13 Statistics

Fastrack Revision

▶ **Arithmetic Mean or Mean:** The arithmetic mean or mean is the value obtained by dividing the sum of values of the items in a series by the number of items.

1. Mean of Ungrouped Data:

(i) Direct Method: The mean of n observations x_1, x_2, x_3,..., x_n is

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}, \text{ i.e., } \bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

(ii) Frequency Distribution: Let f_1, f_2, f_3,..., f_n be the corresponding frequencies of x_1, x_2, x_3,..., x_n. Then

$$\bar{x} = \frac{f_1x_1 + f_2x_2 + f_3x_3 + \ldots + f_nx_n}{f_1 + f_2 + f_3 + \ldots + f_n} = \frac{\sum_{i=1}^{n} f_ix_i}{\sum_{i=1}^{n} f_i}$$

(iii) Assumed Mean Method (Short Cut Method): Let 'A' be the assumed mean from given data, then

$$\bar{x} = A + \frac{\Sigma f_i d_i}{\Sigma f_i}, \text{ where deviation } d_i = x_i - A$$

2. Mean of Grouped Data: The class mark of the class interval $a_i - b_i$, is the mid value of a_i and b_i, *i.e.*, $(x_i) = \frac{a_i + b_i}{2}$.

(i) Direct Method:

$$\text{Mean } (\bar{x}) = \frac{f_1x_1 + f_2x_2 + f_3x_3 + \ldots + f_nx_n}{f_1 + f_2 + f_3 + \ldots + f_n}$$

$$= \frac{\sum_{i=1}^{n} f_ix_i}{\sum_{i=1}^{n} f_i} = \frac{\sum_{i=1}^{n} \frac{1}{2} f_i(a_i + b_i)}{\sum_{i=1}^{n} f_i}$$

(ii) Assumed Mean Method (Short Cut Method): Let 'A' be assumed mean occurring in the middle of the mid values of the class interval, then

$$\text{Mean } (\bar{x}) = A + \frac{\Sigma f_i d_i}{\Sigma f_i}, \text{ where deviation } d_i = x_i - A$$

(iii) Step-deviation Method:

$$\text{Mean } (\bar{x}) = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h, \text{ where } u_i = \frac{x_i - A}{h} \text{ and } h \text{ is}$$

width of class interval.

Knowledge BOOSTER

1. *The algebraic sum of the deviation of variables from their mean is always zero* (0), *i.e.*, $\sum_{i=1}^{n} f_i(x_i - \bar{x}) = 0$.
2. *Combined Mean* $(\bar{x}) = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$
3. *If each observation is increased by* 5 (*or decreased by* 5), *then the resultant mean is increased by* 5 (*or decreased by* 5).
4. *There is no need to convert discontinuous data into continuous data, while finding the mean of*

▶ **Cumulative Frequency:** It is defined as the sum of all frequencies up to the given class.

▶ **Mode:** The observation which is repeated (occur) maximum number of times in the data or has the highest frequency is called mode.

1. When the Data is Ungrouped: The observation which occurs maximum number of times in the given data or has the highest frequency would be the mode of given data.

2. When the Data is Grouped:

$$\text{Mode} = l + \left(\frac{f_m - f_p}{2f_m - f_p - f_s}\right) \times h$$

where, l = Lower limit of the modal class,

f_m = Frequency of the modal class,

f_p = Frequency of the class preceding the modal class,

f_s = Frequency of the class succeeding the modal class,

h = Size of the class interval.

▶ **Median:** The median of a distribution is the value of the middle variable when the variables are arranged in ascending or descending order.

1. Median of Ungrouped Data:

(i) (a) Arrange the data in ascending or descending order and then find the number of terms n.

(b) If n is odd, then median = $\left(\frac{n+1}{2}\right)$th observation.

(c) If n is even, then median.

$$= \frac{1}{2}\left\{\begin{array}{l}\left(\frac{n}{2}\right)\text{th observation} \\ +\left(\frac{n}{2}+1\right)\text{th observation}\end{array}\right\}$$

(ii) In Frequency Distribution:

(a) First find $\frac{N}{2}$, where $N = \Sigma f$

(b) Find the cumulative frequency of each value of the variable and take the value which is equal to or just greater than $N/2$

(c) This value of the variable is the median.

2. Median of Grouped Data:

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

where, l = Lower limit of median class,

f = Frequency of the median class,

cf = Cumulative frequency of the class preceding the median class,

h = Size of the class interval,

N = Sum of the frequencies.

► **Empirical Formula:** Mode = 3 (Median) – 2 (Mean)

Practice Exercise

Multiple Choice Questions ↘

Q 1. Which of the following is a measure of central tendency?

a. Class limit b. Lower limit
c. Cumulative frequency d. Median

Q 2. While computing mean of grouped data, we assume that the frequencies are:

a. centered at the class marks of the class
b. centered at lower limits of the class
c. centered at upper limits of the class
d. None of the above

Q 3. If x_i's are the mid-points 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: *[NCERT EXEMPLAR]*

a. 0 b. –1 c. 1 d. 2

Q 4. 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: *[NCERT EXEMPLAR]*

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

Q 5. Construction of a cumulative frequency table is useful in determining the: *[NCERT EXEMPLAR]*

a. mean b. mode
c. median d. All of these

Q 6. The range of the following data is:

Diameter (in mm)	30-40	40-50	50-60	60-70	70-80
No. of screws	10	15	18	12	7

a. 10 b. 30 c. 50 d. 70

Q 7. In the following distribution table, the preceding frequency value of modal class is:

Class	0-5	5-10	10-15	15-20	20-25
Frequency	2	5	18	14	8

a. 8 b. 5
c. 18 d. 14

Q 8. For the following distribution:

Marks below	10	20	30	40	50	60
Number of students	3	12	27	57	75	80

The modal class is: *[CBSE 2023]*

a. 10-20 b. 20-30
c. 30-40 d. 50-60

Q 9. Find the upper limit of the modal class from the given distribution: *[CBSE SQP 2023-24]*

Height (in cm)	Number of girls
Below 140	4
Below 145	11
Below 150	29
Below 155	40
Below 160	46
Below 165	51

a. 165 b. 160
c. 155 d. 150

Q 10. Consider the following distribution:

Marks obtained	Number of students
More than or equal to 0	63
More than or equal to 10	58
More than or equal to 20	55
More than or equal to 30	51
More than or equal to 40	48
More than or equal to 50	42

The frequency of the class 30-40 is: *[NCERT EXEMPLAR]*

a. 3 b. 4
c. 48 d. 51

Q 11. Consider the following frequency distribution:

Class	0-5	6-11	12-17	18-23	24-29
Frequency	13	10	15	8	11

The upper limit of the median class is: *[NCERT EXEMPLAR]*

a. 17 b. 17.5
c. 18 d. 18.5

Q 12. If median of the following data is 345,

Daily wages (in ₹)	Number of workers
320-330	10
330-340	15
340-350	8
350-360	7
360-370	8

Then, find the median class.

a. 330-340 b. 350-360
c. 340-350 d. Can't be determined

Q 13. The just next frequency of median class in the data is:

Pocket expenses (in ₹)	Number of students (Frequency)
0-5	10
5-10	20
10-15	28
15-20	42
20-25	50
25-30	30

a. 48 b. 42 c. 30 d. 50

Q 14. For the following distribution:

Class	0-5	5-10	10-15	15-20	20-25
Frequency	10	15	12	20	9

The sum of lower limits of the median class and modal class is: *[NCERT EXEMPLAR, CBSE SQP 2022-23, CBSE 2023]*

a. 15 b. 25 c. 30 d. 35

Q 15. Consider the data:

Class	Frequency
65-85	4
85-105	5
105-125	13
125-145	20
145-165	14
165-185	7
185-205	4

The difference of the upper limit of the median class and the lower limit of the modal class is: *[NCERT EXEMPLAR]*

a. 0 b. 19 c. 20 d. 38

Q 16. If the difference of mode and median of a data is 24, then the difference of median and mean is: *[CBSE SQP 2022-23]*

a. 8 b. 12 c. 24 d. 36

Assertion & Reason Type Questions

Directions (Q. Nos. 17-21): *In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:*

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A)
b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A)
c. Assertion (A) is true but Reason (R) is false
d. Assertion (A) is false but Reason (R) is true

Q 17. Assertion (A): If $\Sigma f_i = 20$, $\Sigma f_i x_i = 3\lambda + 20$ and mean of the distribution is 4, then the value of λ is 20.

Reason (R): If there are $x_1, x_2, \ldots\ldots, x_n$ observations where corresponding frequencies are $f_1, f_2, \ldots\ldots f_n$, then mean is determined by the formula,

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

Q 18. Assertion (A): The mode of the following frequency distribution is 52.25 kg.

Weight (in kg)	Frequency
40–45	20
45-50	30
50-55	35
55-60	20
60-65	10

Reason (R): A modal class is a class which has highest frequency.

Q 19. Assertion (A): The median of the frequency distribution is 68.75.

Marks obtained (Class Interval)	Number of students (Frequency)	Cumulative frequency
30-40	5	5
40-50	10	15
50-60	3	18
60-70	8	26
70-80	14	40
80-90	10	50

Reason (R): The cumulative frequency of median is just next to the median class.

