25 MEASURES OF CENTRAL TENDENCY (MEAN)

Syllabus : **Mean :** Mean for raw and arrayed data. Mean by all three methods included.

Direct : $\frac{\Sigma fx}{\Sigma f}$, **Short-cut :** $A + \frac{\Sigma fd}{\Sigma f}$, where $d = x - A$

Step Deviation : $A + \frac{\Sigma ft}{\Sigma t} \times i$, where $t = \frac{x - A}{i}$

Introduction

Suppose we want to compare the wage distribution of workers in two factories and try to know which factory pays more to its workers. Clearly, by comparing on individual basis, we conclude nothing. However, if for each data, there exists a certain value representing that data, then the comparison becomes very clear.

Average of a Data

For a given data, a single value of the variable representing the entire data, which describes the characteristics of the data, is called an average of the data.

An average tends to lie centrally with the values of the variable arranged in ascending order of magnitude. So, we call an average a ***measure of central tendency*** of the data.

Mainly, we are interested in three types of averages :

(*i*) Mean (*ii*) Median (*iii*) Mode.

Arithmetic Mean

The average of numbers in arithmetic is known as the Arithmetic Mean of these numbers in statistics.

Mean of an Ungrouped Data

The *Arithmetic Mean* or simply the *Mean* of n observations $x_1, x_2, x_3, ..., x_n$ is given by the formula :

$$\textbf{Mean} = \frac{(x_1 + x_2 + x_3 + ... + x_n)}{n} = \frac{\Sigma x_i}{n}$$

where the symbol Σ, called *sigma* stands for the summation of the terms.

SOLVED EXAMPLES

Example 1. *Calculate the mean of the following numbers :*

(*i*) 14, 11, 23, 14, 18, 7, 8, 5 (*ii*) 5.8, 6.3, 7.1, 4.9, 9.4

Solution : (*i*) Sum of the given numbers = (14 + 11 + 23 + 14 + 18 + 7 + 8 + 5) = 100

Number of these numbers = 8.

Mean of the given numbers $= \frac{100}{8} = \frac{25}{2} = 12.5$

(*ii*) Sum of the given numbers = (5.8 + 6.3 + 7.1 + 4.9 + 9.4) = 33.5.
Number of these numbers = 5.

Mean of the given numbers $= \frac{33.5}{5} = 6.7$

Example 2. *If the mean of* 7, 10, 4, 12, x, 3 *is* 7.5, *find the value of* x.

Solution : Sum of the given numbers = (7 + 10 + 4 + 12 + x + 3) = (36 + x).
Number of these numbers = 6.

Mean of the given numbers $= \frac{36+x}{6}$.

But, mean = 7.5.

$\therefore \frac{36+x}{6} = 7.5 \Rightarrow 36 + x = 45 \Rightarrow x = (45 - 36) = 9.$

Hence, $x = 9$.

Example 3. *The weights (in kg) of* 5 *persons in a group are :*
61, 55, 48, 63, 59.
Find their mean weight.

Solution : Sum of the weights of the given persons = (61 + 55 + 48 + 63 + 59) kg = 286 kg.
Number of persons = 5.

Mean weight $= \left(\frac{286}{5}\right)$ kg = 57·2 kg.

Some Useful Results

Let the mean of $x_1, x_2, x_3, \ldots\ldots, x_n$ be A. Then

(*i*) Mean of $(x_1 + k), (x_2 + k), (x_3 + k)\ldots\ldots, (x_n + k)$ is $(A + k)$;

(*ii*) Mean of $(x_1 - k), (x_2 - k), (x_3 - k) \ldots\ldots, (x_n - k)$ is $(A - k)$;

(*iii*) Mean of $kx_1, kx_2, kx_3 \ldots\ldots, kx_n$ is kA, where $k \neq 0$.

The above results will be more clear from the following example.

Example 4. *The marks obtained by* 15 *students in a class-test are :*
16, 9, 14, 11, 13, 6, 18, 15, 10, 12, 9, 5, 11, 8, 17
Find : (*i*) *their mean marks;*
(*ii*) *the mean of their marks, when the marks of each student are increased by* 3;
(*iii*) *the mean of their marks, when* 2 *marks are deducted from the marks of each student;*
(*iv*) *the mean of their marks, when the marks of each student are doubled.*

Solution : (*i*) Sum of all the marks = 174.
Number of students = 15.

