Statistics

1. The mean and median of a statistical data are 21 and 23 respectively. The mode of the data is : (2024)
(a) 27
(b) 22
(c) 17
(d) 23

Answer. Ans: (a) 27

2. If a certain variable x divides a statistical data arranged in order into two equal parts, then the value of x is called the : (2024)
(a) mean
(b) median
(c) mode
(d) range of the data.

Answer. (b) median

3. Gurpreet is very fond of doing research on plants. She collected some leaves from different plants and measured their lengths in mm. (2024)

The data obtained is represented in the following table:

Length (in mm) :	70-80	80-90	90-100	100-110	110-120	120-130	130-140
Number of leaves :	3	5	9	12	5	4	2

Based on the above information, answer the following questions:
(i) Write the median class of the data. (2024)

Answer. (i) Median class : 100 – 110 1

(ii) How many leaves are of length equal to or more than 10 cm ? (2024)

Answer. (ii) No. of leaves equal to or more than 10cm(100 mm) = 23 1

(iii) (a) Find median of the data. ()2024

(iii) (a)

C.I.	f	cf
70 – 80	3	3
80 – 90	5	8
90 – 100	9	17
100 – 110	12	29
110 – 120	5	34
120 – 130	4	38
130 – 140	2	40 = N

Correct table

$$\text{Median} = 100 + \frac{10}{12}(20 - 17) = 102{\cdot}5$$

OR

(b) Write the modal class and find the mode of the data. (2024)

Answer. Modal class is 100 – 110

$$\text{Mode} = 100 + 10 \times \frac{12 - 9}{24 - 9 - 5} = 103$$

4. For some data $x_1, x_2, \ldots\ldots Xn$ with respective frequencies fi, $f_2, \ldots fIn$ (2024)

the value of $\sum_{1}^{n} f_i \left(x_i - \bar{x} \right)$ is equal to :

(a) nx
(b) 1
(c) Σfi
(d) 0

Answer. (d) 0

5. The middle most observation of every data arranged in order is called : (2024)

(a) mode
(b) median

(c) mean
(d) deviation

Answer. (b) median

13.1 Introduction

MCQ

1. If the value of each observation of a statistical data is increased by 3, then the mean of the data
(a) remains unchanged
(b) increases by 3
(c) increases by 6
(d) increases by 3n (2023)

VSA (1 mark)

2. If the mean of the first n natural number, is 15, then find n. (2020)

3. If mean of 5 observations x, x + 2,x+4,x+6 and x+8 is 11, then find the value of x. (Board Term I, 2015)

SA II (3 marks)

4. The mean weight of 150 students in a class is 60 kg. The mean weight of boys is 70 kg while that of girls is 55 kg. Find the number of boys and girls in the class. (Board Term I, 2016)

13.2 Mean of Grouped Data

VSA (1 mark)

5.

In the formula $\bar{x} = a + \left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right) \times h, u_i =$ _____ .

(NCERT Exemplar, 202

SAI (2 marks)

6. Find the mean of the following distribution:

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

(2020)

7. If the mean of the following frequency distribution is 10.8, then find the value of p:

Class	0-4	4-8	8-12	12-16	16-20
Frequency	3	*p*	5	8	2

(Term II, 2021-22 C) An

8. Data of 'missed catches' for the 40 matches played bya player is as follows:

Number of missed catches in a match	0-3	3-6	6-9	9-12	12-15
Number of matches	15	16	3	4	2

Calculate the mean number of catches missed by him. (Board Term I, 2016)

SA II (3 marks)

9. Find the mean of the following frequency distribution:

Class	Frequency
0-10	12
10-20	18
20-30	27
30-40	20
40-50	17
50-60	6

(Term II, 2021-22)

10. The weights (in kg) of 50 wild animals of a National Park were recorded and the following data was obtained:

Weight (in kg)	Number of animals
100-110	4
110-120	12
120-130	23
130-140	8
140-150	3

Find the mean weight (in kg) of animals, using assumed mean method. (Term II, 2021-22)

11. The mean of the following frequency distribution is 25. Find the value of f.

Class	0-10	10-20	20-30	30-40	40-50
Frequency	5	18	15	*f*	6

(Term II, 2021-22) Ev

13. The arithmetic mean of the following frequency distribution is 53. Find the value of k.

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

(Delhi 2019) Ev

14. Find the mean of the following frequency distribution:

Class	0-20	20-40	40-60	60-80	80-100
Frequency	17	28	32	24	19

(AI 2019) Ev

15. If the mean of the following distribution is 54, find the missing frequency x:

Class	0-20	20-40	40-60	60-80	80-100
Frequency	16	14	24	26	*x*

(Board Term-I, 2017) Ap

16. Find the mean of the following distribution:

Class	0-6	6-12	12-18	18-24	24-30
Frequency	7	5	10	12	2

(Board Term I, 2017) Ev

17. Find the mean of the data by step deviation method:

Class	15-25	25-35	35-45	45-55	55-65	65-75	75-85	85-95
Frequency	6	11	7	4	4	2	1	10

(Board Term I, 2017) Ap

18. Find the mean of the following data:

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

(Board Term I, 2017)

19. Calculate the mean for the following frequency distribution:

Class	10-30	30-50	50-70	70-90	90-110
Frequency	15	18	25	10	2

(Board Term I, 2016) Ev

20. The following table gives the literacy rate (in %) in 40 cities. Find the mean literacy rate.

Literacy rate (in %)	45-55	55-65	65-75	75-85	85-95
Number of cities	4	11	12	9	4

(Board Term I, 2015) Ev

LA (4/5/6 marks)

21. If the mean of the following frequency distribution is 62.8, then find the missing frequencyx:

Class	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	5	8	x	12	7	8

(2019C) Ap

22. The mean of the following distribution is 18. Find the frequency f of the class 19-21.

Class	11-13	13-15	15-17	17-19	19-21	21-23	23-25
Frequency	3	6	9	13	*f*	5	4

(2018) Ap

13.3 Mode of Grouped Data

MCQ

23. The distribution below gives the marks obtained by 80 students on a test:

Marks	Less than 10	Less than 20	Less than 30	Less than 40	Less than 50	Less than 60
Number of Students	3	12	27	57	75	80

The modal class of this distribution is:
(a) 10-20
(b) 20-30
(c) 30-40
(d) 50-60 (2023)

SAI (2 marks)

24. The mode of a grouped frequency distribution is 75 and the modal class is 65-80. The frequency of the class preceding the modal class is 6 and the frequency of the class succeeding the modal class is 8. Find the frequency of the modal class. (Term II, 2021-22)

25. Find the missing frequency 'x' of the following data, if its mode is 240:

Daily household expenditure (in ₹)	0-100	100-200	200-300	300-400	400-500
Number of families	140	230	270	*x*	150

(Term II, 2021-22 C) Ap

26. Find the mode of the given frequency distribution.

Class	15-25	25-35	35-45	45-55	55-65	65-75
Frequency	6	11	22	23	14	5

(Term II, 2021-22) Ev

27. If mode of the following frequency distribution is 55, then find the value of x.

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

(Term II, 2021-22) Ap

28. Find the mode of the following distribution:

Class	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	45	30	75	20	35	15

(2020 C) Ev

29. Find the mode of the following distribution:

Marks	0-10	10-20	20-0	30-40	40-50	50-60
Number of Students	4	6	7	12	5	6

(2020) Ev

30. 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

(2020) Ev

31. Find the mode of the following data:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	7	14	13	12	20	11	15	8

(Board Term I, 2015) Ev

SA II (3 marks)

32. The weights of tea in 70 packets is given in the following table:

Weight (in g.)	Number of packets
200-201	12
201-202	26
202-203	20
203-204	9
204-205	2
205-206	1

Find the modal weight. *(2019 C)*

33. The following table gives the literacy rate of 40 cities:

Literacy rate (in %)	30-40	40-50	50-60	60-70	70-80	80-90
Number of cities	6	7	10	6	8	3

LA (4/5/6 marks)

35. In a village, number of members in 50 families are given in the following frequency distribution:

Number of members	1-3	3-5	5-7	7-9	9-11	11-13	13-15	15-17	17-19
Number of families	2	8	6	10	5	5	7	4	3

Find the mode and mean of the above data. (Board Term I, 2016)

13.4 Median of Grouped Data

MCQ

36. 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 median class and modal class is
(a) 15
(b) 25
(c) 30
(d) 35 (2023)

37. The mean and median of a distribution are 14 and 15 respectively. The value of mode is
(a) 16
(b) 17
(c) 13
(d) 18 (2020 C)

VSA (1 mark)

38. Write the empirical relationship between the three measures of central tendency. (2021C, Board Term I, 2017)

39. In a certain distribution, mean and median are 9.5 and 10 respectively. Find the mode of the distribution, using an empirical relation. (Board Term-1, 2017)

40. Find the mean of the data, using an empirical formula, when it is given that mode = 50.5 and median = 45.5. (Board Term I, 2017)

41. Find the sum of upper limit and lower limit of the class interval in which the 20th observation of the following data lies:

Class interval	0-100	100-200	200-300	300-400	400-500	500-600	600-700
Frequency	5	7	6	3	20	4	8

(Board Term I, 2016) An

SAI (2 marks)

42. In a class test, 50 students obtained marks are as follows. Find the modal class and the median class.

Marks	0-20	20-40	40-60	60-80	80-100
Number	4	6	25	10	5

(Board Term I, 2017) Ev

43. The following table gives the literacy rate (in %) of 25 cities. Find the median class and modal class.

Literacy rate (in percent)	50-60	60-70	70-80	80-90
Number of cities	9	6	8	2

(Board Term I, 2017) Ev

SA II (3 marks)

44. For the following frequency distribution, find the median:

Class	1400-1550	1550-1700	1700-1850	1850-2000
Frequency	6	13	25	10

(Term II, 2021-22) Ev

45. Heights of 50 students in class X of a school are recorded and following data is obtained:

Height (in cm)	130-135	135-140	140-145	145-150	150-155	155-160
Number of students	4	11	12	7	10	6

Find the median height of the students.

