

Assignments in Mathematics Class IX (Term 2)

14. STATISTICS

IMPORTANT TERMS, DEFINITIONS AND RESULTS

- | The facts or figures, which are numerical or otherwise, collected with a definite purpose are called *data*. Data is the plural form of the Latin word '*datum*'.
- | Statistics is the area of study dealing with the presentation, analysis and interpretation of data.
- | The data which are collected by an investigator personally to fulfill his objective is called *primary data*.
- | The data which are collected by someone else but used by the investigator for his own purpose is called *secondary data*.
- | Putting the data in the form of tables, in condensed form, is known as the *presentation of data*.
- | The number of times an observation occurs is called its *frequency*.
- | The tabular arrangement of data, showing the frequency of each observation, is called a *frequency distribution*.

There are two types of frequency distributions.

- | (a) **Exclusive form (or continuous form) :**
A frequency distribution in which upper limit of each class is excluded and lower limit is included, is called an *exclusive form*.
We may consider the classes : 0 – 10, 10 – 20, etc. In class 0 – 10 we include 0 and exclude 10. In class 10 – 20, we include 10 and exclude 20.
- | (b) **Inclusive form (or discontinuous form) :**
A frequency distribution in which each upper limit as well as lower limit is included, is called an inclusive form. Thus, we have classes of the form 0 – 10, 11 – 20, 21 – 30, etc. In 0 – 10, both 0 and 10 are included.
- | Each group into which the raw data is condensed, is called a class interval. Each class is bounded by two figures, which are called *class limits*. The figure on the left side of a class is called its *lower limit* and that on the right is called its *upper limit*.
- | In the case of exclusive classes the upper and lower limits are respectively known as its *true upper limits* and *true lower limits*.
But in the case of inclusive classes, the true lower and upper limits are obtained by subtracting 0.5 from the lower limit and adding 0.5 to the upper limit.

Thus in the case of classes 5 – 10, 10 – 15, 15 – 20, ...,

True lower limit of the class 10 – 15 = 10

True upper limit of the class 10 – 15 = 15

In the case of class 1 – 10, 11 – 20, 21 – 30, ...

True lower limit of the class 11 – 20 = $11 - 0.5 = 10.5$

True upper limit of the class 11 – 20 = $20 + 0.5 = 20.5$

True upper limits and true lower limits are also known as boundaries of the classes.

- | The difference between the true upper limit and the true lower limit of a class is called the *size of the class*.
- | The value which lies midway between lower and upper limits of a class is known as its *mid-value* or *class mark*.
i.e., Class mark

$$= \frac{\text{lower limit of class} + \text{upper limit of class}}{2}$$

- | The difference of the highest and the lowest values in the data is called the *range* of the data.
- | **Bar Diagram or Bar Graph**
A set of bars (thick lines or narrow rectangles) representing variable and frequency constitute a bar graph. The following points should be kept in mind while drawing bar graphs.
 - (i) The bars should be at equal distances from each other.
 - (ii) All the bars in a diagram should be of the same width.
 - (iii) Both axes should be adequately labelled.

| **Histogram**

We use a histogram to represent grouped data by representing class boundaries along the horizontal axis and the corresponding frequencies along the vertical axis. Thus, rectangles are constructed with base as the class size and their heights representing the frequencies.

| **Frequency Polygon**

A frequency polygon is obtained by joining the mid-points of the respective tops of the rectangles in a histogram. To complete the polygon join the mid-points of two more classes (called imaginary classes) one at each end.

- If $x_1, x_2, x_3, \dots, x_n$ are n observations, then

$$\text{Mean}(\bar{x}) = \frac{x_1 + x_2 + x_3 + \dots + x_n}{n} \text{ or } \frac{\Sigma x}{n}$$
- If $x_1, x_2, x_3, \dots, x_n$ are n observations and $f_1, f_2, f_3, \dots, f_n$ their corresponding frequencies, then

$$\text{Mean}(\bar{x}) = \frac{f_1 x_1 + f_2 x_2 + f_3 x_3 + \dots + f_n x_n}{f_1 + f_2 + f_3 + \dots + f_n} = \frac{\Sigma(fx)}{\Sigma f}$$
- $\bar{x} = A + \frac{\Sigma d}{n}$, where A is the assumed mean,
 $d = x - A$ and n is the number of observations.