Q 20. Assertion (A): The following table gives the marks scored by students in an examination:

Marks	Number of students
0-5	3
5-10	7
10-15	15
15-20	24
20-25	16
25-30	8

The succeeding frequency of modal class is 16.
Reason (R): The sum of frequency of modal class and its preceding frequency is 40.

Q 21. Assertion (A): If the median and mode of a frequency distribution are 150 and 154 respectively, then its mean is 148.
Reason (R): The relation between, mean, mode and median is:

$$\text{Mode} = 3\,(\text{Median}) - 2\,(\text{Mean})$$

Fill in the Blanks Type Questions

Q 22. The mean of first 10 prime numbers is .....

Q 23. If the mean of 18 observations is 25 and each observation is decreased by 5, the new mean will be .....

Q 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 = ... [NCERT EXEMPLAR]

Q 25. ..... is the value of the middle variable when the variables are arranged in ascending or descending order.

Q 26. If the values of mean and mode are respectively 30 and 15, then median is .....

True/False Type Questions

Q 27. The algebraic sum of the deviation of variables from their mean is always zero.

Q 28. The value of x, if the mean of 5 observations x, $x+2$, $x+4$, $x+6$ and $x+8$ is 11, will be 7.

Q 29. In the frequency distribution, if $\Sigma f_i x_i = 750$ and $\Sigma f_i = 25$, the mean of the distribution is 25.

Q 30. If the values of mean and median are 53.6 and 55.81, then the value of mode is 60.23.

Q 31. The preceding frequency is just after the modal class.

Solutions

1. (d) Median

2. (a) centered at the class marks of the class.

3. (a) Given, $\bar{x}$ is a mean.

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

   $\Rightarrow \quad \bar{x}\,\Sigma f_i = \Sigma f_i x_i$

   Now, $\Sigma f_i (x_i - \bar{x}) = \Sigma f_i x_i - \bar{x}\,\Sigma f_i = \Sigma f_i x_i - \Sigma f_i x_i = 0$

4. (c) mid-points of the classes

5. (c) median

6. (c) Here, upper class boundary of the highest interval $= 80 = u$.

   and lower class boundary of the lowest interval $= 30 = l$

   $\therefore$ Range of grouped data $= u - l = 80 - 30 = 50$

7. (b) In the given distribution table, the highest frequency is 18. Therefore its modal class is 10-15.

TiP

The preceding frequency value of modal class is just before the modal class.

Hence, the preceding frequency value of modal class is 5.

8. (c) The frequency table in terms of class intervals is shown below:

Marks below	Number of students	Class intervals	Frequency
10	3	0-10	3
20	12	10-20	$12 - 3 = 9$
30	27	20-30	$27 - 12 = 15$
40	57	30-40	$57 - 27 = 30$
50	75	40-50	$75 - 57 = 18$
60	80	50-60	$80 - 75 = 5$

Here, highest frequency is 30, which lies in the class interval 30-40. This class is said to be modal class.

9. (d) The frequency table in terms of class intervals is shown below:

Height (in cm)	Number of girls	Class intervals	Frequency
Below 140	4	135-140	4
Below 145	11	140-145	$11 - 4 = 7$
Below 150	29	145-150	$29 - 11 = 18$
Below 155	40	150-155	$40 - 29 = 11$
Below 160	46	155-160	$46 - 40 = 6$
Below 165	51	160-165	$51 - 46 = 5$

Here, highest frequency is 18, which lies in the class interval 145-150. This class is said to be modal class. So, upper limit of the modal class is 150.

10. (a) The frequency of the class 30–40 = Number of students having more than or equal to 30 marks – Number of students having more than or equal to 40 marks

$= 51 - 48 = 3$

11. (b)

TiP

Given frequency table is not continuous, so make continuous by subtracting −0.5 in lower limits and adding 0.5 in the upper limits.

The cumulative frequency table is given below:

Class	Frequency	CF
−0.5-5.5	13	13
5.5-11.5	10	23
11.5-17.5	15	38
17.5-23.5	8	46
23.5-29.5	11	57

Here, $N = 57 \Rightarrow \frac{N}{2} = \frac{57}{2} = 28.5$, which lies in the cumulative frequency 38, whose median class is 11.5-17.5. The upper limit of median class is 17.5.

12. (c) Given median is 345, which lies in the interval 340-350.

13. (d) The cumulative frequency of given data is shown below:

Pocket expenses (in ₹)	Number. of students (Frequency)	Cumulative frequency (cf)
0-5	10	10
5-10	20	30
10-15	28	58
15-20	42	100
20-25	50	150
25-30	30	180

Here, $\frac{N}{2} = \frac{180}{2} = 90$, since 90 lies in the cumulative frequency 100. So, median class is 15-20.

Here, the next class interval is 20-25, where frequency is 50.

14. (b) The cumulative frequency is shown below:

Class	Frequency	Cumulative frequency
0-5	10	10
5-10	15	25
10-15	12	37
15-20	20	57
20-25	9	66

Here, $N = 66 \Rightarrow \frac{N}{2} = \frac{66}{2} = 33$, which lies in the cumulative frequency 37. So, median class is 10-15.

In the given table, the highest frequency is 20. So, modal class is 15-20.

Here, lower limits of median class and modal class are 10 and 15 respectively.

Therefore, the sum of lower limits of median class and modal class is 10 + 15, *i.e.*, 25.

15. (c) The cumulative frequency table is shown below:

Class	Frequency	Cumulative frequency
65-85	4	4
85-105	5	9
105-125	13	22
125-145	20	42
145-165	14	56
165-185	7	63
185-205	4	67

Here, $N = 67 \Rightarrow \frac{N}{2} = \frac{67}{2} = 33.5$, which lies in the cumulative frequency 42. So, median class is 125-145.

In the given table, the highest frequency is 20.

So, modal class is 125-145.

Here, upper limits of median class and lower limit of modal class are 145 and 125 respectively.

Therefore, the difference of upper limits of median class and lower limit of modal class is 145 – 125 = 20.

16. (b) Given.

$$\text{Mode} - \text{Median} = 24$$

$$\because \quad \text{Mode} = 3(\text{Median}) - 2(\text{Mean})$$

$$\text{Median} + 24 = 3(\text{Median}) - 2(\text{Mean})$$

$$\Rightarrow \quad 2(\text{Median} - \text{Mean}) = 24$$

$$\Rightarrow \quad \text{Median} - \text{Mean} = 12$$

17. (a) **Assertion (A):** Given, $\Sigma f_i = 20$, $\Sigma f_i x_i = 3\lambda + 20$ and mean of data is $\bar{x} = 4$

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

$$\Rightarrow \quad 4 = \frac{3\lambda + 20}{20}$$

$$\Rightarrow \quad 3\lambda + 20 = 80$$

$$\Rightarrow \quad 3\lambda = 60 \Rightarrow \lambda = 20.$$

So, Assertion (A) is true.

Reason (R): It is true to say that in frequency distribution, the mean is determined by $\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$

Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

18. (d) **Assertion (A):** In the frequency distribution, the highest frequency is 35, which lies in the class interval 50-55.

So, modal class is 50-55.

Here, $l = 50$, $f_m = 35$, $f_p = 30$ and $f_s = 20$, $h = 5$

$$\because \quad \text{Mode} = l + \left(\frac{f_m - f_p}{2f_m - f_p - f_s}\right) \times h$$

$$= 50 + \left(\frac{35-30}{2\times 35 - 30 - 20}\right) \times 5$$

$$= 50 + \frac{25}{70-50} = 50 + \frac{25}{20}$$

$$= 50 + 1.25 = 51.25 \text{ kg}.$$

So, Assertion (A) is false.

Reason (R): It is a true statement.

Hence, Assertion (A) is false but Reason is true.

19. (c) **Assertion (A):** Given, the sum of frequencies is $N = 50$.

$$\therefore \quad \frac{N}{2} = \frac{50}{2} = 25, \text{ which lies in the cumulative}$$

frequency 26.

So, median class is 60-70.

Here, $l = 60$, $f = 8$, $cf = 18$ and $h = 10$

$$\therefore \quad \text{Median} = l + \frac{\frac{N}{2} - cf}{f} \times h$$

$$= 60 + \frac{25 - 18}{8} \times 10$$

$$= 60 + \frac{70}{8} = 60 + 8.75 = 68.75$$

So, Assertion (A) is true.

Reason (R): Given Reason (R) is false, because cumulative frequency is just before the median class.

Hence, Assertion (A) is true and Reason (R) is false.

20. (c) **Assertion (A):** In a given table, the highest frequency is 24, whose modal class is 15-20.

The succeeding frequency of modal class is 16.

So, Assertion (A) is true.

Reason (R): In the given table, frequency of modal class is 24 and preceding frequency is 15.

$\therefore$ The sum of modal class frequency and preceding frequency is 24 + 15, *i.e.*, 39.

So, Reason (R) is false.

Hence, Assertion (A) is true but Reason (R) is false.

21. (a) **Assertion (A):** Given that,

$$\text{median} = 150 \text{ and mode} = 154$$

By using empirical relation,

$$\text{mode} = 3\,(\text{median}) - 2\,(\text{mean})$$

$$\Rightarrow \quad 154 = 3 \times 150 - 2\,(\text{mean})$$

$$\Rightarrow \quad 2\,(\text{Mean}) = 450 - 154$$

$$\Rightarrow \quad \text{Mean} = \frac{296}{2} = 148.$$

So, Assertion (A) is true.

