\text{Mean} = A + \frac{h\ \Sigma f_id_i}{\Sigma f_i}$$

$$= 25.5 + \frac{10 \times 75}{90}$$

$$= 25.5 + 8.33 = 33.83$$

(2) Median $\left(\frac{N}{2} = \frac{90}{2} = 45\right)$ falls in the class 31-40

$$\therefore \qquad \text{Median} = l + \frac{\left(\frac{N}{2} - C\right)}{f} \times h$$

$$= 30.5 + \frac{\left(\frac{90}{2} - 35\right)}{31} \times 10$$

$$= 30.5 + 3.22 = 33.72$$

(3) Mode: The maximum frequuency is in the class 31-40

$$\text{Mode} = l + \frac{f_m - f_1}{2f_m - f_1 - f_2} \times h$$

$$= 30.5 + \frac{31 - 26}{2 \times 31 - 26 - 16} = 33.00$$

Example 21 Find the numbers whose arithmetic mean is 12.5 and geometric mean is 10.

Solution Let the two numbers be a and b

Then, AM = $\frac{a + b}{2}$ and GM = $\sqrt{ab}$

$$\therefore \qquad \frac{a + b}{2} = 12.5 \quad \sqrt{ab} = 10$$

$$\therefore \qquad a + b = 25 \quad \text{or,} \quad ab = 100$$

Consider

$$(a + b)^2 - (a - b)^2 = 4ab$$

$$\therefore \qquad (25)^2 - (a - b)^2 = 4 \times 100$$

$$\therefore \qquad (a - b) = 625 - 400 = 225$$

$$\therefore \qquad a - b = 15.$$

$$\therefore \qquad \left.\begin{aligned} a + b &= 25 \\ a - b &= 15 \end{aligned}\right\} \quad \text{Solving, } a = 20,\ b = 5$$

Example 22 An aeroplane covers the four sides of a square at speeds of 1,000, 2,000, 3000 and 4000 km per hour respectively. What is the average speed of the plane in its flight around the square?

Solution For arithmetic man, we compute as

$$\bar{x} = \frac{1000 + 2000 + 3000 + 4000}{4} = 2{,}500 \text{ km per hour.}$$

However, that is not the correct answer in such a problem harmonic mean is an appropriate average.

$$HM = \frac{4}{\frac{1}{1000}+\frac{1}{2000}+\frac{1}{3000}+\frac{1}{4000}} = \frac{4}{\frac{25}{12,000}}$$

$$= \frac{4 \times 12,000}{25} = 1,920 \text{ km per hour.}$$

Note: The harmonic mean is a measure of central tendency for data expressed as rates such as km per hour, km per litre, hours per semester tonnes per month, etc.

Example 23 The mean annual salaries paid to 100 employees of a company was Rs. 5,000. The mean annual salaries paid to male and female employees were Rs. 5,200 and Rs. 4,200 respectively. Determine the percentage of males and females employed by the company.

Solution Let n_1 represent percentage of males and n_2 represent precentage of females so that

$$n_1 + n_2 = 100$$

Given, combined mean $\bar{x} = 5,000$, $\bar{x}_1 = 5,200$ and $\bar{x}_2 = 4200$

Consider, $$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$$

$$\therefore \quad 5000 = \frac{n_1 \times 5000 + n_2 \times 4200}{n_1 + n_2}$$

$$\therefore \quad (n_1 + n_2)\, 5000 = 5200\, n_1 + 4200\, n_2$$

$$\therefore \quad 5000\, [n_1 + (100 - n_1)] = 5200\, n_1 + 4200\, (100 - n_1)$$

$$5000\, n_1 + 500000 - 5000\, n_1 = 5200\, n_1 + 420000 - 4200\, n_1$$

$$\therefore \quad 1,000\, n_1 = 80,000$$

$$\therefore \quad n_1 = 80 \text{ and } n_2 = 20$$

Thus, the percentage of males and females employed is 80 and 20 respectively.

General merits and uses of Averages

So far we have discussed the methods of computing the various types of averages and also their distinctive features. At this point, we have a problem "which of these is the best average to be used." To have a solution to this we must know the following:

(i) The purpose which the average is designed to serve.

(ii) Would the average be used for further computations?

(iii) The type of data available. If they are badly skewed (avoid the mean). gappy around the middle (avoid the median) and unequal in class interval (avoid the mode).

(iv) The typical value required in the particular problem. Within the framework of descriptive statistics the main requirement is to know what each average means and then select one that fulfuils the purpose.

(v) In some cases it is required to work out more than one averages and present them.