- Median is the middle item in the arrayed data.

$$\text{Median} = \left(\frac{n+1}{2} \right) \text{th item, if } n \text{ is odd.}$$

Median

$$= \text{Mean of } \left[\frac{n}{2} \text{th item} + \left(\frac{n}{2} + 1 \right) \text{th item} \right], \text{ if } n \text{ is even.}$$

- Mode is the most frequently occurring observation.

Empirical Formula for mode is

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

SUMMATIVE ASSESSMENT

MULTIPLE CHOICE QUESTIONS

[1 Mark]

A. Important Questions

- The mean age of 5 students of a class is 10 years. If one student is excluded from the class, the new mean age becomes 9 years. The age of student who is excluded from the class is :
 (a) 11 years (b) 12 years
 (c) 13 years (d) 14 years
- The ratio between upper limit and lower limit of a class is 3 : 2. If the class mark is 15, then lower limit of the class-interval is :
 (a) 9 (b) 12 (c) 15 (d) 18
- For $x = -1$, the mode of data $x + 1, 0, x + 2, x + 3$ and $x + 4$ is :
 (a) 0 (b) 1 (c) 2 (d) 3
- A cricket player has a mean score of 50 runs in the four innings. How many runs to be scored by the player in the fifth innings to raise the mean score by five ?
 (a) 25 (b) 50 (c) 75 (d) 100
- The mean of the prime factors of 24 is :
 (a) $\frac{10}{3}$ (b) $\frac{9}{4}$ (c) $\frac{5}{2}$ (d) $\frac{17}{3}$
- The mode of the following data 44, 40, 40, 41, 45, 43, 45, 40, 41 is :
 (a) 40 (b) 41 (c) 43 (d) 44
- If lower limit and upper limit of a class are in the ratio 3 : 5 and its class size is 6, then the class-mark of this class is :
 (a) 3 (b) 5 (c) 6 (d) 12
- $x + 8, x$ and $x - 3$ are the frequencies of three numbers 5, 8 and 10 respectively. If their arithmetic mean is 6, then the value of x is :
 (a) 4 (b) 5 (c) 5.5 (d) 6
- Range of the data 25.7, 16.3, 2.8, 21.7, 24.3, 22.7, 24.9 is :
 (a) 22 (b) 22.9 (c) 21.7 (d) 20.5
- The median of first six whole numbers is :
 (a) 2 (b) 2.5 (c) 3 (d) 4.5
- Class-marks of (30-40) and (60-70) are :
 (a) 35 and 60 (b) 30 and 65
 (c) 35 and 65 (d) 40 and 70
- Two students scored following marks (out of 10 marks) in five different subjects :
 Student I : 2, 3, 4, 5, 6
 Student II : 3, 3, 3, 4, 8
 Which student scored better ?
 (a) I (b) II
 (c) both (d) information is not sufficient
- The mean of perimeters of two squares having sides x units and y units is :
 (a) $(x + y)$ units (b) $\frac{(x + y)}{2}$ units
 (c) $2(x + y)$ units (d) $\frac{(x + y)}{4}$ units
- The mean weight of 10 students in a class is 50 kg. If the sum of the weights of 9 students is 453 kg, the weight of 10th student is :
 (a) 53 kg (b) 50 kg (c) 47 kg (d) 43 kg
- For $x = 1$, the median of data $x, x + 1, x - 1, x + 3$ and $x + 2$ is :
 (a) 1 (b) 2 (c) 3 (d) 4
- The mean of three numbers is 4. If two of the numbers are 1 and 2, then the third number is :
 (a) 4 (b) 8 (c) 9 (d) 11