Mean Marks $= \frac{174}{15} = 11{\cdot}6.$

(*ii*) On increasing 3 marks of each student, marks increased = (15 × 3) = 45.
New sum of all the marks = (174 + 45) = 219.
Number of students = 15.

Mean Marks now $= \frac{219}{15} = 14{\cdot}6.$

(*iii*) On decreasing 2 marks of each, marks decreased = (15 × 2) = 30.

New sum of all the marks = (174 − 30) = 144.

Number of students = 15.

Mean Marks now = $\frac{144}{15}$ = 9·6.

(*iv*) On doubling the marks of each, the sum is doubled.

∴ New sum of all the marks = (2 × 174) = 348.

Number of students = 15.

Mean Marks now = $\frac{348}{15}$ = 23·2.

Mean of Grouped Data

I. Direct Method : *When the variates* $x_1, x_2, x_3, \ldots\ldots, x_n$ *have frequencies* $f_1, f_2, f_3 \ldots\ldots, f_n$ *respectively, then the mean is given by the formula :*

$$\textbf{Mean} = \frac{(f_1x_1 + f_2x_2 + f_3x_3 \ldots + f_nx_n)}{(f_1 + f_2 + f_3 + \ldots + f_n)} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

Example 5. *The following table shows the weights of* 15 *members of an athletic team in a school.*

Weight (in kg)	42	45	46	48	49
Number of athletes	4	3	5	2	1

Find the mean weight.

Solution : From the above data, we may prepare the table given below :

Weight (in kg) x_i	Number of athletes (Frequency) f_i	$f_i\, x_i$
42	4	168
45	3	135
46	5	230
48	2	96
49	1	49
	Σf_i = 15	$\Sigma f_i x_i$ = 678

∴ Mean Weight = $\frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{678}{15}$ = 45.2 kg .

Hence, the mean weight of the given team is 45.2 kg.

Example 6. *The marks obtained by* 40 *students in a short assessment are given below, where a and b are two missing data :*

Marks	5	6	7	8	9
Number of students	6	*a*	16	13	*b*

If the mean of the distribution is 7.2, *find a and b.* **(2012)**

Solution : We have

Marks (x)	Number of students (f)	($f \times x$)
5	6	30
6	a	$6a$
7	16	112
8	13	104
9	b	$9b$
	$\Sigma f = (35 + a + b)$	$\Sigma(fx) = 246 + (6a + 9b)$

But, $\Sigma f = 40 \Rightarrow 35 + a + b = 40 \Rightarrow a + b = 5$ ...(*i*)

Also, Mean $= \dfrac{\Sigma(f \times x)}{\Sigma f} = \dfrac{246 + (6a + 9b)}{40}$

$\therefore \dfrac{246 + (6a + 9b)}{40} = 7.2 \Rightarrow 246 + (6a + 9b) = 40 \times 7.2$

$\Rightarrow 246 + (6a + 9b) = 288 \Rightarrow 6a + 9b = 42$

$\Rightarrow 2a + 3b = 14$ ...(*ii*)

On solving (*i*) and (*ii*), we get : $a = 1$ and $b = 4$.

II. Short Cut Method for Finding Mean of Grouped Data (*Not in Classes*) :

Under this method, larger quantities get converted into smaller ones, making the process of multiplication and division easier.

Method : *From the given data, we suitably choose a term, usually the middle term and call it the assumed mean, to be denoted by A. We find the deviations,* $d_i = (x_i - A)$ *for each term.*

Then, we apply the formula : **Mean** $= \left(A + \dfrac{\Sigma f_i d_i}{\Sigma f_i}\right)$.