(Term II, 2021-22) Ev

46. The table below shows the salaries of 280 persons:

Salary (In thousand)	No. of Persons
5 - 10	49
10 - 15	133
15 - 20	63
20 - 25	15
25 - 30	6
30 - 35	7
35 - 40	4
40 - 45	2
45 -50	1

Calculate the median salary of the data.

(NCERT Exemplar, 2018) Ev

47. Find the median of the following data:

Class Interval	0-10	10-20	20-30	30-40	40-50	Total
Frequency	8	16	36	34	6	100

(Board Term I, 2015) Ev

LA (4/5/6 marks)

48. India meteorological department observe seasonal and annual rainfall every year in different sub- divisions of our country.

It helps them to compare and analyse the results. The table given below shows sub-division wise seasonal (monsoon) rainfall (mm) in 2018:

Rainfall (mm)	Number of Sub-divisions
200-400	2
400-600	4
600-800	7
800-1000	4
1000-1200	2
1200-1400	3
1400-1600	1
1600-1800	1

Based on the above information, answer the following questions.
(1) Write the modal class.
(II) Find the median of the given data.

OR

Find the mean rainfall in this season.
(III) If sub-division having at least 1000 mm rainfall during monsoon season, is considered good rainfall sub-division, then how many sub-divisions had good rainfall?
(2023)

49. The monthly expenditure on milk in 200 families of a Housing Society is given below:

Monthly Expenditure (in ₹)	Number of Students
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. (2023)

50. Health insurance is an agreement whereby the insurance company agrees to undertake a guarantee of compensation for medical expenses in case the insured falls ill or meets with an accident which leads to hospitalisation of the insured. The government also promotes health insurance by providing a deduction from income tax. An SBI health insurance agent found the following data for distribution of ages of 100 policy holders. The health insurance policies are given to persons having age 15 years and onwards but less than 60 years.

Age (in years)	Number of Policy Holders
15-20	2
20-25	4
25-30	18
30-35	21
35-40	33
40-45	11
45-50	3
50-55	6
55-60	2

(i) Find the modal age of the policy holders.
(ii) Find the median age of the policy holders. (Term II, 2021-22 C)

51. During the annual sports meet in a school, all the athletes were very enthusiastic. They all wanted to be the winner so that their house could stand first. The instructor noted down the time taken by a group of students to complete a certain race. The data recorded is given below:

Time (in sec)	0-20	20-40	40-60	60-80	80-100
Number of students	1	4	3	7	5

Based on the above, answer the following questions:
(i) What is the class mark of the modal class?
(a) 60
(b) 70
(c) 80
(d) 140
(ii) The mode of the given data is
(a) 70-33
(b) 71.33
(c) 72-33
(d) 73.33
(iii) The median class of the given data is
(a) 20-40
(b) 40-60
(c) 80-100
(d) 60-80
(iv) The sum of the lower limits of median class and modal class is 1
(a) 80
(b) 140
(c) 120
(d) 100
(v) The median time (in seconds) of the given data is
(a) 65-7
(b) 85-7
(c) 45.7
(d) 25.7 (2021 C)

52. The distribution given below shows the number of wickets taken by bowlers in one-day cricket matches. Find the mean and the median of the number of wickets taken.

Number of wickets	Number of bowlers
20-60	7
60-100	5
100-140	16
140-180	12
180-220	2
220-260	3

(2020) Ev

53. The median of the following data is 525. Find the values of x and y, if total frequency is 100.

Class	Frequency
0-100	2
100-200	5
200-300	x
300-400	12
400-500	17
500-600	20
600-700	y
700-800	9
800-900	7
900-1000	4

(NCERT, 2020) An

54. If the median of the following frequency distribution is 32.5, find the values of f_1 and f2.

Class	Frequency
0-10	f_1
10-20	5
20-30	9
30-40	12
40-50	f_2
50-60	3
60-70	2
Total	**40**

(Delhi 2019) An

55. Find the values of frequencies x and y in the following frequency distribution table, if N = 100 and median is 32.

Marks	No. of students
0 – 10	10
10 – 20	x
20 – 30	25
30 – 40	30
40 – 50	y
50 – 60	10
Total	**100**

(AI 2019) Ev

56. In an apple orchard, the number of apples on 80 trees are as follows:

Number of apples	40-60	60-80	80-100	100-120	120-140	140-160	160-180
Number of trees	12	11	14	16	13	9	5

Find the mode and median of the above data. (Board Term I, 2017)

57. If the median of the following distribution is 46, find the missing frequencies p and q.

Class interval	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
Frequency	12	30	p	65	q	25	18	**230**

(Board Term I, 2017) Ap

58. If the median of the distribution given below is 27. Find the value of x and y.

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60	Total
Frequency	5	x	20	14	y	8	**68**

(Board Term I, 2015) AP

CBSE Sample Questions

13.2 Mean of Grouped Data

SA II (3 marks)

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

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

(Term II, 2021-22) Ev

13.3 Mode of Grouped Data

SAI (2 marks)

2. Mrs. Garg recorded the marks obtained by her students in the following table. She calculated the modal marks of the students of the class as 45. While printing the data, a blank was left. Find the missing frequency in the table given below.

Marks obtained	0-20	20-40	40-60	60-80	80-100
Number of students	5	10	–	6	3

(Term II, 2021-22) Ap

13.4 Median of Grouped Data

MCQ

4. If the difference of Mode and Median of a data is 24, then the difference of median and mean is
(a) 8
(b) 12
(c) 24
(d) 36 (2022-23)

5. For the following distribution,

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

The sum of the lower limits of the median and modal class is
(a) 15
(b) 25
(c) 30
(d) 75 (2022-23)

SA II (3 marks)

6. 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.

7. The median of the following data is 16. Find the missing frequencies a and b, if the total of the frequencies is 70.

Class	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	12	*a*	12	15	*b*	6	6	4

(2020-21) AP

LA (4/5/6 marks)

8. The median of the following data is 525. Find the values of x and y, if the total frequency is 100.

Class interval	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Frequency	2	5	*x*	12	17	20	*y*	9	7	4

(2022-23) Ap

Case study based questions are compulsory. Attempt any four subparts. Each subpart carries 1 mark.

9. 100 m RACE
A stopwatch was used to find the time that it took a group of students to run 100 m.

SOLUTIONS

Previous Years' CBSE Board Questions

1. (b): If each value of observation is increased by 3, then mean is als increased by 3.

2. Given, mean of first n natural numbers is 15.

$$\Rightarrow \quad \frac{1+2+3+.....+n}{n}=15$$

$$\Rightarrow \quad 1+2+3+.....+n=15n$$

$$\Rightarrow \quad \frac{n(n+1)}{2}=15n$$

$$\left[\because \text{ Sum of first } n \text{ natural numbers} = \frac{n(n+1)}{2}\right.$$

$$\Rightarrow \quad n^2+n=30n \Rightarrow n^2-29n=0$$

$$\Rightarrow \quad n(n-29)=0 \Rightarrow n=29 \quad [n\neq 0]$$

3.

$$\text{Mean} = \frac{x+(x+2)+(x+4)+(x+6)+(x+8)}{5}$$

$$\Rightarrow \quad 11=\frac{5x+20}{5} \Rightarrow 55=5x+20 \Rightarrow 5x=35 \Rightarrow x=7$$

4. Total number of students = 150
Mean weight = 60 kg
Total weight of 150 students = 150 × 60 = 9000 kg
Let the total number of boys be x.
:- Total number of girls = 150 - x
Mean weight of boys = 70 kg

:- Total weight of boys = 70 x x = 70x kg
Mean weight of girls = 55 kg
:- Total weight of girls (150-x)55 kg
Now, Total weight = Weight of boys + Weight of girls
9000 70x+55(150-x)
9000 70x + 150 x 55-55x
9000825070x-55x
750=15x⇒
x=50
:- Number of boys = 50
and number of girls = 100.