17. The class marks of a frequency distribution are given as follows :
15, 20, 25, ...
The class corresponding to the class mark 20 is:
(a) 12.5 – 17.5 (b) 17.5 – 22.5
(c) 18.5 – 21.5 (d) 19.5 – 20.5
18. In the class intervals 10-20, 20-30, the number 20 is included in :
(a) 10–20 (b) 20–30
(c) both the intervals (d) none of these
19. If each observation of a data is increased by 5, then their mean :
(a) remains the same
(b) becomes 5 times the original mean
(c) is decreased by 5
(d) is increased by 5
20. The class mark of the class 90-120 is :
(a) 90 (b) 105 (c) 115 (d) 120
21. The range of the data 25, 18, 20, 22, 16, 6, 17, 15, 12, 30, 32, 10, 19, 8, 11, 20 is :
(a) 10 (b) 15 (c) 18 (d) 26
22. In a frequency distribution, the mid value of a class is 10 and the width of the class is 6. The lower limit of the class is :
(a) 6 (b) 7 (c) 8 (d) 12
23. The marks obtained by 17 students in a mathematics test (out of 100) are given below :
91, 82, 100, 100, 96, 65, 82, 76, 79, 90, 46, 64, 72, 68, 66, 48, 49.
The range of the data is :
(a) 46 (b) 54 (c) 90 (d) 100
24. The class-mark of the class 130-150 is :
(a) 130 (b) 135 (c) 140 (d) 145
25. The median of the data 78, 56, 22, 34, 45, 54, 39, 68, 54, 84 is :
(a) 45 (b) 49.5 (c) 54 (d) 56
26. For drawing a frequency polygon of a continuous frequency distribution, we plot the points whose ordinates are the frequencies of the respective classes and abscissae are respectively.
(a) upper limits of the classes
(b) lower limits of the classes
(c) class marks of the classes
(d) upper limits of preceding classes
27. Median of the numbers 4, 4, 5, 7, 6, 7, 7, 12, 3 is:
(a) 4 (b) 5 (c) 6 (d) 7
28. Mode of the data 15, 14, 19, 20, 14, 15, 16, 14, 15, 18, 14, 19, 15, 17, 15 is :
(a) 14 (b) 15 (c) 16 (d) 17
29. The mean temperature of 30 days was taken as 15°C , but later it was found that temperature of one day was noted as 16°C instead of 13°C . The correct mean is :
(a) 14.5°C (b) 14.4°C (c) 14.9°C (d) 13°C
30. The median of first 10 even numbers is :
(a) 10 (b) 10.5 (c) 11 (d) 11.5
31. Numbers 7, 8, $3x + 2$, $5x - 4$, 40, 41 are given in ascending order. If the median of the data is 15, then the value of x is :
(a) 3 (b) 3.5 (c) 4 (d) 4.5
32. The mean marks obtained by 15 students in a class is 73. If the marks of each student are doubled, then the new mean marks is :
(a) 30 (b) 75 (c) 146 (d) 103
33. The median of first 49 whole numbers is :
(a) 24 (b) 25 (c) 26 (d) 48
34. The median of first 49 natural numbers is :
(a) 24 (b) 25 (c) 27 (d) 30
35. If the mean of three consecutive numbers is 3, then the median of these numbers is :
(a) 3 (b) 4 (c) 5 (d) 6
36. The mean age of 5 students of a class is 10 years. If one student is added to the class, the new mean age becomes 11 years. The age of the student who is added to the class is :
(a) 12 years (b) 15 years
(c) 16 years (d) 14 years
37. If the class-mark and class-size of a class are 6 and 2 respectively, then the upper limit of the class is :
(a) 2 (b) 5 (c) 6 (d) 7
38. The mean of first five prime numbers is :
(a) 5.6 (b) 6.5 (c) 5.2 (d) 6.8
39. The average area of two rectangles having dimensions as (3 units \times 4 units) and (4 units \times 5 units) is :
(a) 12 sq units (b) 14 sq units
(c) 16 sq units (d) 20 sq units
40. The mean of class-marks of (20– 30) and (30– 40) is :
(a) 20 (b) 30 (c) 40 (d) 35
41. The mean of 15 numbers is 18 and the mean of 10 numbers is 13. The mean of all the 25 numbers is :
(a) 16 (b) 16.5 (c) 12 (d) none of these
42. The sum of first n natural numbers is given by $\frac{n(n+1)}{2}$. The mean of first 100 natural numbers is :
(a) 101 (b) 50.5 (c) 50 (d) 100