Example 7. *Using* ***short cut method,*** *find the mean from the following data.*

Variate (x_i)	18	19	20	21	22	23	24
Frequency (f_i)	184	212	327	376	614	372	415

Solution : Let the assumed mean be, **A = 21.**

From the given data, we prepare the table given below :

Variate (x_i)	Frequency (f_i)	$d_i = (x_i - A) = (x_i - 21)$	$f_i d_i$
18	184	–3	–552
19	212	–2	–424
20	327	–1	–327
21 = A	376	0	0
22	614	1	614
23	372	2	744
24	415	3	1245
	$\Sigma f_i = 2500$		$\Sigma f_i d_i = 1300$

$$\therefore \quad \text{Mean} = \left(A + \frac{\Sigma f_i d_i}{\Sigma f_i}\right) = \left(21 + \frac{1300}{2500}\right) = \left(21 + \frac{13}{25}\right) = 21 + 0.52 = 21.52.$$

Hence, the mean is 21.52.

Formulae for Mean of Grouped Data in the form of classes

I. Direct Method

Step 1. For each class, find the class mark x_i by using the relation,
$x_i = \frac{1}{2}$ (lower limit + upper limit).

Step 2. Use the formula, **Mean** = $\frac{\Sigma f_i x_i}{\Sigma f_i}$.

II. Short Cut Method or Deviation Method

Step 1. For each class, find the class mark x_i.

Step 2. Let **A** be the assumed mean.

Step 3. Find $d_i = (x_i - A)$.

Step 4. Use the formula, **Mean** = $\left(A + \frac{\Sigma f_i d_i}{\Sigma f_i}\right)$

III. Step Deviation Method

Step 1. For each class, find the class mark x_i.

Step 2. Let **A** be the assumed mean.

Step 3. Calculate, $u_i = \frac{(x_i - A)}{c}$, where c is the class size.

Step 4. Use the formula, **Mean** = $\left(A + c \cdot \frac{\Sigma f_i u_i}{\Sigma f_i}\right)$

Example 8. *Using **direct method**, find the mean of the following frequency distribution:*

Class-interval	80 – 100	100 – 120	120 – 140	140 – 160	160 – 180
Frequency	20	30	20	40	90

Solution : From the given data, we may prepare the table given below :

Class-interval	Class Mark (x_i)	Frequency (f_i)	($f_i \times x_i$)
80 – 100	90	20	1800
100 – 120	110	30	3300
120 – 140	130	20	2600
140 – 160	150	40	6000
160 – 180	170	90	15300
		$\Sigma f_i = 200$	$\Sigma f_i x_i = 29000$

$$\therefore \quad \text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{29000}{200} = 145$$

Example 9. *Calculate the mean of the following distribution using Short Cut Method :* **(2009)**

Class-interval	45 – 50	50 – 55	55 – 60	60 – 65	65 – 70	70 – 75	75 – 80
Frequency	5	8	30	25	14	12	6

Solution : From the given data, we may prepare the frequency distribution table as under.

Let the assumed mean be, A = 62.5.

Class-interval	Mid-value (x_i)	Frequency (f_i)	$d_i = (x_i - A)$	$f_i \times d_i$
45 – 50	47.5	5	–15	–75
50 – 55	52.5	8	–10	–80
55 – 60	57.5	30	–5	–150
60 – 65	62.5 = A	25	0	0
65 – 70	67.5	14	5	70
70 – 75	72.5	12	10	120
75 – 80	77.5	6	15	90
		$\Sigma f_i = 100$		$\Sigma f_i d_i = -25$

Hence, the mean is given by : $\bar{x} = A + \frac{\Sigma f_i d_i}{\Sigma f_i} = 62.5 + \left(\frac{-25}{100}\right) = 62.5 - 0.25 = 62.25$

Hence, the mean of the given data is 62.25

Example 10. *Calculate the mean of the following frequency distribution using the Short Cut Method:* **(2014)**