Reason (R): It is true to say that the relation between mean, mode and median is

$$\text{Mode} = 3\,(\text{Median}) - 2\,(\text{Mean})$$

Hence, both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

22.

TR!CK

First 10 *prime numbers are* 2, 3, 5, 7, 11, 13, 17, 19, 23, 29.

Mean of first 10 prime numbers

$$= \frac{\text{Sum of all the observations}}{\text{Total number of observations}}$$

$$= \frac{2+3+5+7+11+13+17+19+23+29}{10}$$

$$= \frac{129}{10} = 12.9$$

23. Let 18 observations be $x_1, x_2, \ldots\ldots x_{18}$.

Then, mean of 18 observations is

$$25 = \frac{\sum_{i=1}^{18} x_i}{18} \qquad \ldots(1)$$

When 5 is decreased in each observation, then new mean

$$\bar{x} = \frac{\sum_{i=1}^{18} (x_i - 5)}{18}$$

$$= \frac{\sum_{i=1}^{18} x_i - \sum_{i=1}^{18} 5}{18}$$

$$= \frac{\sum_{i=1}^{18} x_i}{18} - \frac{(5+5+\_\_ \text{ 18 times})}{18}$$

$$= 25 - \frac{18 \times 5}{18} \qquad \text{[from eq. (1)]}$$

$$= 25 - 5 = 20$$

24. $\frac{x_i - a}{h}$

25. Median

26. Given, mean = 30 and mode = 15

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

$$15 = 3\,(\text{Median}) - 2 \times 30$$

$$\Rightarrow \quad 3\,(\text{Median}) = 15 + 60$$

$$\Rightarrow \quad \text{Median} = \frac{75}{3} = 25$$

27. True

28.
$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

$$\Rightarrow \quad 11 = \frac{x + (x+2) + (x+4) + (x+6) + (x+8)}{5}$$

$$\Rightarrow \quad 55 = 5x + 20$$

$$5x = 35$$

$$\Rightarrow \quad x = 7.$$

Hence, given statement is true.

29. Given, $\Sigma f_i x_i = 750$ and $\Sigma f_i = 25$

$$\therefore \quad \text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{750}{25} = 30$$

Hence, given statement is false.

30. Given, mean = 53.6 and median = 55.81

$$\therefore \quad \text{Mode} = 3\,\text{Median} - 2\,\text{Mean}$$

$$= 3 \times 55.81 - 2 \times 53.6$$

$$= 167.43 - 107.2$$

$$= 60.23$$

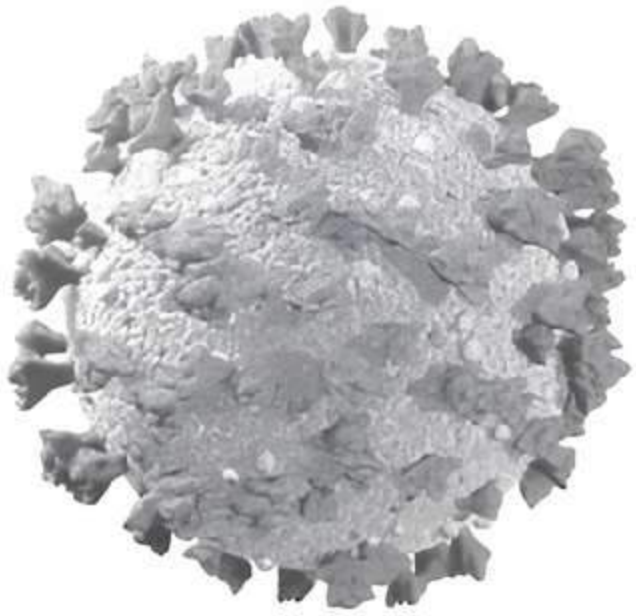
Hence, given statement is true.

31. False, because preceding frequency is just before the modal class.

Case Study Based Questions

Case Study 1

The COVID-19 pandemic, also known as Corona virus pandemic, is an ongoing pandemic of Corona virus disease caused by the transmission of Severe Acute Respiratory Syndrome Corona virus 2 (SARS-CoV-2) among humans.



The following tables shows the age distribution of cases admitted during a day in two different hospitals.

Table for hospital-1

Age (in years)	8-18	18-28	28-38	38-48	48-58	58-68
Number of cases	8	12	24	26	16	7

Table for hospital-2

Age (in years)	8-18	18-28	28-38	38-48	48-58	58-68
Number of cases	10	18	8	48	28	14

Based on the above tables, solve the following questions:

Refer to Table-1

Q 1. The difference of lower limit of median class and upper limit of modal class is:

a. 0 b. 5
c. 10 d. 15

Q 2. The average of upper limit of median class and lower limit of modal class is:

a. 38 b. 40
c. 42 d. 43

Q 3. The mean of the given data is:

a. 26.25 years b. 32.47 years
c. 33.53 years d. 38.48 years

Refer to Table-2

Q 4. The mode of the given data is:

a. 44.67 years b. 48.2 years
c. 55.3 years d. 64.6 years

Q 5. The median of the given data is:

a. 32.7 years b. 43.6 years
c. 42.3 years d. 48.6 years

Solutions

1. Table for cumulative frequency

Age (in years)	8-18	18-28	28-38	38-48	48-58	58-68
Number of cases (f)	8	12	24	26	16	7
Cumulative frequency (*cf*)	8	20	44	70	86	93

Here, $N = 93$

$\therefore \quad \frac{N}{2} = \frac{93}{2} = 46.5$

Since, 46.5 lies under cumulative frequency 70.
So, median class is 38-48.

$\therefore$ Lower limit of median class = 38.

It is clear from table 1, 38-48 has the maximum frequency. So, modal class is 38-48.

$\therefore$ Upper limit of modal class = 48.

Now, upper limit of modal class – lower limit of median class = 48 – 38 = 10

So, option (c) is correct.

2. $\because$ Median class is (38-48).

$\therefore$ Upper limit of median class = 48

$\because$ Modal class is (38-48).

$\therefore$ Lower limit of modal class = 38

Now, required average

$= \frac{1}{2}$ (upper limit of median class + lower limit of modal class)

$= \frac{1}{2}(48 + 38) = \frac{1}{2} \times 86 = 43$

So, option (d) is correct.

3. Table for mean

Age (in years)	Mid value (x)	Number of cases (frequency) (f)	$f \times x$
8-18	13	8	104
18-28	23	12	276
28-38	33	24	792
38-48	43	26	1118
48-58	53	16	848
58-68	63	7	441
		$\Sigma f = 93$	$\Sigma fx = 3579$

By direct method.

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$= \frac{3579}{93} = 38.48 \text{ years}$$

So, option (d) is correct.

4. It is clear from table 2, (38-48) has the maximum frequency, *i.e.*, 48. So, modal class is (38-48).

Here, $l = 38$, $f_m = 48$, $f_p = 8$, $f_s = 28$ and $h = 10$

$\therefore \quad \text{Mode} = l + \left(\frac{f_m - f_p}{2f_m - f_p - f_s} \times h \right)$

$$= 38 + \left(\frac{48-8}{2\times 48-8-28}\right)\times 10$$

$$= 38 + \left(\frac{40\times 10}{96-36}\right) = 38 + \frac{400}{60}$$

$$= 38 + 6.67 = 44.67 \text{ years}$$

So, option (a) is correct.

5. **Table for cumulative frequency**

Age (in year)	8-18	18-28	28-38	38-48	48-58	58-68
Number of cases	10	18	8	48	28	14
Cumulative Frequency (cf)	10	28	36	84	112	126

Here, $N = 126$

$\therefore \quad \frac{N}{2} = \frac{126}{2} = 63$

Since, 63 lies under cumulative frequency 84.

So, median class is (38-48).

$\therefore \quad l = 38,\ f = 48,\ cf = 36$ and $h = 10$

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

$$= 38 + \left\{\frac{63-36}{48}\right\}\times 10$$

$$= 38 + \frac{27\times 10}{48} = 38 + 5.6 = 43.6 \text{ years}$$

So, option (b) is correct.

Case Study 2

A 110 m hurdle race is organised for a group of 150 athletes. The time, in seconds, taken by the athletes to run the race are tabulate below:

Time (in sec)	Number of athletes
13.8-14.0	2
14.0-14.2	4
14.2-14.4	5
14.4-14.6	71
14.6-14.8	48
14.8-15.0	20

Based on the above table, solve the following questions:

Q 1. What is the class mark of class interval corresponding to frequency 48?

a. 14.5 b. 14.7 c. 14.75 d. 14.65

Q 2. What will be the upper limit of the modal class?

a. 14.4 b. 14.2 c. 14.8 d. 14.6

Q 3. Estimate the median time taken by an athlete to finish the race:

a. 14.76 sec b. 14.58 sec
c. 14.42 sec d. 14.6 sec

Q 4. The mean time taken by an athlete is 14.6 sec, then the mode of the given data is:

a. 14.54 sec b. 14.64 sec
c. 14.94 sec d. 14.44 sec

Q 5. How many athletes finished the hurdle race in less than 14.6 seconds?

a. 71 b. 76 c. 82 d. 91

Solutions

1. Class interval corresponding to frequency 48 is (14.6-14.8).

$\therefore$ Required class mark

$$= \frac{1}{2}(\text{lower limit} + \text{upper limit})$$

$$= \frac{1}{2}(14.6 + 14.8)$$

$$= \frac{1}{2}\times 29.4 = 14.7$$

So, option (b) is correct.