B. Questions From CBSE Examination Papers

1. If the mean of the data $x, x + 1, x + 3, x + 6$ is $\frac{15}{2}$, then the value of x is : [T-II (2011)]
(a) 3 (b) 4 (c) 5 (d) 6
2. The class mark of the class 100 – 150 is : [T-II (2011)]
(a) 100 (b) 125 (c) 130 (d) 150
3. Class mark of a particular class is 10.5 and class size is 7, then the class interval is : [T-II (2011)]
(a) 10.5–17.5 (b) 3.5–10.5
(c) 7–17.5 (d) 7–14
4. The mean of a, b is 8.5 and mean of a, b, c is 7. The value of c is : [T-II (2011)]
(a) 2 (b) 4 (c) 5 (d) 9
5. Median of the data 5, 9, 8, 6, 3, 5, 7, 12, 15 is : [T-II (2011)]
(a) 3 (b) 6 (c) 5 (d) 7
6. If the class marks in a frequency distribution are 19.5, 26.5, 33.5, 40.5, then the class corresponding to the class mark 33.5 is : [T-II (2011)]
(a) 16–23 (b) 23–30
(c) 30–37 (d) 37–41
7. Class mark of class interval 60–70 is : [T-II (2011)]
(a) 60 (b) 70 (c) 65 (d) 75
8. The mean of 10 numbers is 55. If one number is excluded, their mean becomes 50, the excluded number is : [T-II (2011)]
(a) 60 (b) 70 (c) 80 (d) 100
9. Class mark of a particular class is 6.5 and class size is 3, then class interval is : [T-II (2011)]
(a) 5–8 (b) 6.5–9.5
(c) 3.5–6.5 (d) 4.25
10. The range of the data 25.7, 16.3, 2.8, 21.7, 24.3, 22.7, 24.9 is : [T-II (2011)]
(a) 22 (b) 22.9 (c) 21.7 (d) 20.5

SHORT ANSWER TYPE QUESTIONS

[2 Marks]

A. Important Questions

1. Is it correct to say that in a histogram, the area of each rectangle is proportional to the class size of the corresponding class interval ? Justify your answer.
2. A student was asked to find the median of the data : 3, 14, 18, 20, 5. He writes the answer as 18. Is this the correct median ? If not, find the correct median of the data.
3. The mean of a data is \bar{x} . What will be the new mean if each value of the data is increased by a ?
4. In a histogram, the areas of the rectangles are proportional to the frequencies. Can we say that the lengths of the rectangles are also proportional to the frequencies ?
5. Find the median of the following numbers. 2, 3, 7, 11, 10, 9, 9, 5, 2.
6. The ages (in years) of 8 children are given below: 15, 15, 16, 15, 15, 16, 14, 14. Find the modal age.
7. Observe the data : 16, 9, 3, 9, 9, 3, 2. Since, 16 is the highest value in the observation, so the mode of the data is 16. Is it correct ?
8. Find the mean of first 10 whole numbers.
9. The mean of 10, 12, 18, 13, x and 17 is 15. Find the value of x .
10. What is the median of first 19 natural numbers ?
11. The mean of 5 numbers is 27. If one of the numbers is excluded, the mean of remaining numbers is 25. Find the excluded number.
12. Find the median of first ten prime numbers.
13. In a test in mathematics, 12 students scored the following marks (out of 100) :
46, 52, 40, 98, 44, 48, 11, 41, 53, 54, 62, 96.
Which average will be a good representative of the above data ? Justify your answer.
14. The class marks of a continuous distribution are 1.04, 1.14, 1.24, 1.34, 1.44, 1.54 and 1.64. What will be the last class interval of the distribution ?