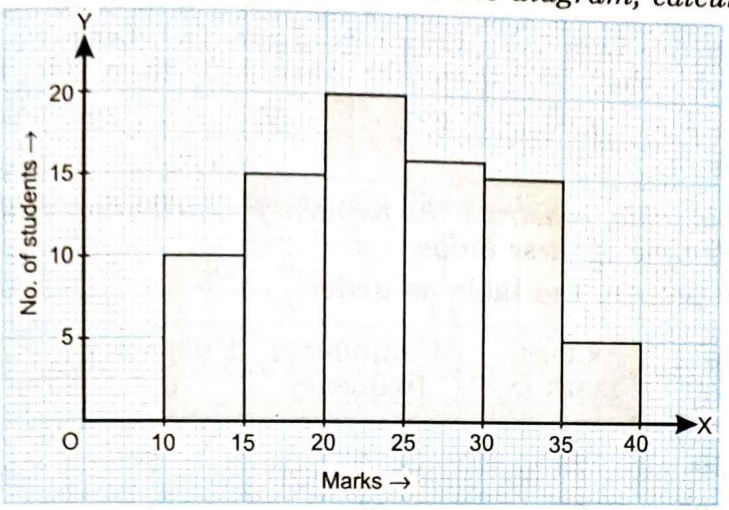
Marks	11 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80
Number of students	2	6	10	12	9	7	4

Solution : The given class intervals are in inclusive form. So, we convert them into exclusive form, and prepare the table as given below.

Marks	Class-mark (x_i)	No. of students (f_i)	$d_i = x_i - A = x_i - 45.5$	$f_i \times d_i$
10.5 – 20.5	15.5	2	– 30	– 60
20.5 – 30.5	25.5	6	– 20	– 120
30.5 – 40.5	35.5	10	– 10	– 100
40.5 – 50.5	45.5 = A	12	0	0
50.5 – 60.5	55.5	9	10	90
60.5 – 70.5	65.5	7	20	140
70.5 – 80.5	75.5	4	30	120
		$\Sigma f_i = 50$		$\Sigma f_i d_i = 70$

$\therefore$ Mean $= A + \frac{\Sigma f_i d_i}{\Sigma f_i} = \left(45.5 + \frac{70}{50}\right) = (45.5 + 1.4) = 46{\cdot}9.$

Example 11. *The histogram given below represents the marks obtained by some candidates in an examination. Using the data in the diagram, calculate the mean marks.*



Solution : Here, class size, $c = 5$.

Thus, from the given data, we may prepare the table as shown below :

Class-interval	Class-mark (x_i)	Frequency (f_i)	$d_i = (x_i - A)$ $= (x_i - 22.5)$	$f_i\, d_i$
10 – 15	12.5	10	– 10	– 100
15 – 20	17.5	15	– 5	– 75
20 – 25	22.5 = A	20	0	0
25 – 30	27.5	16	5	80
30 – 35	32.5	15	10	150
35 – 40	37.5	5	15	75
		$\Sigma f_i = 81$		$\Sigma f_i d_i = 130$

$$\text{Mean} = \left(A + \frac{\Sigma f_i d_i}{\Sigma f_i}\right) = \left(22.5 + \frac{130}{81}\right) = (22.5 + 1.6) = 24.1.$$

Hence, mean marks = 24.1.

Example 12. *Using* ***Step Deviation Method,*** *calculate the mean for the following data :*

Height (in cm)	135–140	140–145	145–150	150–155	155–160	160–165	165–170	170 –175
Number of boys	4	9	18	28	24	10	5	2

Solution : Here, class size, $c = 5$. Take assumed mean, A = 152·5.

Thus, from the given data, we may prepare the table given below :

Class-interval	Class-mark (x_i)	Frequency (f_i)	$\left(u_i = \frac{(x_i - A)}{c}\right)$	$f_i\, u_i$
135 – 140	137·5	4	– 3	– 12
140 – 145	142·5	9	– 2	– 18
145 – 150	147·5	18	– 1	– 18
150 – 155	152·5 = A	28	0	0
155 – 160	157·5	24	1	24
160 – 165	162·5	10	2	20
165 – 170	167·5	5	3	15
170 – 175	172·5	2	4	8
		$\Sigma f_i = 100$		$\Sigma f_i u_i = 19$

$$\text{Mean} = \left(A + c \times \frac{\Sigma f_i u_i}{\Sigma f_i}\right) = \left(152{\cdot}5 + \frac{5 \times 19}{100}\right) = (152{\cdot}5 + 0{\cdot}95) = 153{\cdot}45 \text{ cm}.$$

Example 13. *The following table gives the life-time (in days) of 100 electric bulbs of a certain make:*

Life-time (in days)	Less than 50	Less than 100	Less than 150	Less than 200	Less than 250	Less than 300
Number of bulbs	7	21	52	79	91	100

From this table, construct the frequency distribution table and hence find the mean life-time of these bulbs.