5.

In the formula $\bar{x}=a+\left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right)\times h$

$u_i=\frac{x_i-a}{h}$, where a is assumed mean and h = class size.

6. The frequency distribution table from the given data can be drawn as:

Class	Class marks (x_i)	Frequency (f_i)	$f_i x_i$
3-5	4	5	20
5-7	6	10	60
7-9	8	10	80
9-11	10	7	70
11-13	12	8	96
Total		**40**	**326**

$\therefore$ Mean $=\frac{\Sigma f_i x_i}{\Sigma f_i}=\frac{326}{40}=8.15$

7. Table for the given data is as follows:

Class interval	Frequency (f_i)	Class marks (x_i)	$f_i x_i$
0-4	3	2	6
4-8	p	6	$6p$
8-12	5	10	50
12-16	8	14	112
16-20	2	18	36
Total	$\Sigma f_i = 18 + p$		$\Sigma f_i x_i = 204 + 6p$

$$\text{Now, mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 10{\cdot}8 = \frac{204+6p}{18+p}$$

$\Rightarrow$ $(18 + p)\ 10{\cdot}8 = 204 + 6p$

$\Rightarrow$ $194{\cdot}4 + 10{\cdot}8p = 204 + 6p$

$\Rightarrow$ $10{\cdot}8p - 6p = 204 - 194{\cdot}4;\ 4{\cdot}8p = 9{\cdot}6$

$$\therefore \quad p = \frac{96}{48} \Rightarrow p = 2$$

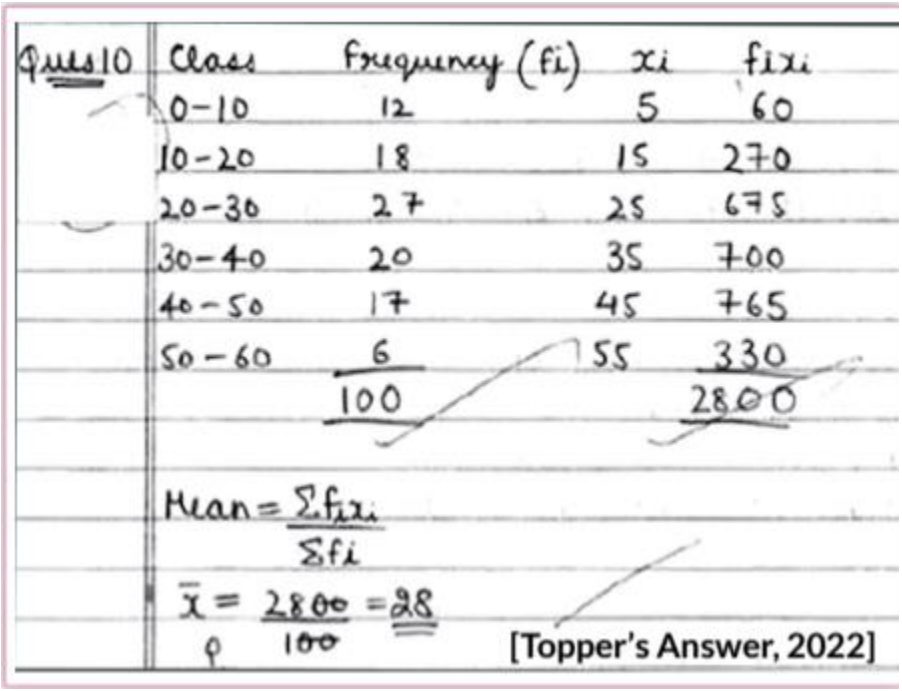
8. The frequency distribution table from the given data can be drawn as:

Missed catches	Class marks (x_i)	Frequency (f_i)	$f_i x_i$
0-3	1.5	15	22.5
3-6	4.5	16	72
6-9	7.5	3	22.5
9-12	10.5	4	42
12-15	13.5	2	27
Total		$\Sigma f_i = 40$	$\Sigma f_i x_i = 186$

$$\therefore \quad \text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{186}{40} = 4.65$$

Hence, mean catches missed by him = 4.65.

9.



Ques 10	Class	Frequency (f_i)	x_i	$f_i x_i$
	0–10	12	5	60
	10–20	18	15	270
	20–30	27	25	675
	30–40	20	35	700
	40–50	17	45	765
	50–60	6	55	330
		100		2800

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

$\bar{x} = \frac{2800}{100} = 28$

[Topper's Answer, 2022]

10. Let the assumed mean, a = 125 We have the frequency distribution table for the given data as follows:

Weight (in kg)	Number of animals (f_i)	Class marks (x_i)	$d_i = x_i - a = x_i - 125$	$f_i d_i$
100-110	4	105	−20	−80
110-120	12	115	−10	−120
120-130	23	125	0	0
130-140	8	135	10	80
140-150	3	145	20	60
Total	$N = \Sigma f_i = 50$			$\Sigma f_i d_i = -60$

$$\therefore \text{Mean } (\bar{x}) = a + \frac{1}{N}\sum f_i d_i = 125 + \frac{1}{50} \times (-60)$$

$$= 125 - \frac{60}{50} = 125 - 1.2 = 123.8$$

Hence, mean weight of animals = 123.8 kg.

11. The frequency distribution table from the given data is as follows:

Class	Class marks (x_i)	Frequency (f_i)	f_ix_i
0-10	5	5	25
10-20	15	18	270
20-30	25	15	375
30-40	35	f	$35f$
40-50	45	6	270
Total		$\Sigma f_i = 44 + f$	$\Sigma f_ix_i = 940 + 35f$

$$\therefore \text{ Mean } (\bar{x}) = \frac{\sum f_i x_i}{\sum f_i}$$

$$\Rightarrow 25 = \frac{940 + 35f}{44 + f} \qquad [\because \text{ Given, mean} = 25]$$

$\Rightarrow 25(44 + f) = 940 + 35f \Rightarrow 1100 + 25f = 940 + 35f$

$\Rightarrow 10f = 160 \Rightarrow f = 16$

Hence, the value of f is 16.

12. Let the assumed mean, a = 12.5

:- d=x-a = x; - 12.5

Now, we have the frequency distribution table as follows:

Class	Class marks (x_i)	Frequency (f_i)	$d_i = x_i - a$ $= x_i - 12.5$	f_id_i
0-5	2.5	8	−10	−80
5-10	7.5	7	−5	−35
10-15	12.5	10	0	0
15-20	17.5	13	5	65
20-25	22.5	12	10	120
Total		$N = \Sigma f_i = 50$		$\Sigma f_id_i = 70$

$$\therefore \quad \text{Mean } (\bar{x}) = a + \frac{1}{N}\sum f_i d_i = 12.5 + \frac{70}{50} = 12.5 + 1.4 = 13.9$$

13. The frequency distribution table from the given data is 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	$70k$
80-100	90	13	1170
Total		$N = \Sigma f_i = 72 + k$	$\Sigma f_i x_i = 3340 + 70k$

Now, $\text{mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = 53$ [Given]

$$\therefore \quad \frac{3340 + 70k}{72 + k} = 53 \Rightarrow 3340 + 70k = 3816 + 53k$$

$$\Rightarrow \quad 70k - 53k = 3816 - 3340 \Rightarrow 17k = 476 \Rightarrow k = 28$$

14. The frequency distribution table for the given data can be drawn as:

Class	Class marks (x_i)	Frequency (f_i)	$f_i x_i$
0–20	10	17	170
20–40	30	28	840
40–60	50	32	1600
60–80	70	24	1680
80–100	90	19	1710
Total		$\Sigma f_i = 120$	$\Sigma f_i x_i = 6000$

$$\therefore \text{ Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{6000}{120} = 50$$

15. The frequency distribution table for the given data can be drawn as:

Class	Class marks (x_i)	Frequency (f_i)	f_ix_i
0-20	10	16	160
20-40	30	14	420
40-60	50	24	1200
60-80	70	26	1820
80-100	90	x	$90x$
Total		$\Sigma f_i = 80 + x$	$\Sigma f_ix_i = 3600 + 90x$

$$\therefore \quad \text{Mean} = \frac{\sum f_ix_i}{\sum f_i} \Rightarrow 54 = \frac{3600+90x}{80+x} \quad \text{[Given, Mean = 54]}$$

$$\Rightarrow \quad 54(80+x) = 3600 + 90x \Rightarrow 4320 + 54x = 3600 + 90x$$

$$\Rightarrow \quad 720 = 36x \Rightarrow x = 20$$

16. The frequency distribution table for the given data can be drawn as:

Class	Class marks (x_i)	Frequency (f_i)	f_ix_i
0-6	3	7	21
6-12	9	5	45
12-18	15	10	150
18-24	21	12	252
24-30	27	2	54
Total		$\Sigma f_i = 36$	$\Sigma f_ix_i = 522$

$$\therefore \quad \text{Mean} = \frac{\sum f_ix_i}{\sum f_i} = \frac{522}{36} = 14.5$$