2. It is clear from the given frequency distribution table, (14.4-14.6) has the maximum frequency, *i.e.*, 71. So, modal class is (14.4-14.6).

$\therefore$ Upper limit of modal class is 14.6.

So, option (d) is correct.

3. **Cumulative frequency table**

CI	f_i	cf
13.8-14.0	2	2
14.0-14.2	4	2 + 4 = 6
14.2-14.4	5	6 + 5 = 11
14.4-14.6	71	11 + 71 = 82
14.6-14.8	48	82 + 48 = 130
14.8-15.0	20	130 + 20 = 150

Here, $N = 150$

$\therefore \quad \frac{N}{2} = \frac{150}{2} = 75$

Since, 75 lies under cumulative frequency 82.

So, median class is (14.4-14.6).

Here, $l = 14.4,\ f = 71,\ cf = 11$ and $h = 0.2$

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

$$= 14.4 + \left\{\frac{75-11}{71}\right\}\times 0.2$$

$$= 14.4 + 0.18 = 14.58 \text{ sec}$$

So, option (b) is correct.

4. Given that, mean time = 14.6 sec and from part (3), Median time = 14.58 sec

Using empirical formula,

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

$$= 3\times 14.58 - 2\times 14.6$$

$$= 43.74 - 29.2 = 14.54 \text{ sec}$$

So, option (a) is correct.

5. Number of athletes who finished the hurdle race in less than 14.6 sec = 2 + 4 + 5 + 71 = 82
So, option (c) is correct.

Case Study 3

On Diwali, a social welfare company decided to give some gifts to the orphan children. They visit on orphanage to determine the number of children there and to which age group they belong. Social welfare bought gift for every children according to their age group, which is shown in the following table:

Age group of children (in years)	4–8	8-12	12-16	16-20
Number of children	5	6	10	9

Based on the above table, solve the following questions:

Q 1. Find the median class of the given data.

Q 2. Find the median of the given data.

Or

Find the mode of the given data.

Q 3. Find the mean of the given data.

Solutions

1. The cumulative frequency of given data is given below:

Age group of children (in years)	Number of children (f)	Cumulative frequency (cf)
4-8	5	5
8-12	6	11
12-16	10	21
16-20	9	30

Here, $N = 30 \quad \Rightarrow \quad \frac{N}{2} = \frac{30}{2} = 15$

Since, 15 lies in the cumulative frequency 21, therefore median class is 12-16.

2. From part (1), median class is 12-16.
Therefore, $l = 12$, $cf = 11$, $f = 10$ and $h = 4$.

$$\text{Median} = l + \frac{\frac{N}{2} - cf}{f} \times h = 12 + \frac{15 - 11}{10} \times 4$$

$$= 12 + \frac{16}{10} = 12 + 1.6 = 13.6 \text{ years}$$

Hence, median of the given data is 13.6 years.

Or

In the given table, the maximum number of children is 10, which lies in the age group 12-16 years. So, the modal class is 12-16, because it has maximum frequency 10.

$\therefore$ $l = 12$, $f_m = 10$, $f_p = 6$, $f_s = 9$ and $h = 4$

$\because$ $$\text{Mode} = l + \frac{f_m - f_p}{2f_m - f_s - f_p} \times 4$$

$$= 10 + \frac{10 - 6}{2 \times 10 - 9 - 6} \times 4$$

$$= 10 + \frac{16}{20 - 15}$$

$$= 10 + \frac{16}{5}$$

$$= 10 + 3.2 = 13.2 \text{ years}$$

Hence, mode of the given data is 13.2 years.

3. **Table for mean:**

Age group of children (in years)	Number of children (f)	Mid value (x)	$f \times x$
4–8	5	6	30
8-12	6	10	60
12-16	10	14	140
16-20	9	18	162
	$\Sigma f = 30$		$\Sigma fx = 392$

By direct method.

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{392}{30} = 13.06 \text{ years}$$

Case Study 4

An agency was working on its new report. In which they were telling about the electricity consumption of houses according to the number of families members. An officer was hired to complete the report of a normal locality of 120 families. The details of the families electric bill is given below:

Monthly consumption (in kWh)	Number of families
0-100	10
100-200	12
200-300	x
300-400	15
400-500	20
500-600	24
600-700	15
700-800	18

Based on the above table, solve the following questions:

Q 1. Find the value of x.

Q 2. Find the median class of monthly consumption of electricity by the families.

Q 3. Find the mean of monthly consumption of electricity by the families.

Or

Find the mode of monthly consumption of electricity by the families.

Solutions

1. Given, sum of frequencies is 120.

$\therefore \quad 10 + 12 + x + 15 + 20 + 24 + 15 + 18 = 120$

$\Rightarrow \quad 114 + x = 120$

$\Rightarrow \quad x = 6$

2. The cumulative frequency table is given below:

Monthly consumption (in kWh)	Number of families (f)	Cumulative frequency (cf)
0-100	10	10
100-200	12	22
200-300	6	28
300-400	15	43
400-500	20	63
500-600	24	87
600-700	15	102
700-800	18	120

Here, $\frac{N}{2} = \frac{120}{2} = 60$

Since, 60 lies in the cumulative frequency 63.

So, median class is 400-500.

3.

Class interval	Mid value (x_i)	Frequency (f_i)	$d_i = x_i - A$, $A = 450$	$f_i d_i$
0-100	50	10	-400	-4000
100-200	150	12	-300	-3600
200-300	250	6	-200	-1200
300-400	350	15	-100	-1500
400-500	450	20	0	0
500-600	550	24	$+100$	$\div 2400$
600-700	650	15	$+200$	$+3000$
700-800	750	18	$+300$	$+5400$
Total		$\Sigma f_i = 120$		$\Sigma f_i d_i = 500$

Here, $A = 450$, $\Sigma f_i = 120$ and $\Sigma f_i d_i = -500$

By using short cut method,

$$\text{Mean} = A + \frac{\Sigma f_i d_i}{\Sigma f_i} = 450 + \frac{(500)}{120}$$

$$= 450 + 4.17 = 454.17 \text{ kWh}$$

Or

The modal class is 500-600, because it has maximum frequency 24.

Here, $l = 500$, $f_m = 24$, $f_p = 20$, $f_s = 15$ and $h = 100$

$$\therefore \quad \text{Mode} = l + \frac{f_m - f_p}{2f_m - f_p - f_s} \times h$$

$$= 500 + \frac{24 - 20}{2 \times 24 - 20 - 15} \times 100$$

$$= 500 + \frac{400}{13} = 500 + 30.77$$

$$= 530.77 \text{ kWh}$$

Very Short Answer Type Questions

Q 1. Find the class marks of the classes 10-25 and 35-55. *[CBSE 2020]*

Q 2. If $\sum f_i = 15$, $\sum f_i x_i = 3p + 36$ and mean of the distribution is 3, then find the value of p.

Q 3. What is the mean of first five positive multiples of 3?

Q 4. The following table shows the gain in weight by 25 children in a year.

Gain in weight (x_i) (in kg)	1.5	2	2.4	3	3.2	3.4
Number of children (f_i)	4	5	8	5	2	1

Find the mean of gain in weight.

Q 5. Suppose $\Sigma f_i x_i = 30$, $\Sigma f_i = 5$ and mean is $\bar{x} = 6$. If each observation is multiplied by 3, then find the new mean.

Q 6. If the mode of the data 3, 5, 8, 9, 8, 12, 7, 12 and x is 8, find the value of x. *[CBSE 2015]*

Q 7. Find the succeeding value of the modal class in the following data:

Marks	50-60	60-70	70-80	80-90	90-100
Number of students	4	8	14	19	5

Q 8. Find the median of 3, 9, 6, 12, 19 and 11.

Q 9. In a continuous frequency distribution, the median of the data is 21. If each observation is increased by 5, then find the new median. *[CBSE 2015]*

Q 10. The following table gives production yield in kg per hectare of wheat of 100 farms of a village:

Production yield (kg/hectare)	Number of farms
40-45	4
45-50	6
50-55	16
55-60	20
60-65	30
65-70	24

Change the distribution to a 'more than type' distribution.

Q 11. Find the sum of the frequencies after the median class:

Height (in cm)	Number of students
140-150	5
150-160	6
160-170	10
170-180	4
180-190	7

Q 12. Find the median of the data, using an empirical relation when it is given that mode = 12.4 and mean = 10.5. *[CBSE 2016]*

Short Answer Type-I Questions

Q 1. A survey was conducted by a group of students as a part of their environment awareness programme, in which they collected the following data regarding the number of plants in 20 houses in a locality. Find the mean number of plants per house. *[NCERT EXERCISE]*

Number of plants	Number of houses
0-2	1
2-4	2
4-6	1
6-8	5
8-10	6
10-12	2
12-14	3

Q 2. If the mean of the following data is 12, then find the value of p. *[CBSE 2017]*

x_i	4	8	p	16	20
f_i	5	3	12	5	4

Q 3. Find the mean of the following distribution by assumed mean method:

Class intervals	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	10	6	8	12	5	9

Q 4. The following is the distribution of weights (in kg) of 40 persons: *[CBSE 2017]*

Weight (in kg)	Number of persons
40-45	4
45-50	4
50-55	13
55-60	5
60-65	6
65-70	5
70-75	2
75-80	1

Construct a cumulative frequency distribution (of the less than type) table for the above data.