Solution : We may prepare the table as under :

Class-interval	Class-mark (x_i)	Cumulative frequency	Frequency (f_i)	$u_i = \left(\frac{x_i - A}{c}\right)$	$f_i u_i$
0 – 50	25	7	7	– 2	– 14
50 – 100	75	21	14	– 1	– 14
100 – 150	125 = A	52	31	0	0
150 – 200	175	79	27	1	27
200 – 250	225	91	12	2	24
250 – 300	275	100	9	3	27
			$\Sigma f_i = 100$		$\Sigma f_i u_i = 50$

$$\text{Mean} = \left(A + c \times \frac{\Sigma f_i u_i}{\Sigma f_i}\right) = \left(125 + 50 \times \frac{50}{100}\right) = (125 + 25) = 150.$$

Hence, mean life-time of given bulbs = 150 days.

EXERCISE 25

1. *Find the mean of each of the following sets of numbers* :
(*i*) 10, 4, 6, 12, 9 (*ii*) 0·2, 0·02, 2, 2·02, 1.22, 1.02

2. *Find the arithmetic mean of* :
(*i*) first eight natural numbers; (*ii*) first five prime numbers;
(*iii*) first six positive even integers; (*iv*) first five positive integral multiples of 3;
(*v*) all factors of 20.

3. The daily minimum temperature recorded (in degrees F) at a place during a week was as under :

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
35·5	30·8	28·3	31·1	23·8	29·9	32·7

Find the mean temperature of the week.

4. The marks obtained by 10 students in a class-test were as follows :
38, 41, 36, 31, 45, 38, 27, 32, 29, 39
Find (*i*) the mean of their marks;
(*ii*) the mean of their marks, when the marks of each student are increased by 2;
(*iii*) the mean of their marks, when 1 mark is deducted from the marks of each student;
(*iv*) the mean of their marks, when the marks of each student are halved.

5. If the mean of 11, 8, 13, 10, x and 9 is 9·5, find the value of x.

6. Find the mean of 25 numbers, it being given that the mean of 15 of them is 18 and the mean of remaining ones is 13.

7. The mean weight of 60 students of a class is 52·75 kg. If the mean weight of 25 of them is 51 kg, find the mean weight of the remaining students.

8. The mean of five numbers is 18. On excluding one number, the mean becomes 16. Find the excluded number.

9. The ages of 40 students of a group are given below :

Age (in years)	12	13	14	15	16	17
Number of students	6	8	5	7	9	5

Find the mean age of the group.

10. Find the mean of the following frequency distribution :

Variate	5	6	7	8	9
Frequency	7	8	14	11	10

11. In a book of 300 pages, the distribution of misprints is shown below :

Number of misprints per page	0	1	2	3	4	5
Number of pages	154	95	36	7	6	2

Find the average number of misprints per page.

12. The following table gives the wages of different categories of workers in a factory :

Category	A	B	C	D	E	F	G
Wages in ₹/day	250	300	350	400	450	500	550
Number of workers	2	4	8	12	10	6	8

(*i*) Calculate the mean wage.
(*ii*) If the number of workers in each category is doubled, what would be the new mean wage?

13. If the mean of the following distribution is 7.5, find the missing frequency f :

Variable	5	6	7	8	9	10	11	12
Frequency	20	17	f	10	8	6	7	6

(2005)

14. If the mean of the following observations is 16·6, find the numerical value of p.

Variate (x_i)	8	12	15	18	20	25	30
Frequency (f_i)	12	16	20	p	16	8	4

15. Find the numerical value of x, if the mean of the following frequency distribution is 12·58.

Variate	5	8	10	12	x	20	25
Frequency	2	5	8	22	7	4	2

16. Using **short cut method,** compute the mean height from the following frequency distribution:

Height (in cm)	58	60	62	65	66	68
Number of plants	15	14	20	18	8	5

17. The number of match sticks contained in 50 match boxes is given below :

Number of Match sticks	40	42	43	44	45	48
Number of boxes	6	7	12	9	10	6

(*i*) Using **short cut method,** find the mean number of match sticks per box.
(*ii*) How many extra match sticks are to be added to all the contents of 50 match boxes to bring the mean exactly equal to 45 match sticks per box?