17. The frequency distribution table from the given data can be drawn as:

Class	Class-marks (x_i)	Frequency (f_i)	$u_i = \frac{x_i - A}{h}$	f_iu_i
15-25	20	6	-4	-24
25-35	30	11	-3	-33
35-45	40	7	-2	-14
45-55	50	4	-1	-4
55-65	60	4	0	0

65-75	70	2	1	2
75-85	80	1	2	2
85-95	90	10	3	30
Total		$N=\Sigma f_i=45$		$\Sigma f_i u_i=-41$

Let assumed mean = 60, we have $h = 10$,
$N = \Sigma f_i = 45$, $\Sigma f_i u_i = -41$

Now, $\text{Mean, } \bar{X} = A + \left(\frac{\sum f_i u_i}{N}\right) \times h = 60 + \left(\frac{-41}{45}\right) \times 10$

$= 60 - 9.11 = 50.89$

18. The frequency distribution table for the given data can be drawn as:

Class Intervals	Class marks (x_i)	Frequency (f_i)	$f_i x_i$
0-20	10	6	60
20-40	30	8	240
40-60	50	10	500
60-80	70	12	840
80-100	90	6	540
100-120	110	5	550
120-140	130	3	390
Total		$\Sigma f_i = 50$	$\Sigma f_i x_i = 3120$

$\therefore \quad \text{Mean, } \bar{X} = \frac{\sum f_i x_i}{\sum f_i} = \frac{3120}{50} = 62.4$

19. The frequency distribution table from the given data can be drawn as:

Class	Class marks (x_i)	Frequency (f_i)	$f_i x_i$
10-30	20	15	300
30-50	40	18	720
50-70	60	25	1500
70-90	80	10	800
90-110	100	2	200
Total		$\Sigma f_i = 70$	$\Sigma f_i x_i = 3520$

$\therefore \quad \text{Mean, } \bar{X} = \frac{\sum f_i x_i}{\sum f_i} = \frac{3520}{70} = 50.286$

20. The frequency distribution table from the given data can be drawn as:

Literacy rate	Class-marks (x_i)	Frequency (f_i)	$u_i = \frac{x_i - A}{h}$	$f_i u_i$
45-55	50	4	−2	−8
55-65	60	11	−1	−11
65-75	70	12	0	0
75-85	80	9	1	9
85-95	90	4	2	8
Total		$\Sigma f_i = 40$		$\Sigma f_i u_i = -2$

Let assumed mean (A) = 70

$$\therefore \quad \text{Mean, } \bar{X} = A + \frac{\sum f_i u_i}{\sum f_i} \times h = 70 + \left(\frac{-2}{40}\right) \times 10 = 70 - \frac{20}{40} = 69.5$$

21. Here h = 20

Let us construct the following table for the given data.

Class interval	Frequency (f_i)	Class-marks (x_i)	$f_i x_i$
0-20	5	10	50
20-40	8	30	240
40-60	x	50	50x
60-80	12	70	840
80-100	7	90	630
100-120	8	110	880
Total	$\Sigma f_i = x + 40$		$\Sigma f_i x_i = 2640 + 50x$

We know that mean, $\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$

$$\Rightarrow \quad 62.8 = \frac{2640 + 50x}{40 + x} \qquad [\because \text{ Mean} = 62.8 \text{ (given)}]$$

$$\Rightarrow \quad 62.8\,(40 + x) = 2640 + 50x$$
$$\Rightarrow \quad 2512 + 62.8x = 2640 + 50x$$
$$\Rightarrow \quad 62.8x - 50x = 2640 - 2512$$
$$\Rightarrow \quad 12.8x = 128 \Rightarrow x = \frac{128}{12.8}$$

Missing frequency, x = 10

22. The frequency distribution table for the given data can be drawn as:

Class interval	Class mark (x_i)	Frequency (f_i)	f_ix_i
11-13	12	3	36
13-15	14	6	84
15-17	16	9	144
17-19	18	13	234
19-21	20	f	$20f$
21-23	22	5	110
23-25	24	4	96
Total		$N = \Sigma f_i = 40 + f$	$\Sigma f_ix_i = 704 + 20f$

$$\text{Mean, } \bar{x} = \frac{\Sigma f_i x_i}{N} \Rightarrow 18 = \frac{704+20f}{40+f} \qquad \text{[Given, Mean = 18]}$$

$\Rightarrow$ $18(40 + f) = 704 + 20f \Rightarrow 720 + 18f = 704 + 20f$

$\Rightarrow$ $20f - 18f = 720 - 704 \Rightarrow 2f = 16 \Rightarrow f = 8.$

$\therefore$ The frequency of class 19-21 is 8.

23. (c): We have, the following table:

Class interval	Frequency
0-10	3
10-20	12 – 3 = 9
20-30	27 – 12 = 15
30-40	57 – 27 = 30
40-50	75 – 57 = 18
50-60	80 – 75 = 5

Since, class 30-40 has maximum frequency.

$\therefore$ Modal class is 30-40.

24.

We know that

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h \quad \ldots(i)$$

Here given $l = 65, f_0 = 6, f_1 = f, h = 15, f_2 = 8$ and mode = 75

So, from equation (i), we get

$$75 = 65 + \left(\frac{f-6}{2f-6-8}\right) \times 15 \; ; \; 75 = 65 + \frac{f-6}{2f-14} \times 15$$

$$75 - 65 = \frac{(f-6)15}{2f-14}$$

$(2f - 14)\ 10 = 15f - 90 \Rightarrow 20f - 15f = -90 + 140$

$5f = 50 \quad \therefore f = 10$

25.

Here the given mode = 240, which lies in interval 200 -300.

So, $l = 200, f_1 = 270, f_0 = 230, f_2 = x$ (missing frequency) and $h = 100$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$240 = 200 + \left(\frac{270-230}{2\times 270 - 230 - x}\right) \times 100$$

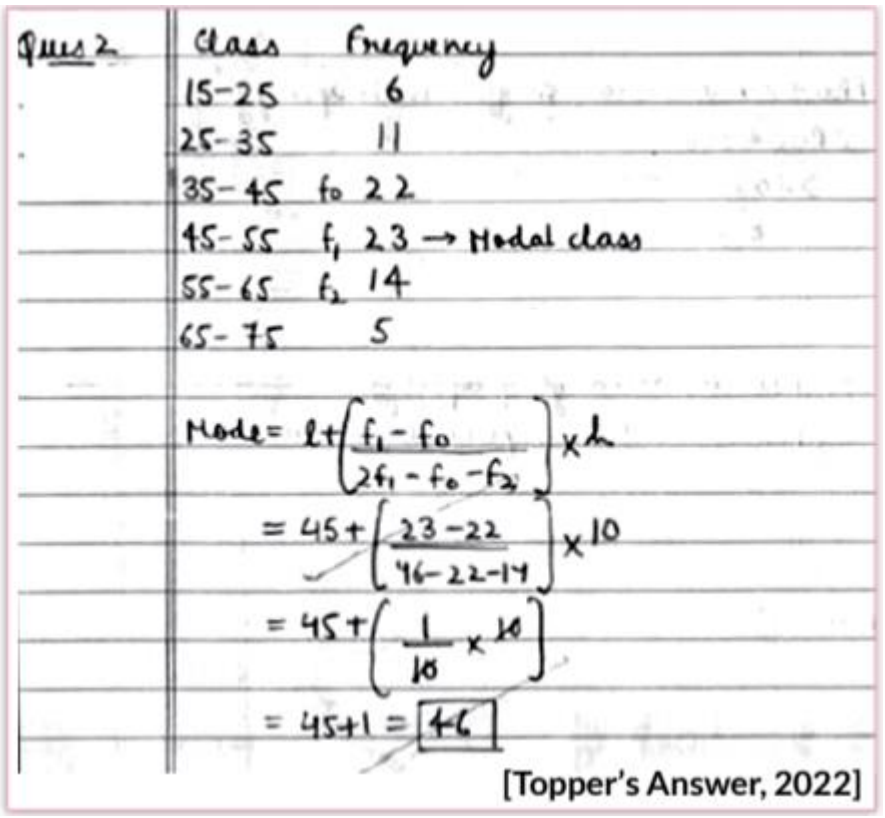
$$240 = 200 + \frac{40}{310-x} \times 100 \Rightarrow 240 - 200 = \frac{4000}{310-x}$$

$$\Rightarrow \quad 40 = \frac{4000}{310-x} \Rightarrow 310 - x = 100$$

$$\Rightarrow \quad x = 310 - 100 = 210$$

Missing frequency, $x = 210$

26.