Q 5. If mode of the following frequency distribution is 55, then find the value of x: *[CBSE 2022 Term-II]*

Class	Frequency
0-15	10
15-30	7
30-45	x
45-60	15
60-75	10
75-90	12

Q 6. Find the mode of the following frequency distribution: *[CBSE 2022 Term-II]*

Class	Frequency
10-20	15
20-30	10
30-40	12
40-50	17
50-60	4

Short Answer Type-II Questions

Q 1. The distribution given below shows the runs scored by batsmen in one-day cricket matches. Find the mean number of runs:

Runs scored	Number of batsmen
0-40	12
40-80	20
80-120	35
120-160	30
160-200	23

[CBSE SQP 2022 Term-II]

Q 2. The arithmetic mean of the following frequency distribution is 53. Find the value of k. *[CBSE 2019]*

Class	0-20	20-40	40-60	60-80	80-100
Frequency	12	15	32	k	13

Q 3. The mean of the following data is 42. Find the missing frequencies x and y, if the sum of frequencies is 100. *[CBSE 2015]*

Class interval	Frequency
0-10	7
10-20	10
20-30	x
30-40	13
40-50	y
50-60	10
60-70	14
70-80	9

Q 4. The average score of boys in the examination of a school is 71 and that of the girls is 73. The average score of the school in the examination is 71.8. Find the ratio of number of boys to the number of girls who appeared in the examination. *[CBSE 2015]*

Q 5. The length of 40 leaves of a plant are measured correct to nearest millimetre and the data obtained is represented in the following table:

[CBSE SQP 2023-24]

Length (in mm)	Number of leaves
118-126	3
127-135	5
136-144	9
145-153	12
154-162	5
163-171	4
172-180	2

Find the average length of the leaves.

Q 6. The following table shows the marks obtained by 100 students of Class X in a school during a particular academic session. Find the mode of this distribution.

Marks	Number of students
Less than 10	7
Less than 20	21
Less than 30	34
Less than 40	46
Less than 50	66
Less than 60	77
Less than 70	92
Less than 80	100

Q 7. Given below is the frequency distribution of the heights of players in a school.

Height (in cm)	Number of students
160-162	15
163-165	118
166-168	142
169-171	127
172-174	18

Find the modal height and interpret it.

Q 8. Following is the distribution of the long jump competition in which 250 students participated. Find the median distance jumped by the students. Interpret the median: *[CBSE SQP 2022, Term-II]*

Distance (in m)	Number of students
0-1	40
1-2	80
2-3	62
3-4	38
4-5	30

Long Answer Type Questions

Q 1. Calculate the mean of the following frequency distribution by assumed mean method: *[CBSE 2019]*

Class	Frequency
10-30	5
30-50	8
50-70	12
70-90	20
90-110	3
110-130	2

Q 2. 250 apples of a box were weighed and the distribution of masses of the apples is given in the following table: *[CBSE 2023]*

Mass (in grams)	80-100	100-120	120-140	140-160	160-180
Number of apples	20	60	70	x	60

(i) Find the value of x and the mean mass of the apples.

(ii) Find the modal mass of the apples.

Q 3. The table shows the daily expenditure on food of 25 households in a locality. Find the mean and mode of daily expenditure on food. *[CBSE 2019]*

Daily expenditure (in ₹)	Number of households
100-150	4
150-200	5
200-250	12
250-300	2
300-350	2

Q 4. Mode of the following frequency distribution is 65 and sum of all the frequencies is 70. Find the missing frequencies x and y. *[CBSE 2015]*

Class	Frequency
0-20	8
20-40	11
40-60	x
60-80	12
80-100	y
100-120	9
120-140	9
140-160	5

Q 5. The median of the following data is 50. Find the values of 'p' and 'q', if the sum of all frequencies is 90. Also, find the mode. *[CBSE SQP 2023-24]*

Marks obtained	Number of students
20-30	p
30-40	15
40-50	25
50-60	20
60-70	q
70-80	8
80-90	10

Q 6. The frequency distribution of weekly pocket money received by a group of students is given below:

Pocket money in (₹)	Number of students
More than or equal to 20	90
More than or equal to 40	76
More than or equal to 60	60
More than or equal to 80	55
More than or equal to 100	51
More than or equal to 120	49
More than or equal to 140	33
More than or equal to 160	12
More than or equal to 180	8
More than or equal to 200	4

Find median of the given data.

Q 7. A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarised it in the table given below. Find the mean and median of the following data. *[CBSE 2023]*

Number of cars	Frequency (periods)
0-10	7
10-20	14
20-30	13
30-40	12
40-50	20
50-60	11
60-70	15
70-80	8

Q 8. Find the missing frequencies and the median for the following distribution, if the mean is 1.46.

Number of accidents	Number of days (frequency)
0	46
1	?
2	?
3	25
4	10
5	5
Total	200

Q 9. The monthly expenditure on milk in 200 families of a housing society is given below: *[CBSE 2023]*

Monthly expenditure (in ₹)	Frequency (periods)
1000-1500	24
1500-2000	40
2000-2500	33
2500-3000	x
3000-3500	30
3500-4000	22
4000-4500	16
4500-5000	7

Find the value of x and also, find the median and mean expenditure on milk.

Solutions

Very Short Answer Type Questions

1. Class mark of 10-25 is $\frac{10+25}{2} = \frac{35}{2} = 17.5$

TR!CK

Class mark of an interval $= \frac{\text{Lower limit} + \text{Upper limit}}{2}$

and class mark of 35-55 is $\frac{35+55}{2} = \frac{90}{2} = 45$

2. $\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 3 = \frac{3p+36}{15}$

$\Rightarrow \quad 3 \times 15 = 3p + 36$

$\Rightarrow \quad 45 - 36 = 3p$

$\Rightarrow \quad 3p = 9$

$\Rightarrow \quad p = \frac{9}{3} = 3$

Hence, the value of p is 3.

3. First five positive multiples of 3 are 3, 6, 9, 12 and 15.

$\therefore \quad \text{Mean} = \frac{3+6+9+12+15}{5} = \frac{45}{5} = 9$

4.

x_i	f_i	$x_i f_i$
1.5	4	6
2	5	10
2.4	8	19.2
3	5	15
3.2	2	6.4
3.4	1	3.4
Total	25	60

Here, $\Sigma f_i = 25$ and $\Sigma x_i f_i = 60$

$$\therefore \quad \text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{60}{25} = 2.4$$

Hence, mean of gain in weight is 2.4 kg.

5. Given, $\Sigma f_i x_i = 30$, $\Sigma f_i = 5$ and $\bar{x} = 6$.

TR!CK

Let the mean of n terms is $\bar{x}$, then if each term is multiplied by a non-zero number m, then new mean will be $m\bar{x}$.

$\therefore$ New mean $= 3 \times \bar{x} = 3 \times 6 = 18$.

6. Given, mode = 8

Here, the terms 8 and 12 are repeated same number of times.

Hence, the value of x would be 8, since mode is the term which has the highest frequency.

7. In the given data, the highest frequency is 19. Therefore, its modal class is 80-90.

TiP

The succeeding value of modal class is just next to the modal class.

Hence, the succeeding value of modal class is 5.

8. On arranging the data in ascending order, we get 3, 6, 9, 11, 12, 19.

Here, $n = 6$ (even)

So, $$\text{Median} = \frac{1}{2}\left\{\left(\frac{n}{2}\right)\text{th term} + \left(\frac{n}{2}+1\right)\text{th term}\right\}$$

$$= \frac{1}{2}\left\{\left(\frac{6}{2}\right)\text{th term} + \left(\frac{6}{2}+1\right)\text{th term}\right\}$$

$$= \frac{1}{2}(3\text{rd term} + 4\text{th term})$$

$$= \frac{1}{2}(9+11) = \frac{1}{2} \times 20 = 10$$

9. Given, median = 21

Increased value of each observation = 5

TR!CK

When a fixed constant value is added to each observation then median increases by the same constant.

$\therefore$ Required new median = Given median + Increased value

$$= 21 + 5 = 26$$

10. The cumulative frequency distribution of more than type can be obtained as follows:

Production yield	Number of farms
More than 65	24
More than 60	24 + 30 = 54
More than 55	54 + 20 = 74
More than 50	74 + 16 = 90
More than 45	90 + 6 = 96
More than 40	96 + 4 = 100

11. The cumulative frequency table is shown below:

Height (in cm)	Number of students (f)	Cumulative frequency (cf)
140-150	5	5
150-160	6	11
160-170	10	21
170-180	4	25
180-190	7	32

Here, $\frac{N}{2} = \frac{32}{2} = 16$

Since, 16 lies in cumulative frequency 21. Therefore median class is 160-170. Now, the required sum of frequencies after median class is $4 + 7$ *i.e.* 11.