[Hint :
(*i*) *Mean number of match sticks* = 43.68 $\simeq$ 44.
(*ii*) *Number of match sticks to be added* = (50 × 45) – (2184) = (2250 – 2184) = 66.]

18. The following table gives the marks scored by a set of students in an examination. Calculate the mean of the distribution by using the short cut method. **(2023)**

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of students	3	8	14	9	4	2

19. Given below are the daily wages of 200 workers in a factory :

Daily Wages (in ₹)	240 – 300	300 – 360	360 – 420	420 – 480	480 – 540
Number of Workers	20	30	20	40	90

Calculate the mean daily wages.

20. If the mean of the following distribution is 24, find the value of a. **(2018)**

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
No. of students	7	a	8	10	5

21. Calculate the mean of the following distribution using step deviation method. **(2017)**

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of students	10	9	25	30	16	10

22. Using **step deviation method**, calculate the mean of the following frequency distribution:

Class-interval	50 – 60	60 – 70	70 – 80	80 – 90	90 – 100	100 – 110	110 – 120
Frequency	9	11	10	14	8	12	11

23. The weights of 50 apples were recorded as given below. Calculate the mean weight, to the nearest gram, by the step Deviation Method. **(2008)**

Weight in grams	80 – 85	85 – 90	90 – 95	95 – 100	100 – 105	105 – 110	110 – 115
No. of apples	5	8	10	12	8	4	3

24. Weights of 60 eggs were recorded as given below :

Weights (in gms)	75 – 79	80 – 84	85 – 89	90 – 94	95 – 99	100 – 104	105 – 109
Number of eggs	4	9	13	17	12	3	2

Calculate their mean weight to the nearest gm.

[**Hint :** *The given intervals may be taken as* :
74.5 – 79.5, 79.5 – 84.5, 84.5 – 89.5, etc.]

25. The following table gives marks scored by students in an examination :

Marks	Less than 5	Less than 10	Less than 15	Less than 20	Less than 25	Less than 30	Less than 35	Less than 40
Number of students	3	10	25	49	65	73	78	80

Calculate the mean marks correct to 2 decimal places.

26. The data on the number of patients attending a hospital in a month are given below. Find the average (mean) number of patients attending the hospital in a month by using the shortcut method.

Take the assumed mean as 45. Give your answer correct to 2 decimal places.

Number of patients	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
Number of days	5	2	7	9	2	5

(2019)

27. Calculate the mean of the following frequency distribution. **(2022, Semester 2)**

Class-interval	5-15	15-25	25-35	35-45	45-55
Frequency	2	6	4	8	4

MULTIPLE CHOICE QUESTIONS

Choose the correct option :

1. Which of the following is not a measure of central tendency?
   (a) Mean (b) Mode (c) Range (d) Median
2. The mean of the following data is : 34, 89, 37, 144, 78, 240, 128, 98
   (a) 102 (b) 104 (c) 106 (d) 108
3. If the mean of 7, 5, 13, x and 9 be 10, then the value of x is :
   (a) 10 (b) 12 (c) 14 (d) 16
4. In a monthly test, the marks obtained in Mathematics by 16 students of a class are as follows:
   0, 0, 2, 2, 3, 3, 3, 4, 5, 5, 5, 5, 6, 6, 7, 8
   The arithmetic mean of the marks obtained is :
   (a) 3 (b) 4 (c) 5 (d) 6
5. Out of 100 numbers, 20 were 4s, 40 were 5s, 30 were 6s and the remaining were 7s. The mean of the numbers is :
   (a) 5.3 (b) 5.4 (c) 6.1 (d) 6.5
6. If $36\,a + 36\,b = 576$, then the mean of a and b is :
   (a) 6 (b) 8 (c) 12 (d) 16
7. If the mean of 7 observations is 43 and each observation is increased by 7, then what will be the new mean?
   (a) 36 (b) 43 (c) 44 (d) 50
8. While computing the mean of grouped data, we assume that the frequencies are :
   (a) evenly distributed over all the classes
   (b) centred at the class marks of the classes
   (c) centred at the upper limits of the classes
   (d) centred at the lower limits of the classes
9. If the mean of five observations x, $x + 2$, $x + 4$, $x + 6$ and $x + 8$ is 11, then the man of first three observations is :
   (a) 9 (b) 11 (c) 13 (d) none of these
10. The mean of five consecutive odd numbers A, B, C, D and E in ascending order is 37. What is the product of B and D?
    (a) 1365 (b) 1585 (c) 1935 (d) 2035
11. The mean of 5 consecutive odd numbers of set A is 37. What will be the average of set B containing four consecutive even numbers if the smallest number of set B is 13 more than the greatest number of set A?
    (a) 53 (b) 55 (c) 57 (d) 59
12. If the mean of four observations is 20 and when a constant c is added to each observation the mean becomes 22. The value of c is :
    (a) –2 (b) 2 (c) 4 (d) 6
13. If the mean of the observations $x_1, x_2, x_3, \ldots\ldots, x_n$ is $\bar{x}$, then the mean of $x_1 - a, x_2 - a, x_3 - a, \ldots\ldots, x_n - a$ is :
    (a) $\bar{x}$ (b) $\bar{x} + a$ (c) $\bar{x} - a$ (d) $\frac{n\,\bar{x} - a}{n}$