Ques 2

Class	Frequency
15-25	6
25-35	11
35-45 f_0	22
45-55 f_1	23 → Modal class
55-65 f_2	14
65-75	5

$$\text{Mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$= 45 + \left[\frac{23 - 22}{46 - 22 - 14}\right] \times 10$$

$$= 45 + \left[\frac{1}{10} \times 10\right]$$

$$= 45 + 1 = \boxed{46}$$

[Topper's Answer, 2022]

27. Here, mode of the frequency distribution = 55, which lies in the class interval 45-60.

:- Modal class is 45-60

Here, $f_1 = 15, f_0 = x, f_2 = 10, h = 15$ and $l = 45$

Now, $\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

$\Rightarrow 55 = 45 + \left(\frac{15 - x}{2 \times 15 - x - 10}\right) \times 15$

$\Rightarrow 55 = 45 + \left(\frac{15 - x}{30 - x - 10}\right) \times 15 \Rightarrow 55 - 45 = \frac{15 - x}{20 - x} \times 15$

$\Rightarrow 10(20 - x) = 15(15 - x) \Rightarrow 200 - 10x = 225 - 15x$

$\Rightarrow 15x - 10x = 225 - 200 \Rightarrow 5x = 25 \Rightarrow x = 5$

Hence, the value of x is 5.

28. From the given data, we have maximum frequency 75, which lies in the interval 20-25.

:- Modal class is 20-25

So, $l = 20,\ f_0 = 30, f_1 = 75, f_2 = 20, h = 5$

$$\therefore \quad \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$= 20 + \left(\frac{75 - 30}{2(75) - 30 - 20}\right) \times 5 \quad = 20 + \frac{45}{100} \times 5$$

Mode = 20 + 2.25 = 22.25

29. From the given data, we observed that, highest frequency is 12, which lies in the class-interval 30-40.

:- 30-40 is the modal class.

$\therefore l = 30, f_1 = 12, f_0 = 7, f_2 = 5, h = 10$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h \quad = 30 + \left(\frac{12 - 7}{2 \times 12 - 7 - 5}\right) \times 10$$

$$= 30 + \left(\frac{5}{24 - 12}\right) \times 10 \quad = 30 + \frac{50}{12} = 30 + 4.17 = 34.17$$

30. From the given data, we observe that, highest frequency is 12, which lies in the class-interval 60-80.

$\therefore \quad l = 60, f_1 = 12, f_0 = 10, f_2 = 6$ and $h = 20$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h \quad = 60 + \left(\frac{12 - 10}{2 \times 12 - 10 - 6}\right) \times 20$$

$$= 60 + \left(\frac{2}{24 - 16}\right) \times 20 \quad = 60 + \left(\frac{2}{8}\right) \times 20 \quad = 60 + 5 = 65$$

31. From the given data, we observe that, highest frequency is 20, which lies in the class-interval 40-50.

$\therefore \quad l = 40, f_1 = 20, f_0 = 12, f_2 = 11, h = 10$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h \quad = 40 + \left(\frac{20 - 12}{40 - 12 - 11}\right) \times 10$$

$$= 40 + \frac{80}{17} = 40 + 4.7 = 44.7$$

Now, $l = 201, f_0 = 12, f_1 = 26, f_2 = 20, h = 1$

$$\therefore \quad \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 201 + \left(\frac{26 - 12}{2 \times 26 - 12 - 20}\right) \times 1$$

$$= 201 + \left(\frac{14}{20}\right) = 201 + 0.7$$

$\therefore$ Modal weight = 201.7 gm.

33. From the given data, we observe that, highest frequency is 10, which lies in the class interval 50-60.

:- l=50, $f_1 = 10$, fo = 7, $f_2 = 6$, h = 10

$$\therefore \quad \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 50 + \left(\frac{10 - 7}{2 \times 10 - 7 - 6}\right) \times 10$$

$$= 50 + \frac{30}{7} = 50 + 4.29 = 54.29$$

34. Since it is given that mode = 36 which lies in the class interval 30-40.

:- Modal class is 30-40.

$\therefore \quad l = 30, f_1 = 16, \ f_0 = x, \ f_2 = 12, h = 10$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$\Rightarrow 36 = 30 + \left(\frac{16 - x}{2 \times 16 - x - 12}\right) \times 10$$

$$\Rightarrow \quad 36 = 30 + \left(\frac{16 - x}{20 - x}\right) \times 10 \Rightarrow (20 - x) \times 6 = (16 - x) \times 10$$

$$\Rightarrow \quad 120 - 6x = 160 - 10x \Rightarrow 4x = 40 \quad \Rightarrow \quad x = 10$$

Number of members	Class marks (x_i)	Frequency (f_i)	$f_i x_i$
1-3	2	2	4
3-5	4	8	32
5-7	6	6	36
7-9	8	10	80
9-11	10	5	50
11-13	12	5	60
13-15	14	7	98
15-17	16	4	64
17-19	18	3	54
Total		$\Sigma f_i = 50$	$\Sigma f_i x_i = 478$

$$\therefore \quad \text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{478}{50} = 9.56$$

Now, maximum frequency lies in the class interval 7-9.

$\therefore$ Modal class is 7-9.

$l = 7, h = 2, f_1 = 10, \ f_0 = 6, f_2 = 5$

$$\text{Mode} = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

$$\text{Mode} = 7 + \left[\frac{10-6}{2\times 10 - 6 - 5}\right] \times 2$$

$$= 7 + \left[\frac{4}{20-11}\right] \times 2 = 7 + \frac{8}{9}$$

$= 7 + 0.89 = 7.89$

35. The frequency distribution table from the given data can be drawn as:

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

Now, $n = 66 \Rightarrow \frac{n}{2} = \frac{66}{2} = 33$, which lies in class 10-15.

$\therefore$ 10-15 is the median class.

Also, highest frequency is 20, which lies in the interval 15-20.

$\therefore$ 15-20 is the modal class.

Sum of lower limits of median class and modal class

= 10 + 15 = 25

37.

(b): We know that Mode = 3 Median – 2 Mean

So, Mode = 3 × 15 – 2 × 14 = 45 – 28 = 17 (mean = 14, median = 15) (Given)

38. Mode = 3 Median - 2 Mean

39. We know that, empirical relation between mean, median and mode is

Mode = 3 Median - 2 Mean ...(i)

We have, Mean = 9.5, Median = 10

:- Mode = 3(10)-2(9.5)=30-19 (Using (i))

⇒ Mode = 11

40. We have, Mode = 50.5 and Median = 45.5

Now, we know that, 3 Median = Mode + 2 Mean

⇒ 3× 45.5 = 50.5 + 2 Mean

136.5-50.5

$\Rightarrow$ Mean $= \frac{136.5 - 50.5}{2} = 43$

41. We have the following table as:

Class	Frequency	Cumulative frequency
0-100	5	5
100-200	7	12
200-300	6	18
300-400	3	21
400-500	20	41
500-600	4	45
600-700	8	53

Clearly, 20^{th} observation lies near to 21 i.e., between the class 300-400 so by adding upper limit and lower limit we get $300 + 400 = 700$.

42. The frequency distribution table for the given data can be drawn as:

Marks	Frequency (f_i)	Cumulative frequency (c.f.)
0-20	4	4
20-40	6	10
40-60	25	35
60-80	10	45
80-100	5	50
Total	$\Sigma f_i = 50$	

$\therefore$ 40-60 is the modal class as it has highest frequency.

Also, $\frac{N}{2} = \frac{50}{2} = 25$

The c.f. just greater than 25 lies in the class interval 40-60. Hence, the median class is 40-60.

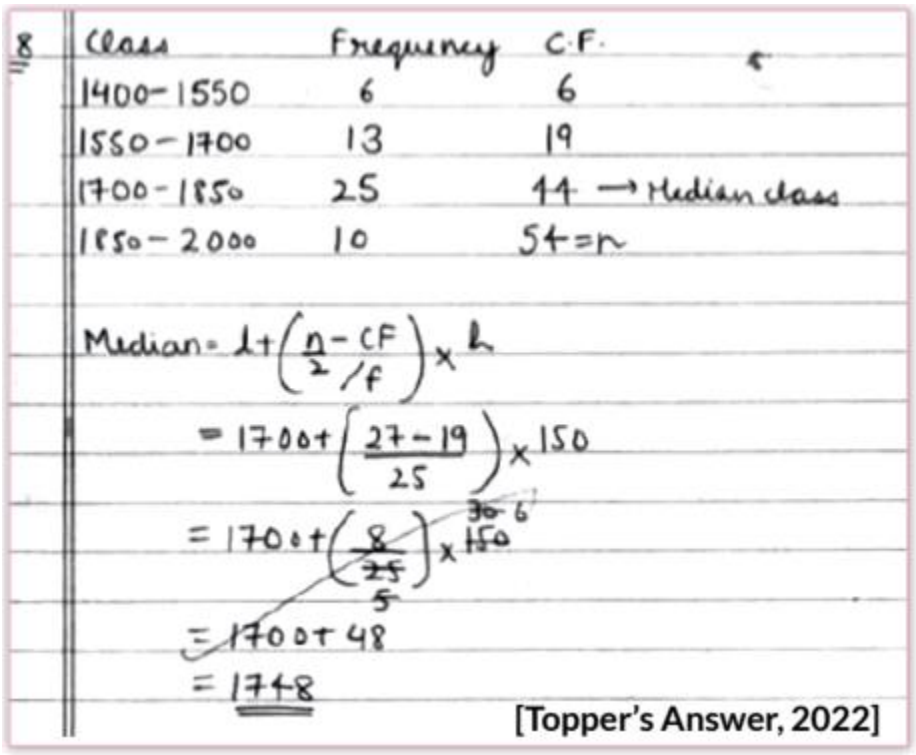
43. The frequency distribution table for the given data can be drawn as:

Literacy Rate (in percent)	Number of cities (f_i)	Cumulative frequency (c.f.)
50-60	9	9
60-70	6	15
70-80	8	23
80-90	2	25
Total	$\Sigma f_i = 25$	

Now, 50-60 is the modal class as it has highest frequency.