12. From Empirical relation,

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

$$12.4 = 3 \times \text{Median} - 2 \times 10.5$$

$$\Rightarrow \quad 12.4 = 3 \times \text{Median} - 21$$

$$\therefore \quad 3 \times \text{Median} = 12.4 + 21 = 33.4$$

$$\therefore \quad \text{Median} = \frac{33.4}{3} = 11.13$$

Short Answer Type-I Questions

1. We know that,

$$\text{Class mark } x_i = \frac{\text{Upper limit} + \text{Lower limit}}{2}$$

The values of x_i and $f_i x_i$ can be calculated as follows:

CI	f_i	x_i	$f_i x_i$
0-2	1	1	$1 \times 1 = 1$
2-4	2	3	$2 \times 3 = 6$
4-6	1	5	$1 \times 5 = 5$
6-8	5	7	$5 \times 7 = 35$
8-10	6	9	$6 \times 9 = 54$
10-12	2	11	$2 \times 11 = 22$
12-14	3	13	$3 \times 13 = 39$
Total	$\Sigma f_i = 20$		$\Sigma f_i x_i = 162$

By direct method,

$$\text{Mean } \bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{162}{20} = 8.1$$

Hence, the mean number of plants per house is 8.1

2. Given, mean = 12

The values of $f_i x_i$ can be calculated as follows:

x_i	f_i	$f_i x_i$
4	5	20
8	3	24
p	12	$12p$
16	5	80
20	4	80
Total	$\Sigma f_i = 29$	$\Sigma f_i x_i = 204 + 12p$

By direct method.

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

$$\Rightarrow \quad 12 = \frac{204 + 12p}{29}$$

$$\Rightarrow \quad 12 \times 29 = 204 + 12p$$

$$\Rightarrow \quad 348 = 204 + 12p$$

$$\Rightarrow \quad 12p = 348 - 204 = 144$$

$$\Rightarrow \quad p = \frac{144}{12} = 12$$

Hence, the value of p is 12.

3.

Class interval	Mid value (x_i)	Frequency (f_i)	$d_i = x_i - A$, $A = 55$	$f_i d_i$
20-30	25	10	–30	–300
30-40	35	6	–20	–120
40-50	45	8	–10	–80
50-60	55	12	0	0
60-70	65	5	10	50
70-80	75	9	20	180
Total		50		–270

Here, $A = 55$, $h = 10$, $\Sigma f_i = 50$ and $\Sigma f_i d_i = -270$.

By using assumed mean method.

$$\text{Mean} = A + \frac{\Sigma f_i d_i}{\Sigma f_i} = 55 + \frac{(-270)}{50}$$

$$= 55 - 5.4 = 49.6$$

Hence, mean of given distribution table is 49.6.

4. Cumulative frequency distribution (of the less than type) table for the given data is as follows:

Less than type	cf
Less than 45	4
Less than 50	4 + 4 = 8
Less than 55	8 + 13 = 21
Less than 60	21 + 5 = 26
Less than 65	26 + 6 = 32
Less than 70	32 + 5 = 37
Less than 75	37 + 2 = 39
Less than 80	39 + 1 = 40

5. Given mode of distribution is 55, which lies in the interval 45-60.

So, 45-60 is a modal class.

$\therefore\ l = 45,\ f_m = 15,\ f_p = x,\ f_s = 10$ and $h = 15$

$$\text{Mode} = l + \frac{f_m - f_p}{2f_m - f_p - f_s} \times h$$

$$55 = 45 + \frac{15 - x}{2 \times 15 - x - 10} \times 15$$

$$\Rightarrow \quad 10 = \frac{(15 - x)}{30 - x - 10} \times 15$$

$$\Rightarrow \quad 2(20 - x) = (15 - x) \times 3$$

$$\Rightarrow \quad 40 - 2x = 45 - 3x$$

$$\Rightarrow \quad x = 5$$

6. In given frequency distribution, the highest frequency is 17, which lies in the interval 40-50.

Thus, 40-50 is a modal class.

$\therefore\ l = 40,\ f_m = 17,\ f_p = 12,\ f_s = 4$ and $h = 10$

$$\therefore \quad \text{Mode} = l + \frac{f_m - f_p}{2f_m - f_p - f_s} \times h$$

$$\text{Mode} = 40 + \frac{17 - 12}{2 \times 17 - 12 - 4} \times 10$$

$$= 40 + \frac{5 \times 10}{34 - 16} = 40 + \frac{50}{18}$$

$$= 40 + 2.78 = 42.78$$

Short Answer Type-II Questions

1.

Runs scored	Number of batsmen (f_i)	Mid value (x_i)	$u_i = \frac{x_i - A}{h}$, $A = 100$, $h = 40$	$f_i u_i$
0-40	12	20	– 2	– 24
40-80	20	60	–1	– 20
80-120	35	100	0	0
120-160	30	140	1	30
160-200	23	180	2	46
Total	$\Sigma f_i = 120$			$\Sigma f_i u_i = 32$

Here, $\Sigma f_i = 120$, $A = 100$, $h = 40$ and $\Sigma f_i u_i = 32$

By step deviation method.

$$\therefore \quad \text{Mean} = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 100 + \frac{32 \times 40}{120}$$

$$= 100 + 10.67 = 110.67$$

2. The values of x_i and $f_i x_i$ can be calculated as follows:

Class	Class marks (x_i)	Frequency (f_i)	$f_i x_i$
0-20	10	12	120
20-40	30	15	450
40-60	50	32	1600
60-80	70	k	70 k
80-100	90	13	1170
Total		$\Sigma f_i = 72 + k$	$\Sigma f_i x_i =$ 3340 + 70 k

Here, $\Sigma f_i = 72 + k$ and $\Sigma f_i x_i = 3340 + 70k$

$\therefore$ $\text{Mean}(\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 53 = \frac{3340 + 70k}{72 + k}$ (given)

$\Rightarrow 3816 + 53k = 3340 + 70k$

$\Rightarrow 17k = 476$

$\Rightarrow k = 28$

Hence, the value of k is 28.

3. Given, mean = 42 and sum of frequencies = 100

$\therefore 7 + 10 + x + 13 + y + 10 + 14 + 9 = 100$

$\Rightarrow 63 + x + y = 100 \Rightarrow y = 100 - 63 - x$

$\Rightarrow y = 37 - x$

The values of x_i and $f_i x_i$ can be calculated as follows:

CI	f_i	x_i	$f_i x_i$
0-10	7	5	35
10-20	10	15	150
20-30	x	25	$25x$
30-40	13	35	455
40-50	$y=(37-x)$	45	$1665 - 45x$
50-60	10	55	550
60-70	14	65	910
70-80	9	75	675
Total	$\Sigma f_i = 100$		$\Sigma f_i x_i = 4440 - 20x$

By direct method,

$\therefore$ $\text{Mean } \bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$

$\Rightarrow 42 = \frac{4440 - 20x}{100}$ (given)

$\Rightarrow 4200 = 4440 - 20x$

$\Rightarrow 20x = 4440 - 4200$

$\Rightarrow x = \frac{240}{20} = 12$

$\therefore y = 37 - 12 = 25$

Hence, $x = 12$ and $y = 25$.

4. Let the number of boys = n_1

and number of girls = n_2

Average score of boys = 71 = $\overline{x_1}$

Average score of girls = 73 = $\overline{x_2}$

Average score of school = 71.8 = $\overline{x_{12}}$

$\therefore$ Combined mean, $\overline{x_{12}} = \frac{n_1 x_1 + n_2 x_2}{n_1 + n_2}$

$\Rightarrow 71.8 = \frac{n_1(71) + n_2(73)}{n_1 + n_2}$

$\Rightarrow 71.8\, n_1 + 71.8\, n_2 = 71 n_1 + 73 n_2$

$\Rightarrow 0.8 n_1 = 1.2 n_2$

$\Rightarrow \frac{n_1}{n_2} = \frac{1.2}{0.8} = \frac{3}{2}$

$\Rightarrow n_1 : n_2 = 3 : 2$

Hence, the required ratio is 3 : 2.

5. Given data is not continuous, so we make continuous by subtracting and adding 0.5 in lower and upper limits respectively.

The continuous data is shown below:

Length (in mm)	**Mid value (x_i)**	**No. of leaves (f_i)**	$u_i = \frac{x_i - A}{h}$, $h = 9$, $A = 149$	$f_i u_i$
117.5-126.5	122	3	-3	-9
126.5 -135.5	131	5	-2	-10
135.5-144.5	140	9	-1	-9
144.5-153.5	149	12	0	0
153.5-162.5	158	5	1	5
162.5-171.5	167	4	2	8
171.5-180.5	176	2	3	6
Total		$\Sigma f_i = 40$		$\Sigma f_i u_i = -9$

Here, $\Sigma f_i = 40$, $\Sigma f_i u_i = -9$, $A = 149$ and $h = 9$.

By step-deviation method,

$$\text{Mean } (\bar{x}) = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 149 + \frac{(-9)}{40} \times 9$$

$$= 149 - \frac{81}{40} = 149 - 2.025$$

$$= 146.975$$

So, average length of the leaves is 146.957 mm.

6. The given distribution can be written as:

Class interval	**Frequency**
0-10	7
10-20	$21 - 7 = 14$
20-30	$34 - 21 = 13$
30-40	$46 - 34 = 12$
40-50	$66 - 46 = 20$
50-60	$77 - 66 = 11$
60-70	$92 - 77 = 15$
70-80	$100 - 92 = 8$

$\because$ Class interval 40-50 has the maximum frequency, so modal class is 40-50.

Here, $l = 40$, $f_m = 20$, $f_p = 12$, $f_s = 11$ and $h = 10$.

$\therefore$ $\text{Mode} = l + \left(\frac{f_m - f_p}{2f_m - f_p - f_s}\right) \times h$

$$= 40 + \left(\frac{20 - 12}{2 \times 20 - 12 - 11}\right) \times 10$$

$$= 40 + \frac{8}{17} \times 10 = 40 + 4.71 = 44.71$$

Hence, the mode of given distribution is 44.71.