14. The mean of a certain number of observations is $\bar{x}$. If each observation is multiplied by m ($m \neq 0$) and then increased by n, then the mean of new observations is :

(a) $\frac{\bar{x}}{m} + n$ (b) $m\bar{x} + n$ (c) $m\bar{x} - n$ (d) $\frac{\bar{x}}{m} - n$

15. The mean of 100 observations is 50. If one of the observations was misread as 50 instead of 40, the correct mean is :

(a) 40 (b) 49.9 (c) 50 (d) 50.1

16. If the mean of the following data is 25, the value of p is equal to :

x	5	15	25	35	45
f	3	p	3	6	2

(a) 2 (b) 3 (c) 4 (d) 5

17. Consider the table given below :

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of students	12	18	27	20	17	6

The mean of the marks given above is :

(a) 6 (b) 18 (c) 27 (d) 28

18. If the mean of the following distribution is 27, then the value of p is :

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	8	p	12	13	10

(a) 6 (b) 7 (c) 9 (d) 11

19. The mean of 5 numbers is 27. If one of the numbers be excluded, their mean is 25. The excluded number is :

(a) 25 (b) 26 (c) 28 (d) 35

20. For what value of x the mean of the given observations $(2x - 5)$, $(x + 3)$, $(7 - x)$, $(5 - x)$ and $(x + 9)$ with frequencies 2, 3, 4, 6 and 1 respectively is 4?

(a) 1 (b) 2 (d) 3 (d) 4

21. The mean of n observations is $\bar{x}$. If the first observation is increased by 1, second by 2 and so on, then the new mean is :

(a) $\bar{x} + n$ (b) $\bar{x} + \frac{n}{2}$ (c) $\bar{x} + \frac{n+1}{2}$ (d) $\bar{x} + \frac{n-1}{2}$

22. In the formula $\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$ for finding the mean of grouped data, d_i s are deviations from a, of

(a) lower limits of the classes (b) upper limits of the classes
(c) mid-points of the classes (d) frequencies of the class marks

23. If x_i's are the class marks of the class-intervals of grouped data, f_i's are the corresponding frequencies and $\bar{x}$ is the mean, then $\Sigma(f_i x_i - \bar{x})$ is equal to :

(a) –1 (b) 0 (c) 1 (d) 2

24. In the formula $\bar{x} = a + h\left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right)$ for finding the mean of grouped frequency distribution, u_i =

(a) $\frac{x_i + a}{h}$ (b) $h(x_i - a)$ (c) $\frac{x_i - a}{h}$ (d) $\frac{a - x_i}{h}$

25. In a class of 100 students, the mean marks obtained in a certain test is 30 and in another class of 50 students the mean marks obtained in the same test is 60. The mean marks obtained by the students of both the classes taken together is :

(a) 40 (b) 45 (c) 48 (d) 50

26. A distribution consists of three components with frequencies 45, 40 and 15 having their means 2, 2.5 and 2 respectively. The mean of the combined distribution is :

(a) 2.1 (b) 2.2 (c) 2.3 (d) 2.4

27. The combined mean of three groups is 12 and the combined mean of first two groups is 3. If the first, second and third groups have 2, 3 and 5 items respectively, then the mean of third group is :

(a) 10 (b) 12 (c) 13 (d) 21

28. The mean weight of 17 boxes is 92 kg. If 18 new boxes are added, the mean weight increases by 3 kg. What will be the mean weight of the 18 new boxes?