Also, $\frac{N}{2} = \frac{25}{2} = 12.5$

The cumulative frequency just greater than 12.5 lies in the interval 60-70.
Hence, the median class is 60-70.



8

Class	Frequency	C.F.
1400-1550	6	6
1550-1700	13	19
1700-1850	25	44 → Median class
1850-2000	10	54 = n

Median = $l + \left(\frac{n - CF}{2} / f\right) \times h$

$= 1700 + \left(\frac{27 - 19}{25}\right) \times 150$

$= 1700 + \left(\frac{8}{25}\right) \times 150^{6}$

$= 1700 + 48$

$= 1748$

[Topper's Answer, 2022]

45. The cumulative frequency distribution table is as follows:

Height (in cm)	Number of students	Cumulative frequency (*c.f.*)
130 - 135	4	4
135 - 140	11	4 + 11 = 15
140 - 145	12	15 + 12 = 27
145 - 150	7	27 + 7 = 34
150 - 155	10	34 + 10 = 44
155 - 160	6	44 + 6 = 50
Total	$N = 50$	

Now, we have $N = 50$

$\Rightarrow \frac{N}{2} = \frac{50}{2} = 25$

Since, the cumulative frequency just greater than 25 is 27.

$\therefore$ The median class is 140 – 145

and also, $l = 140$, $c.f. = 15$, $f = 12$ and $h = 5$

$\therefore$ Median $= l + \left[\frac{\frac{N}{2} - c.f.}{f}\right] \times h$

$= 140 + \left[\frac{25 - 15}{12}\right] \times 5 = 140 + \left[\frac{10}{12}\right] \times 5$

$= 140 + 4.16 = 144.16$

$\therefore$ Median height of the students = 144.16 cm.

46. The cumulative frequency table for the given date is as follows:

Salary (In thousand)	No. of persons	Cumulative frequency
5-10	49	49
10-15	133	49 + 133 = 182
15-20	63	182 + 63 = 245
20-25	15	245 + 15 = 260
25-30	6	260 + 6 = 266
30-35	7	266 + 7 = 273
35-40	4	273 + 4 = 277
40-45	2	277 + 2 = 279
45-50	1	279 + 1 = 280

Now, we have $N = 280 \Rightarrow \frac{N}{2} = \frac{280}{2} = 140$

Since, the cumulative frequency just greater than 140 is 182.

$\therefore$ The median class is 10-15.

and also $l = 10$, c.f. $= 49$, $f = 133$ and $h = 5$

$$\therefore \quad \text{Median} = l + \left[\frac{\frac{N}{2} - \text{c.f.}}{f}\right] \times h$$

$$= 10 + \left[\frac{140 - 49}{133}\right] \times 5 = 10 + \frac{91}{133} \times 5 = 10 + 3.42 = 13.42$$

$\therefore$ Median salary = 13.42 thousand

47. The frequency distribution table from the given data can be drawn as:

Class Interval	Frequency (f_i)	Cumulative frequency (*c.f.*)
0-10	8	8
10-20	16	24
20-30	36	60
30-40	34	94
40-50	6	100
Total	**100**	

Here, $N = 100$, $\frac{N}{2} = 50$, which lies in the class interval 20-30.

$\therefore$ Median class is 20-30.

Here, $l = 20$, $c.f. = 24$, $f = 36$, $h = 10$

$$\text{Median} = l + \left[\frac{\frac{N}{2} - c.f.}{f}\right] \times h = 20 + \left[\frac{50 - 24}{36}\right] \times 10$$

$= 20 + 7.22 = 27.22$

48.

Rainfall (mm)	Number of Sub-divisions	Cumulative frequency (*c.f.*)
200-400	2	2
400-600	4	6
600-800	7	13
800-1000	4	17
1000-1200	2	19
1200-1400	3	22
1400-1600	1	23
1600-1800	1	24

(i) Here, maximum class frequency is 7 and class corresponding to this frequency is 600-800, so the modal class is 600-800.

(ii) Here, $\frac{n}{2} = \frac{24}{2} = 12$

Class whose cumulative frequency just greater than and nearest to $\frac{n}{2}$ is called median class.

Here, $c.f. = 13$ (>12) and corresponding class 600 - 800 is median class.

$l = 600$, $c.f. = 6$, $f = 7$, $h = 200$

$$\therefore \quad \text{Median} = l + \left(\frac{\frac{n}{2} - c.f.}{f}\right) \times h$$

$$= 600 + \left(\frac{12 - 6}{7}\right) \times 200 = 600 + \frac{6}{7} \times 200 = 771.429$$

So, the median of the given data is 771.429

OR

Rainfall (mm)	Number of Sub-divisions (f_i)	x_i	$u_i = \frac{x_i - a}{h}$	$f_i x_i$
200-400	2	300	−4	−8
400-600	4	500	−3	−12
600-800	7	700	−2	−14
800-1000	4	900	−1	−4
1000-1200	2	$a = 1100$	0	0
1200-1400	3	1300	1	3
1400-1600	1	1500	2	2
1600-1800	1	1700	3	3
	$\Sigma f_i = 24$			$\Sigma f_i u_i = -30$

Assumed mean $a = 1100$ and class size, $h = 400 - 200 = 200$

$$\therefore \quad \text{Mean} = a + \frac{h}{\sum f_i}[\Sigma f_i u_i]$$

$$= 1100 + \frac{200}{24} \times (-30) = 1100 - \frac{6000}{24} = 850$$

So, mean rainfall in the season is 850 mm.

(iii) Number of sub-division having good rainfall

$= 2 + 3 + 1 + 1 = 7$

49.

Class-interval	Frequency (f_i)	Class mark (x_i)	Cumulative frequency (c.f.)	$u_i = \frac{x_i - 3250}{500}$	$f_i u_i$
1000-1500	24	1250	24	−4	−96
1500-2000	40	1750	64	−3	−120
2000-2500	33	2250	97	−2	−66
2500-3000	$x = 28$	2750	125	−1	−28
3000-3500	30	3250	155	0	0
3500-4000	22	3750	177	1	22
4000-4500	16	4250	193	2	32
4500-5000	7	4750	200	3	21
	$n = \Sigma f_i = 172 + x$				$\Sigma f_i u_i = -235$

Since, $200 = 172 + x \Rightarrow x = 28$

Let the assumed mean, $a = 3250$ and class size, $h = 500$

$$\text{Mean}(\bar{x}) = a + h \times \left\{\frac{1}{n}\Sigma f_i \cdot u_i\right\} = 3250 + 500 \times \frac{1}{200}(-235)$$

$= 3250 - 587.5 = 2{,}662.5$

$\therefore$ Mean expenditure = ₹ 2,662.5

Also, we have $\frac{n}{2} = 100$, which lies in the class interval 2500 – 3000.

$\therefore$ Median class is 2500 – 3000.

Here $l = 2500$, $c.f. = 97$, $f = 28$, $h = 500$

$$\text{Median} = l + \left[\frac{\frac{n}{2} - c.f.}{f}\right] \times h$$

$$= 2500 + \left[\frac{100 - 97}{28}\right] \times 500 = 2553.57$$

$\therefore$ Median expenditure = ₹ 2553.57

50. (i) It is clear from the given data, maximum frequency is 33, which lies in 35-40.

:- Modal class is 35-40.

So, $l = 35$, $f_0 = 21$, $f_1 = 33$, $f_2 = 11$ and $h = 5$

$$\therefore \text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

So, modal age of policy holders

$$= 35 + \left(\frac{33 - 21}{2 \times 33 - 21 - 11}\right) \times 5 \quad = 35 + \left(\frac{12}{34}\right) \times 5$$

$$= 35 + \frac{60}{34} = 35 + 1.76 \quad = 36.76 \text{ (approx)}$$

So, modal age of policy holders is 37 years approx.