7. The given frequency distribution is not continuous, so first we convert it into continuous frequency distribution.

TR ! CK

To convert the given distribution into continuous distribution, we subtract 0.5 *in lower limit and add* 0.5 *in upper limit of each interval.*

Class interval	Frequency
159.5-162.5	15
162.5-165.5	118
165.5-168.5	142
168.5-171.5	127
171.5-174.5	18

∵ Class interval 165.5-168.5 has maximum frequency, so it is the modal class.

Here, $l = 165.5$, $f_m = 142$, $f_p = 118$, $f_s = 127$ and $h = 3$.

$$\therefore \quad \text{Mode} = l + \left(\frac{f_m - f_p}{2f_m - f_p - f_s}\right) \times h$$

$$= 165.5 + \left(\frac{142 - 118}{2 \times 142 - 118 - 127}\right) \times 3$$

$$= 165.5 + \frac{24}{39} \times 3$$

$$= 165.5 + 1.85 = 167.35$$

Hence, the modal height is 167.35 cm. This means that the height of maximum number of players in the school is 167.35 cm (approx).

8. The cumulative frequency of given distribution can be calculated as follows:

Distance (In m)	Number of students (f_i)	Cumulative frequency (cf)
0-1	40	40
1-2	80	120
2-3	62	182
3-4	38	220
4-5	30	250

Here, $\frac{N}{2} = \frac{250}{2} = 125$

∵ 125 lies under *Cf* 182, so median class is 2-3.

$\therefore$ $l = 2$, $f = 62$, $Cf = 120$ and $h = 1$

$$\text{Median} = l + \frac{\frac{N}{2} - Cf}{f} \times h$$

$$= 2 + \frac{125 - 120}{62} \times 1$$

$$= 2 + \frac{5}{62}$$

$$= 2 + 0.08 = 2.08 \text{ m}$$

Hence, the median distance is 2.08 m. This means that 50% students jump below 2.08 m and 50% above it.

Long Answer Type Questions

1. Let A = 80 be the assumed mean.

Class interval	Frequency (f_i)	Class mark (x_i)	$d_i = x_i - A = x_i - 80$	$f_i d_i$
10-30	5	20	–60	–300
30-50	8	40	–40	–320
50-70	12	60	–20	–240
70-90	20	80	0	0
90-110	3	100	20	60
110-130	2	120	40	80
Total	$\Sigma f_i = 50$			$\Sigma f_i d_i = -720$

Using short-cut method.

$$\text{Mean, } \bar{x} = A + \frac{\Sigma f_i d_i}{\Sigma f_i}$$

$$= 80 - \frac{720}{50} = 80 - 14.4 = 65.6$$

Hence, the mean of the given frequency distribution is 65.6.

2. (i) Given, number of apples in a box = 250.

$\therefore$ $20 + 60 + 70 + x + 60 = 250$

$\Rightarrow$ $210 + x = 250$

$\Rightarrow$ $x = 250 - 210 = 40$.

Calculation table for mean

Mass (In grams)	Mid values (x_i)	No. of apples (f_i)	$u_i = \frac{x_i - A}{h}$, $A = 130$, $h = 20$	$f_i \times u_i$
80-100	90	20	–2	–40
100-120	110	60	–1	–60
120-140	130	70	0	0
140-160	150	$x = 40$	1	40
160-180	170	60	2	120
Total		$\Sigma f_i = 250$		$\Sigma f_i u_i = 60$

Here, $\Sigma f_i = 250$, $\Sigma f_i u_i = 60$, $h = 20$ and $A = 130$

Using step deviation method.

$$\text{Mean } (\bar{x}) = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 130 + \frac{60}{250} \times 20$$

$$\Rightarrow \quad = 130 + \frac{1200}{250} = 130 + 4.8 = 134.8$$

So, mean mass of the apples is 134.8 grams.

(ii) From the table, (120-140) is a modal class, because it has a maximum frequency, *i.e.*, 70.

$\therefore$ $l = 120$, $f_m = 70$, $f_p = 60$, $f_s = 40$ and $h = 20$

$$\text{Mode} = l + \frac{f_m - f_p}{2f_m - f_p - f_s} \times h = 120 \times \frac{70 - 60}{2 \times 70 - 60 - 40} \times 20$$

$$= 120 + \frac{10 \times 20}{140 - 100} = 120 + \frac{200}{40} = 120 + 5$$

$$= 125$$

So, the modal mass of the apples is 125 gm.

3. The values of x_i and f_ix_i can be calculated as follows:

Daily expendi -ture in (₹)	Frequency (f_i)	Class marks (x_i)	$f_i x_i$
100-150	4	125	500
150-200	5	175	875
200-250	12	225	2700
250-300	2	275	550
300-350	2	325	650
Total	$\Sigma f_i = 25$		$\Sigma f_i x_i =$ 5275

∴ The mean of daily expenditure of food.

$$\overline{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{5275}{25} = 211$$

Hence, mean of daily expenditure food is ₹ 211

The highest frequency in the given table is 12, whose corresponding interval is 200-250. So modal class is 200-250.

Here, $l = 200$, $f_m = 12$, $f_p = 5$, $f_s = 2$ and $h = 50$

$$\therefore \text{Mode} = l + \frac{f_m - f_p}{2f_m - f_p - f_s} \times h$$

$$= 200 + \frac{12-5}{2\times 12 - 5 - 2} \times 50 = 200 + \frac{350}{17}$$

$$= 200 + 20.59 = ₹\ 220.59$$

Hence, mode of daily expenditure of food is ₹220.59.

4. Given, mode = 65

∴ Modal class is 60-80.

Class interval	f
0-20	8
20-40	11
40-60	$x \to f_p$
60-80	$12 \to f_m$
80-100	$y \to f_s$
100-120	9
120-140	9
140-160	5

Also, sum of all the frequencies = 70

$$\Rightarrow 54 + x + y = 70$$

$$\Rightarrow x + y = 70 - 54$$

$$\Rightarrow x + y = 16 \quad \text{...(1)}$$

Here, $l = 60$, $f_m = 12$, $f_p = x$, $f_s = y$ and $h = 20$.

$$\therefore \text{Mode} = l + \left(\frac{f_m - f_p}{2f_m - f_p - f_s}\right) \times h$$

$$\Rightarrow 65 = 60 + \left(\frac{12-x}{2\times 12 - x - y}\right) \times 20$$

$$\Rightarrow 65 - 60 = \left(\frac{12-x}{24 - x - y}\right) \times 20$$

$$\Rightarrow 5(24 - x - y) = 20(12 - x)$$

$$\Rightarrow 24 - x - y = 4(12 - x)$$

$$\Rightarrow 24 - x - y = 48 - 4x$$

$$\Rightarrow 3x - y = 24 \quad \text{...(2)}$$

On adding eqs. (1) and (2), we get.

$$4x = 40 \Rightarrow x = 10$$

$$\therefore 10 + y = 16 \quad \text{[from eq. (1)]}$$

$$\Rightarrow y = 16 - 10 = 6$$

Hence, $x = 10$ and $y = 6$.

5. Given, the sum of all frequencies = 90

$$\therefore p + 15 + 25 + 20 + q + 8 + 10 = 90$$

$$\Rightarrow p + q = 90 - 78 - 12$$

$$\Rightarrow q = 12 - p \quad \text{... (1)}$$

Calculation table for median

Marks	Number of students	Cumulative frequency
20-30	p	p
30-40	15	$p + 15$
40-50	25	$p + 40$
50-60	20	$p + 60$
60-70	q	$p + q + 60$
70-80	8	$p + q + 68$
80-90	10	$p + q + 78$

Given, the median of the above data is 50.

50 lies in the interval 50-60. So, median class is (50-60).

Here, $l = 50$, $\frac{N}{2} = \frac{p+q+78}{2}$, $f = 20$, $cf = p + 40$ and $h = 10$.

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

$$\Rightarrow 50 = 50 + \frac{\left\{\left(\frac{p+q+78}{2}\right) - (p+40)\right\}}{20} \times 10$$

$$\Rightarrow p + q + 78 - 2p - 80 = 0 \quad \text{[from eq. (1)]}$$

$$\Rightarrow p - q = -2 \Rightarrow p - 12 + p = -2$$

$$\Rightarrow 2p = 10 \Rightarrow p = 5$$

$$\Rightarrow q = 12 - 5 = 7$$

From the table, Interval (40-50) is a modal class, because it has a maximum frequency.

Here, $l = 40$, $f_m = 25$, $f_p = 15$, $f_s = 20$ and $h = 10$.

$$\therefore \text{Mode} = l + \frac{f_m - f_p}{2\times f_m - f_p - f_s} \times h$$

$$= 40 + \frac{25-15}{2\times 25 - 15 - 20} \times 10 = 40 + \frac{100}{50-35}$$

$$= 40 + \frac{100}{15} = 40 + 6.67 = 46.67$$

6.