(a) 91.8 kg (b) 92.8 kg (c) 97.8 kg (d) 98.8 kg

29. Consider the following distribution:

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Frequency	17	28	32	f	19

If the mean of the above distribution is 50, what is the value of f ?

(a) 24 (b) 34 (c) 56 (d) 96

30. Which of the following cannot be determined graphically?

(a) Mean (b) Median (c) Mode (d) none of these

Directions (Q 31 to 34) : Study the following information and answer the questions that follow :

The marks obtained by 10 *students in a class-test were as follows:*
36, 64, 48, 52, 57, 73, 26, 39, 78, 67

31. The mean marks of the whole class is :

(a) 49.1 (b) 53.7 (c) 54 (d) 60

32. If the maximum marks in the test were 80, the mean percentage of marks obtained by the students is :

(a) 65% (b) 67.5% (c) 68% (d) 72%

33. The mean marks of the top 5 scorers in the class is :

(a) 65.4 (b) 66.8 (c) 67.2 (d) 67.8

34. As per the Board's instruction each student who obtained less than 50 marks was awarded 3 grace marks. The new mean of the marks thus obtained increases by :

(a) 0.9 (b) 1.2 (c) 1.5 (d) 1.8

Directions (Q 35 to 38) : Study the following information and answer the questions that follow :

At a courier company, a daily report of parcels received for dispatch is prepared every evening, which classifies the parcels on the basis of their weights. The report of a certain day is as under:

Weight of parcel (in grams) (x)	Below 600	Below 500	Below 400	Below 300	Below 200	Below 100
Number of parcels (f)	60	58	54	*35*	22	10

35. How many parcels have weights in the range of 300 – 400 grams?

(a) 4 (b) 12 (c) 13 (d) 19

36. How many parcels have weights in the range of 200 – 300 grams?

(a) 10 (b) 12 (c) 13 (d) 19

37. In which of the following weight ranges, the number of parcels is the lowest?

(a) 100 – 200 (b) 200 – 300 (c) 400 – 500 (d) 500 – 600

38. The mean weight of parcels received on that particular day is :

(a) 226.78 g (b) 251.67 g (c) 284.28 g (d) 302.16 g

ASSERTION-REASON QUESTIONS

Directions : *In each of the following, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option :*

1. **Assertion (A) :** For a grouped frequency distribution, we use Mean $= A + \frac{\Sigma ft}{\Sigma f} \times h$ to find the mean using step deviation method.

   Reason (R) : Here $t = \frac{x - A}{h}$

   (a) A is true, R is the false
   (b) A is false, R is true
   (c) Both A and R are true
   (d) Both A and R are false.

2. **Assertion (A) :** If x_i's are the mid-points of the class intervals of a grouped data, Σfi's are the corresponding frequencies and $\overline{X}$ is the mean, then $\Sigma(f_i x_i - \overline{X}) = 1$

   Reason (R) : The sum of the deviations from the mean is 0.

   (a) A is true, R is the false
   (b) A is false, R is true
   (c) Both A and R are true
   (d) Both A and R are false.

3. **Assertion (A) :** Out of 25 numbers, the mean of 15 of them is 18. If the mean of the remaining numbers is 13, then the mean of the 25 numbers is 14.

   Reason (R) : Mean of the variates $x_1, x_2, ..., x_n$ having corresponding frequencies $f_1, f_2, ..., f_n$ is given by $\overline{X} = \frac{f_1x_1 + f_2x_2 + ..., f_nx_n}{x_1 + x_2 + ... + x_n}$

   (a) A is true, R is the false
   (b) A is false, R is true
   (c) Both A and R are true
   (d) Both A and R are false.