(ii) For finding the median age, we need to construct the following table :

Age (in years)	Number of policy holders (f_i)	Cumulative frequency (f)
15-20	2	2
20-25	4	6
25-30	18	24
30-35	21	45
35-40	33	78
40-45	11	89
45-50	3	92
50-55	6	98
55-60	2	100
Total	$\Sigma f_i = 100$	

Here $N = 100 \Rightarrow \frac{N}{2} = \frac{100}{2} = 50$

Cumulative frequency is just greater than 50 is 78 and corresponding interval is 35-40.

$\therefore$ Median class is 35-40.

So, $l = 35, f = 33, c.f. = 45, h = 5$

$$\therefore \text{ Median} = l + \left(\frac{\frac{N}{2} - c.f.}{f}\right) \times h = 35 + \left(\frac{50 - 45}{33}\right) \times 5$$

$$= 35 + \left(\frac{5 \times 5}{33}\right) = 35 + 0.75 = 35.75 \text{ (approx)}$$

Hence, median age of policy holders = 35.75 years (approx)

51. We need to make the following frequency table as follows:

Time (in sec)	No. of students (frequency(f_i))	Cumulative frequency (*c.f.*)
0-20	1	1
20-40	4	5
40-60	3	8
60-80	7	15
80-100	5	20
Total	$\Sigma f_i = 20$	

(i) (b) : Here the greatest frequency is 7, which lies in the interval 60-80.
So, modal class is 60-80.

$\therefore$ Class mark of modal class $= \frac{\text{upper limit} + \text{lower limit}}{2}$

$= \frac{60+80}{2} = 70$

So, class mark of modal class is 70.

(ii) (d) : From the above data, we can conclude that
$h = 20, l = 60, f_1 = 7, f_0 = 3, f_2 = 5$

$\therefore$ Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h = 60 + \left(\frac{7-3}{2\times 7 - 3 - 5}\right) \times 20$

$= 60 + \frac{4}{6} \times 20 = 60 + 13.33$

Mode = 73.33

(iii) (d) : Here $n = 20 \Rightarrow \frac{n}{2} = 10$

Cumulative frequency just greater than 10 is 15 and corresponding interval is 60-80.
So, median class is 60-80.

(iv) (c) : Median class = 60-80
$\therefore$ Lower limit of median = 60
Modal class = 60–80 = 120
$\therefore$ Lower limit of modal class = 60
So, the sum of lower limit of median and modal class
= 60 +60 = 120

(v) (a) : From the above data, we have
$l = 60, f = 7, c.f. = 8, h = 20$

$\therefore$ Median $= l + \left(\frac{\frac{n}{2} - c.f.}{f}\right) \times h = 60 + \left(\frac{\frac{20}{2} - 8}{7}\right) \times 20$

$= 60 + \frac{(10-8)}{7} \times 20 = 60 + \frac{40}{7} = 60 + 5.714 = 65.71$ (approx)

So, median time (in sec) of the given data = 65.7 sec.

52. The frequency distribution table for the given data can be drawn as:

Number of wickets	Class marks (x_i)	Number of bowlers (f_i)	f_ix_i	Cumulative frequency (c.f.)
20-60	40	7	280	7
60-100	80	5	400	12
100-140	120	16	1920	28
140-180	160	12	1920	40
180-220	200	2	400	42
220-260	240	3	720	45
Total			Σf_ix_i = 5640	

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{5640}{45} = 125.33$$

Here, $\frac{N}{2} = \frac{45}{2} = 22.5$

$\therefore$ Median class is 100-140.

Also, $l = 100$, $c.f. = 12$, $f = 16$, $h = 40$

$$\text{So, Median} = l + \left[\frac{\frac{N}{2} - c.f.}{f}\right] \times h$$

$$= 100 + \left[\frac{22.5 - 12}{16}\right] \times 40 = 100 + \left[\frac{10.5}{16} \times 40\right]$$

$$= 100 + 26.25 = 126.25$$

Hence, mean number of wickets is 125.33 and median number of wickets is 126.25.

53. The frequency distribution table for the given data can be drawn as:

Class	Frequency	Cumulative frequency
0-100	2	2
100-200	5	7

200-300	x	$7+x$
300-400	12	$19+x$
400-500	17	$36+x$
500-600	20	$56+x$
600-700	y	$56+x+y$
700-800	9	$65+x+y$
800-900	7	$72+x+y$
900-1000	4	$76+x+y$
Total	$\mathbf{76+x+y}$	

Here, $\frac{N}{2}=\frac{100}{2}=50$

$\because$ Median = 525 $\therefore$ Median class is 500-600

$\therefore$ $l = 500, f = 20, c.f. = 36 + x, h = 100$

Also, $76 + x + y = 100$

$\Rightarrow$ $x + y = 24$ ...(i)

And, median $= l+\left(\frac{\frac{N}{2}-c.f.}{f}\right)\times h$

$\Rightarrow$ $525 = 500 + \left(\frac{50-(36+x)}{20}\right)\times 100$

$\Rightarrow$ $25 = 5(50 - 36 - x) \Rightarrow 5 = 14 - x \Rightarrow x = 9$

From (i), we have $9 + y = 24$

$\Rightarrow$ $y = 15$

54. The frequency distribution table for the given data is as follows:

Class	Frequency (f_i)	Cumulative frequency (*c.f.*)
0-10	f_1	f_1
10-20	5	$f_1 + 5$
20-30	9	$f_1 + 14$
30-40	12	$f_1 + 26$
40-50	f_2	$f_1 + f_2 + 26$
50-60	3	$f_1 + f_2 + 29$
60-70	2	$f_1 + f_2 + 31$
Total	$\mathbf{31 + f_1 + f_2 = 40}$	

Here, $N = 40 \Rightarrow 31 + f_1 + f_2 = 40$

$\Rightarrow \quad f_1 + f_2 = 9$ ... (i)

Given, median = 32.5, which lies in the class interval 30-40.

So, median class is 30-40.

$\therefore \quad l = 30, h = 10, f = 12, N = 40$ and

c.f. of preceding class = $f_1 + 14$

Now, $\text{median} = l + \left(\frac{\frac{N}{2} - \text{c.f.}}{f}\right) \times h$

$\Rightarrow \quad 32.5 = 30 + \left(\frac{20 - (f_1 + 14)}{12}\right) \times 10$

$\Rightarrow \quad 2.5 = \left(\frac{6 - f_1}{12}\right) 10 \Rightarrow 6 - f_1 = \frac{2.5 \times 12}{10}$

$\Rightarrow 6\text{-}f_1 = 3 \Rightarrow f_1 = 3$

From (i), f29-3 = 6

55. The frequency distribution table for the given data is as follows:

Class	Frequency (f_i)	Cumulative frequency (c.f.)
0–10	10	10
10–20	x	$10 + x$
20–30	25	$35 + x$
30–40	30	$65 + x$
40–50	y	$65 + x + y$
50–60	10	$75 + x + y$
Total	**100**	

Here, $N = 100$, median = 32, it lies in the Interval 30 – 40.

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

$$\Rightarrow 32 = 30 + \left(\frac{50 - (35 + x)}{30}\right) \times 10 \Rightarrow 32 - 30 = \frac{15 - x}{3}$$

$$\Rightarrow \quad 15 - x = 6 \Rightarrow x = 9$$

Also, $75 + x + y = 100 \Rightarrow 75 + 9 + y = 100$

$$\Rightarrow \quad y = 100 - 84 = 16$$

56. The frequency distribution table from the given data can be drawn as:

Class	Frequency (f_i)	Cumulative frequency (c.f.)
40-60	12	12
60-80	11	23
80-100	14	37
100-120	16	53
120-140	13	66
140-160	9	75
160-180	5	80
Total	**80**	

Here, highest frequency is 16, which lies in the class interval 100-120.

$\therefore$ 100-120 is the modal class.

Now, $l = 100, f_1 = 16, f_0 = 14, f_2 = 13, h = 20$

$$\text{Mode} = 100 + \left(\frac{16-14}{2\times16-14-13}\right)\times20 = 100 + \frac{2}{5}\times20$$

$= 100 + 8 = 108$

$\therefore$ Mode = 108

Clearly, $\frac{N}{2} = \frac{80}{2} = 40$ lies in the class interval 100-120.

So, 100-120 is the median class.

$\therefore$ $l = 100$, $c.f. = 37, f = 16, h = 20$

$$\text{Median} = l + \left(\frac{\frac{N}{2} - \text{c.f.}}{f}\right)\times h = 100 + \left(\frac{40-37}{16}\right)\times20 = 100 + \frac{60}{16}$$

$= 100 + 3.75\ 103.75$

Median $= 103.75$

57. The frequency distribution table for the given data can be drawn as:

Class	Frequency (f_i)	Cumulative frequency (*c.f.*)
10-20	12	12
20-30	30	42
30-40	p	$42 + p$
40-50	65	$107 + p$
50-60	q	$107 + p + q$
60-70	25	$132 + p + q$
70-80	18	$150 + p + q$
Total	**230**	

Clearly, median = 46, which lies in the class interval 40-50.