Pocket money in (₹)	Number of students	CI	f_i	cf_i
More than or equal to 20	90	20-40	90–76 = 14	14
More than or equal to 40	76	40-60	76–60 = 16	14 + 16 = 30
More than or equal to 60	60	60-80	60–55 = 5	30 + 5 = 35
More than or equal to 80	55	80-100	55–51 = 4	35 + 4 = 39
More than or equal to 100	51	100-120	51–49 = 2	39 + 2 = 41
More than or equal to 120	49	120-140	49–33 = 16	41 + 16 = 57
More than or equal to 140	33	140-160	33–12 = 21	57 + 21 = 78
More than or equal to 160	12	160-180	12–8 = 4	78 + 4 = 82
More than or equal to 180	8	180-200	8–4 = 4	82 + 4 = 86
More than or equal to 200	4	200-220	4	86 + 4 = 90
Total			90	

Here. $N = 90$. $\frac{N}{2} = \frac{90}{2} = 45$

$\therefore$ Median class is 120-140. Since. 45 lies in the cumulative frequency 57.

Now. $l = 120$. $cf = 41$. $f = 16$ and $h = 20$

$$\therefore \quad \text{Median} = l + \left\{\frac{\frac{N}{2} - cf}{f}\right\} \times h = 120 + \frac{45-41}{16} \times 20$$

$$= 120 + \frac{4 \times 20}{16} = 120 + 5 = ₹125$$

7. Calculation table for Mean and Median

Number of cars	Mid values (x_i)	Frequency (f_i)	Cumulative frequency cf	$u_i = \frac{x_i - A}{h}$, $A = 45$, $h = 10$	$f_i u_i$
0-10	5	7	7	–4	–28
10-20	15	14	21	–3	–42
20-30	25	13	34	–2	–26
30-40	35	12	46	–1	–12
40-50	45	20	66	0	0
50-60	55	11	77	1	11
60-70	65	15	92	2	30
70-80	75	8	100	3	24
Total		$\Sigma f_i = 100$			$\Sigma f_i u_i = -43$

Here. $A = 45$. $h = 10$. $\Sigma f_i = 100$ and $\Sigma f_i u_i = -43$.

By step-deviation method.

$$\therefore \quad \text{Mean}\,(\bar{x}) = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 45 + \frac{(-43)}{100} \times 100$$

$$= 45 - 43 = 40.7$$

Here $= \frac{N}{2} = \frac{100}{2} = 50$ which lies under the cumulative frequency 66 so. median class is (40-50).

$l = 40$. $f = 20$. $cf = 46$ and $h = 10$

$$\text{Median} = l + \frac{\left(\frac{N}{2} - CF\right)}{f} \times h = 40 + \frac{(50-46)}{20} \times 10$$

$$= 40 + \frac{40}{20} = 40 + 2 = 42$$

8. Let the missing frequencies corresponding to 1 and 2 are f_1 and f_2 respectively. Then

Sum of frequencies $= 200 = \Sigma f = N$

$$\Rightarrow \quad 46 + f_1 + f_2 + 25 + 10 + 5 = 200$$

$$\Rightarrow \quad f_1 + f_2 = 200 - 86 = 114 \quad \text{...(1)}$$

x_i	0	1	2	3	4	5
f_i	46	f_1	f_2	25	10	5
$f_i x_i$	0	f_1	$2f_2$	75	40	25

By direct method.

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = 1.46 \quad \text{(given)}$$

$$\Rightarrow \quad \frac{0 + f_1 + 2f_2 + 75 + 40 + 25}{200} = 1.46$$

$$\Rightarrow \quad f_1 + 2f_2 + 140 = 1.46 \times 200$$

$$\Rightarrow \quad f_1 + 2f_2 = 292 - 140 = 152 \quad \text{...(2)}$$

On solving eqs. (1) and (2). we get

$f_2 = 38$ and $f_1 = 76$

The new formed table is shown below.

x	0	1	2	3	4	5
f	46	76	38	25	10	5
cf	46	122	160	185	195	200

Here. $N = 200$. $\frac{N}{2} = \frac{200}{2} = 100$. even

$$\text{Median} = \frac{\left(\frac{N}{2}\right)\text{th term} + \left(\frac{N}{2} + 1\right)\text{th term}}{2}$$

$$= \frac{100\text{th term} + 101\text{th term}}{2}$$

$$= \frac{1+1}{2} = \frac{2}{2} = 1$$

(Since. both 100th and 101th terms lie in cf 122. so. the corresponding value of x is 1.)

Hence. the missing frequencies are 76 and 38 and the required median is 1.

9. Given , number of families = 200

$$24 + 40 + 33 + x + 30 + 22 + 16 + 7 = 200$$

$$\Rightarrow \quad 172 + x = 200$$

$$\Rightarrow \quad x = 200 - 172 = 28$$

Calculation table for mean and medium

Monthly expenditure (in ₹)	Mid value (x_i)	No. of families (f_i)	Cumulative frequency (cf)	$u_i = \frac{x_i - A}{h}$ $A = 3250,\ h = 500$	$f_i u_i$
1000-1500	1250	24	24	–4	– 96
1500 -2000	1750	40	64	–3	– 120
2000-2500	2250	33	97	–2	– 66
2500.-3000	2750	x=28	125	–1	–28
3000-3500	3250	30	155	0	0
3500-4000	3750	22	177	1	22
4000-4500	4250	16	193	2	32
4500-5000	4750	7	200	3	21
Total		$\Sigma f_i = 200$			$\Sigma f_i u_i = -235$

Here, $N = 200 \Rightarrow \frac{N}{2} = \frac{200}{2} = 100$ which lies under the cumulative frequency 125. So, median class is (2500-3000).

$l = 2500,\ cf = 97,\ f = 28$ and $h = 500$

$$\text{Median} = l + \frac{\left(\frac{N}{2} - cf\right)}{f} \times h = 2500 + \frac{(100-97)}{28} \times 500$$

$$= 2500 + \frac{1500}{28} = 2500 + 53.57 = 2553.57$$

Also, by step-deviation method.

$$\text{Mean } (\bar{x}) = A + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h = 3250 + \frac{(-235)}{200} \times 500$$

$$= 3250\text{-}587.5$$

$$= 2662.5$$

Hence, median and mean expenditure on milk are ₹ 2553.57 and ₹ 2662.5 respectively.

Chapter Test

Multiple Choice Questions

Q 1. The mean and median of a distribution are 12 and 14, respectively. The value of the mode is:

a. 16 b. 18 c. 20 d. 24

Q 2. The sum of the class marks of the classes 20-30 and 50-60 is:

a. 80 b. 70 c. 60 d. 50

Assertion and Reason Type Questions

Directions (Q. Nos. 3-4): *In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:*

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

c. Assertion (A) is true but Reason (R) is false.

d. Assertion (A) is false but Reason (R) is true.

Q 3. Assertion (A): The median of the following frequency distribution is 40:

Variate	25	31	34	40	45	48	50	60
Frequency	3	8	10	15	10	9	6	2

Reason (R): If we increase the frequency of initial and last variate, then their median remain same.

Q 4. Assertion (A): The modal class of the following data is 55-60:

Class intervals	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90
Frequency	5	20	10	10	9	6	12	8

Reason (R): The preceding value of modal class is 10.

Fill in the Blanks

Q 5. If each observation is adding by 3, then new mean will be increased by .....

Q 6. The sum of the limits of median class in the following frequency distribution table is .....

Number of plants	0-5	5-10	10-15	15-20	20-25	25-30
Number of houses	3	4	6	4	8	5

True/False

Q 7. In the frequency distribution, if $\Sigma f_i x_i = 800$ and $\Sigma f_i = 40$, the mean of the distribution is 40.

Q 8. In the continuous distribution data, mode is always lies in the interval in which the highest frequency exist.

Case Study Based Question

Q 9. Due to inflations in the price of petrol, suddenly the demand of electric scooters increased. An electric scooter manufacturing company decided to make its so newly manufactured electric scooters in terms of mileage of 50 scooters of new models. Mileage of these scooters are given in following data:

Mileage (km per charge)	100-120	120-140	140-160	160-180
Number of scooters	7	12	18	13

Based on the above information, solve the following questions:

(i) Find the difference of the upper limit of the median class and lower limit of the modal class.

(ii) Find the median value of given data in km/charge.

Or

Find the modal value of given data in km/charge.

(iii) Find the average mileage of scooter in km/charge.

Very Short Answer Type Questions

Q 10. In the following distribution table, find the sum of succeeding and preceding frequencies of the modal class.

Marks	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	10	12	20	11	14	15

Q 11. Find the frequency of the median class in the following frequency distribution table:

Age (in years)	10-15	15-20	20-25	25-30	30-35	35-40
Number of cases	5	7	10	6	8	4

Short Answer Type-I Questions

Q 12. Find the mean of the following distribution:

Class	3-5	5-7	7-9	9-11	11-13
Frequency	5	10	10	7	8

Q 13. Find the mode of the following data:

Class	0-20	20-40	40-60	60-80	80-100	100-120	120-140
Frequency	6	8	10	12	6	5	3

Short Answer Type-II Questions

Q 14. The following is the cumulative frequency distribution (of less than type) of 1000 persons each of age 20 years and above. Determine the mean age.

Age below (in years)	30	40	50	60	70	80
Number of persons	100	220	350	750	950	1000

Q 15. The daily wages of 80 workers in a project are given below:

Wages (in ₹)	400-450	450-500	500-550	550-600	600-650	650-700	700-750
Number of workers	2	6	12	18	24	13	5

Find the median daily wages of the workers.

Long Answer Type Question

Q 16. Find median and mode of the following monthly income distribution:

Monthly income (in ₹)	Number of employees (Frequency)
600-700	40
700-800	68
800-900	86
900-1000	120
1000-1100	90
1100-1200	40
1200-1300	26