Median The median is the best average in open-end grouped distribution especially where if plotted as a frequency curve. For example, in case of price distribution or income distribution. In such cases very high or very low values would cause the mean to be higher to lower than the most 'common' values. In such cases the median or middle value of the series may be a more representative figure to use in describing the mass of data.

Mode Mode can be used to describe quantitative data. The mode can be used in problems involving the expression of preferences where quantitative measurements are not possible. Thus, the preferred type of package design among a number of alternative design would be the model design. If we want to compare consumer preferences for different kinds of products or different kinds of advertising we can compare the model preferences expressed by different groups of people but we cannot calculate the median or mean. Mode is a particularly useful average for discrete, series and best suited for large frequency.

Geometric mean Geometric mean is useful in averaging ratio and percentages and in computing average rates of increase or decrease. It is particularly important in economics and business statistics in index number construction.

Harmonic mean Harmonic mean is useful in problems in which values of a variable are compared with a constant quantity of another variable, i.e. rates distance covered within certain time and quantity purchased or sold per unit, etc.

In the following cases arithmetic mean should not be used.

(a) In highly skewed distributions.

(b) In distributions with open end intervals.

(c) When the distribution is unevenly spread.

(d) The arithmetic mean should not be used to average ratios and rates of change. In such cases, the geometric mean is more suitable.

(e) When there are very large and very small items, arithmetic mean would be seriously misleading on account of undue influence from extreme items.

General demerits of averages:

(a) Since an average is a single value representing a group of values. Otherwise there is every possibility of jumping to wrong conclusions. For example, a person had to cross the river from one bank to another. He was not aware of the depth of the river so he enquired of another man who told him that the average depth of water is 5 ft. 4 inches. The man was 5 ft. and 8 inches and he thought that he can very easily cross the river because at all times the would be above the level of water so he started. In the beginning, the level of water was very low but it as he reached the middle the water was 15 ft. deep and he lost his life. The man was drowned because he had a misconception that average depth means uniform depth throughout but it is not so. An average represents a group of values and lies somewhere in between the two extremes, i.e. the largest and the smallest items of the series.

(b) An average may give us a value that does not exist in the data. For example, the arithmetic mean of 100, 300, 250, 50 and 100 is 160 a value that does not exist in the data.

(c) At times the average may give a very absurd result. For example. It we calculate size of a family we may get a value 5.6. But this is impossible as persons cannot be in fractions. However, we should remember that it is an average value representing the entire group.

(d) Measures of central tendency fail to give an idea about the formation of the series. Two or more series may have the same central value but may differ widely in composition.

(e) We must remember that an average is a measure of central tendency. Hence, unless the data show a clear single concentration of observations an average may not be meaningful at all. This evidently precludes the use of any average to typify a bimodal, a U-shaped or J-shaped distribution.

QUESTION BANK

A. Choose the correct answer from the given alternatives.

1. Different methods give different averages which are known as the
   (a) measures of central tendency (b) statistics
   (c) measures of dispersion (d) skewness
2. If x_1, x_2, x_3 … x_n are a set of n values of a variate, then the mean is given by
   (a) $\frac{n}{\Sigma x_i}$ (b) $\frac{\Sigma x_i}{n}$
   (c) $n\Sigma x_i$ (d) $\frac{n_1\overline{x}_1 + n_2\overline{x}_2}{n_1 + n_2}$
3. If x_1, x_2 x_3 … x_n are a set of n observations then the geometric mean is
   (a) $n\ \Sigma\log x_i$ (b) $\frac{n}{\Sigma\log x_i}$
   (c) $\frac{\Sigma\log x_i}{n}$ (d) Antilog $\frac{\Sigma\log x_i}{n}$
4. If the values of the variables are arranged in ascending order of magnitude, the middle term is
   (a) mean (b) mode
   (c) median (d) quartile
5. In a grouped distribution, the value of the variable of maximum frequency is called
   (a) mode (b) mean
   (c) median (d) quartile
6. In a symmetrical distribution, the mean, median and mode
   (a) differ (b) coincide
   (c) mean-median = mode (d) differ by 0.5
7. In case of individual observations and discrete series, the size can be determined by using the $\left(\frac{n+1}{10}\right)$th item for
   (a) D_{10} (b) D_9
   (c) D_1 (d) D_2
8. For grouped frequency distribution the mode is calculated by using the formula
   (a) $l + \frac{f_m - f_1}{2f_m - f_1 - f_2} \times h$ (b) $\frac{l}{n} + \frac{f_m - f_1}{f_1 - f_2}$