$\therefore \quad l = 40, f = 65, c.f. = 42 + p, h = 10$

$$\text{Median} = l + \left(\frac{\frac{N}{2} - \text{c.f.}}{f}\right) \times h \Rightarrow 46 = 40 + \left(\frac{\frac{230}{2} - (42 + p)}{65}\right) \times 10$$

$$\Rightarrow 6 = \frac{(115 - 42 - p)}{65} \times 10$$

$\Rightarrow 39 = 73 - p \Rightarrow p = 34$ ...(i)

Also, $150 + p + q = 230$

$\Rightarrow 150 + 34 + q = 230 \Rightarrow q = 230 - 184 \Rightarrow q = 46$ (Using (i))

$\therefore$ Missing frequencies are 34 and 46.

58. The frequency distribution table for the given data can be drawn as:

Class	Frequency (f_i)	Cumulative frequency (c.f.)
0-10	5	5
10-20	x	$5+x$
20-30	20	$25+x$
30-40	14	$39+x$
40-50	y	$39+x+y$
50-60	8	$47+x+y$
Total	**68**	

Here, $N = 68$, Median = 27, which lies in the class interval 20-30.

$$\therefore \quad \text{Median} = l + \left(\frac{\frac{N}{2} - \text{c.f.}}{f}\right) \times h \Rightarrow 27 = 20 + \left(\frac{34-(5+x)}{20}\right) \times 10$$

$$\Rightarrow \quad 7 = \frac{34-5-x}{2} \Rightarrow 14 = 29 - x \Rightarrow x = 15$$

Also, $47 + x + y = 68$

$\Rightarrow \quad y = 68 - 47 - 15 \Rightarrow y = 6$

CBSE Sample Questions

1. We construct the following table:

Runs scored	0-40	40-80	80-120	120-160	160-200	Total
Number of batsmen (f_i)	12	20	35	30	23	**120**
x_i	20	60	100	140	180	
$f_i x_i$	240	1200	3500	4200	4140	**13280**

(1½)

$$\therefore \quad \text{Mean}(\bar{x}) = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{13280}{120} = 110.67 \text{ runs}$$ **(1½)**

2.

Since, mode = 45 (Given)

So, modal class is 40 – 60, $l = 40, h = 20, f_1 = ?, f_0 = 10, f_2 = 6$

We know, mode = $l + \frac{f_1 - f_0}{2f_1 - f_2 - f_0} \times h$ **(1/2)**

$\Rightarrow \quad 45 = 40 + \left[\frac{f_1 - 10}{2f_1 - 10 - 6}\right] \times 20$ **(1/2)**

$\Rightarrow \quad \frac{1}{4} = \frac{f_1 - 10}{2f_1 - 16} \Rightarrow 2f_1 - 16 = 4f_1 - 40 \Rightarrow f_1 = 12$ **(1)**

3.

Since it is given that mode = 67, which lies in the interval 60-70. So modal class is 60-70.

$\therefore \quad l = 60, f_1 = 15, f_0 = x, f_2 = 12, h = 10$

We know, mode = $l + \frac{f_1 - f_0}{2f_1 - f_2 - f_0} \times h$ **(1/2)**

$\therefore \quad 67 = 60 + \frac{15 - x}{30 - 12 - x} \times 10$ **(1/2)**

$\Rightarrow \quad 7 = \frac{15 - x}{18 - x} \times 10$ **(1/2)**

$\Rightarrow \quad 7(18 - x) = 10(15 - x)$ **(1/2)**

$\Rightarrow \quad 126 - 7x = 150 - 10x$ **(1/2)**

$\Rightarrow \quad 3x = 24 \Rightarrow x = 8$ **(1/2)**

4. (b): Given, Mode - Median = 24

We know, Mode = 3 Median - 2 Mean

Now, 24+ Median = 3 Median - 2 Mean

⇒ Median - Mean = 12 (1)

Class	Frequency (f_i)	Cumulative frequency (c.f.)
0-5	10	10
5-10	15	25
10-15	12	37
15-20	20	57
20-25	9	66

Here, $\frac{N}{2} = \frac{66}{2} = 33$

5. (b)

Class	Frequency (f_i)	Cumulative frequency (*c.f.*)
0-5	10	10
5-10	15	25
10-15	12	37
15-20	20	57
20-25	9	66

Here, $\frac{N}{2}=\frac{66}{2}=33$

Cumulative frequency just greater than 33 is 37. So, median class is 10-15.
Lower limit of median class = 10
Highest frequency is 20 so modal class is 15-20.
Sum of the lower limits of the median and modal class is 10+ 15 = 25 (1)

6. We construct the following table as:

Distance (in m)	0-1	1-2	2-3	3-4	4-5
Number of students	40	80	62	38	30
c.f.	40	120	182	220	250

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

$\Rightarrow$ Median class is 2 - 3. **(1)**

Here, $l = 2, h = 1, c.f. = 120, f = 62$

$$\text{Median}=l+\left(\frac{\frac{N}{2}-c.f.}{f}\right)\times h$$ **(1/2)**

$$=2+\frac{125-120}{62}\times 1 \quad =2+\frac{5}{62}=\frac{129}{62}=2\frac{5}{62}\text{m or } 2.08\text{m}$$ **(1)**

Interpretation : 50% of students jumped below $2\frac{5}{62}$m and 50% above it. **(1/2)**

7. We construct the following table as:

Class	Frequency	Cumulative frequency
0-5	12	12
5-10	a	$12 + a$
10-15	12	$24 + a$
15-20	15	$39 + a$
20-25	b	$39 + a + b$
25-30	6	$45 + a + b$
30-35	6	$51 + a + b$
35-40	4	$55 + a + b$
Total	**70**	

(1)

Here, $N = 70$

$\Rightarrow \quad 55 + a + b = 70$ **(1/2)**

$\Rightarrow \quad a + b = 15$ ...(i)

Given, median = 16, which lies in the interval 15-20. So, median class is 15-20.

$\therefore \quad l = 15, h = 5, f = 15, N = 70$ and $c.f. = 24 + a$

Now, median $= l + \left(\frac{\frac{N}{2} - \text{c.f.}}{f}\right) \times h$ **(1/2)**

$\therefore \quad 16 = 15 + \frac{35 - 24 - a}{15} \times 5$

$\Rightarrow \quad 1 = \frac{11 - a}{3} \Rightarrow a = 8$ **(1/2)**

From (i), $b = 15 - 8 = 7$ **(1/2)**

8. We have given, Median = 525, so
Median Class = 500-600

Class interval	Frequency	Cumulative frequency
0-100	2	2
100-200	5	7
200-300	x	$7+x$
300-400	12	$19+x$
400-500	17	$36+x$
500-600	20	$56+x$
600-700	y	$56+x+y$
700-800	9	$65+x+y$
800-900	7	$72+x+y$
900-1000	4	$76+x+y$

$76 + x + y = 100$ **(1)**

$\Rightarrow \quad x + y = 24 \quad ...(i)$ **(1/2)**

Median formula is,

$$\text{Median} = l + \frac{\frac{N}{2} - c.f.}{f} \times h$$ **(1/2)**

where l is lower limit of median class, $\frac{N}{2}$ is half of total frequency, c.f. is cumulative frequency of class preceding the median class, f is frequency of median class and h is class interval of median class.

Since, / 500, h = 100, f= 20, cf = 36+x and N = 100 (1)

Therefore, putting the value in the Median formula, we get;

$$525 = 500 + \frac{50-(36+x)}{20} \times 100$$

$\Rightarrow \quad x = 9$

$y = 24 - x$ (from eq. (i) **(1)**

$\Rightarrow \quad y = 24 - 9 = 15$ **(1)**

Therefore, the value of $x = 9$ and $y = 15$.

9.

(i) (c) :

Class	Class marks	Frequency (f)
0-20	10	8
20-40	30	10
40-60	50	13
60-80	70	6
80-100	90	3

$$\text{Mean} = \frac{10\times8+30\times10+50\times13+70\times6+90\times3}{40}$$

$$= \frac{80+300+650+420+270}{40} = \frac{1720}{40} = 43 \qquad \textbf{(1)}$$

(ii) (c): Since, highest frequency is 13, therefore modal class is 40-60.
:- Upper limit of modal class = 60. (1)
(iii) (b): Median (1)
(iv) (c): Clearly, lower limit of modal class = 40

Class	Frequency (f_i)	Cumulative frequency (*c.f.*)
0-20	8	8
20-40	10	18
40-60	13	31
60-80	6	37
80-100	3	40

Here, $\frac{N}{2} = \frac{40}{2} = 20$

Since, *c.f.* just greater than 20 is 31 therefore median class is 40-60.

$\therefore$ Lower limit of median class = 40
So, sum of lower limits of median class and modal class = 40 + 40 = 80. **(1)**
(v) (c) : Number of students who finish the race within 1 minute = 8 + 10 + 13 = 31. **(1)**