B. Questions From CBSE Examination

1. The weights, in grams of 30 oranges picked at random from a basket are given below:
70, 110, 119, 81, 158, 144, 125, 120, 155, 90, 102, 62, 98, 156, 145, 150, 135, 140, 82, 125, 61, 85, 117, 121, 121, 130, 65, 69, 92, 100.
Construct the continuous grouped frequency distribution table, width of each class being 20 grams and first class being 60–80 (80 not included). [T-II (2011)]
2. Find the mean of first 10 natural numbers. [T-II (2011)]
3. Average monthly consumption of petrol for first 3 months is 86 litres and for next 9 months is 152 litres. Find the average consumption for the whole year. [T-II (2011)]
4. Find the mean of first 10 prime numbers. [T-II (2011)]
5. The following observations have been arranged in ascending order. If median of the data is 23.5, find the value of x . [T-II (2011)]
12, 16, 17, 19, x , $x + 3$, 27, 37, 38, 40
6. The mean marks scored by 100 students was 40. Later on, it was discovered that a score of 53 was misread as 83. Find the correct mean marks. [T-II (2011)]
7. Find the mean of 3, 4, 6, 7, 8, 14. If 5 is added to each observation, what will be the new mean? [T-II (2011)]
8. Find the mean of the first eight prime numbers. [T-II (2011)]
9. Find the median of data : 26, 56, 32, 33, 60, 17, 34, 29 and 45. If 26 is replaced by 62, find the new median. [T-II (2011)]
10. The mean of first 8 observations is 18 and last 8 observations is 20. If the mean of all 15 observations is 19, find the 8th observation. [T-II (2011)]
11. If the mean of the data 6, 8, 10, 3, 7 and m is 7, then find the value of m . [T-II (2011)]
12. Give one example of a situation in which
 - (i) the mean is an appropriate measure of central tendency.
 - (ii) the mean is not an appropriate measure of central tendency but the median is an appropriate measure of central tendency. [T-II (2011)]
13. The median of following observations arranged in ascending order is 25. Find x .
11, 13, 15, 19, $x + 2$, $x + 4$, 30, 35, 39, 46. [T-II (2011)]
14. Find median of following data : 17, 23, 57, 46, 33, 29, 28, 30, 34. If observation 23 is removed from data then find new median. [T-II (2011)]
15. The mean of ten observations is 20. If nine of observations are 16, 20, 18, 17, 22, 16, 15, 20, 17. Find the tenth observation. [T-II (2011)]
16. Find the mean of first five prime numbers [T-II (2011)]
17. Find the median of the following data :
15, 35, 18, 27, 19, 23, 29, 20, 28 [T-II (2011)]
18. Find the median of the following data :
23, 31, 47, 24, 46, 27, 37, 30. [T-II (2011)]
19. If the mean of 10, 12, 18, 11, p and 19 is 15, find the value of p . [T-II (2011)]
20. Find the median of first ten prime numbers. [T-II (2011)]

SHORT ANSWER TYPE QUESTIONS

[3 Marks]

A. Important Questions

1. The median of the observations 26, 29, 42, 53, x , $x + 2$, 70, 75, 82, 93 arranged in ascending order is 65. Find the value of x :
2. The following data represents height (in cm) of 20 students of a class :
132, 130, 134, 135, 130, 131, 134, 135, 133, 133, 130, 131, 133, 136, 135, 134, 130, 133, 129, 136.
Make a frequency table for the above information :
3. The mean of 70 observations was found to be 150. While checking, it was detected that one value 210 was wrongly copied as 140, while calculating the mean. Find the correct mean.
4. The class marks of a distribution are 6, 10, 14, 18, 22, 26, 30. Find the class size and the class intervals.
5. If the median of the data 11, 12, 14, 18, $x + 2$, $x + 4$, 30, 32, 35 and 41 arranged in ascending order is 24, find x .

6. The points scored by a basket ball team in a series of matches are as follows :
17, 2, 7, 27, 25, 5, 14, 18, 10, 24, 48, 10, 8, 7, 10, 28.

Find the median and the mode for the data.

7. Find the mean of the following data :

x	4	6	8	10	12
f	4	8	14	11	3

8. The mean of 15 numbers is 9. If each observation is multiplied by 4, what will be the new mean? Give reason for your answer.
9. The mean of 13 observations is 14. If the mean of the first 7 observations is 12, and that of the last 7 observations is 16, find the seventh observation.

10. For what value of x the mode of the following data is 15 ?

15, 16, 17, 13, 17, 16, 15, $x + 10$, 14, 17, 16, 15

11. A class consists of 50 students. Out of which 30 are girls. The mean of marks scored by girls in a test is 73 and that of boys is 71. Find the mean score of the whole class.

12. Observe the following table :

x	5	15	25	35	45
f	3	p	15	8	5

If the mean of the data is 25.75, find the value of p .

13. If the mean of five observations x , $x + 2$, $x + 4$, $x + 6$, $x + 8$ is 11, find the mean of first three observations.

B. Questions From CBSE Examination Papers

1. The following observations have been arranged in ascending order where median of the data is 63 :

29, 32, 48, 50, x , $x + 2$, 72, 78, 84, 95.

Find the mean of the data. [T-II (2011)]

2. The following table gives the life time 400 neon lamps :

Life time (in hrs)	Number of lamps
300 – 400	14
400 – 500	56
500 – 600	60
600 – 700	86
700 – 800	74
800 – 900	62
900 – 1000	48

Represent the above information with the help of a histogram. [T-II (2011)]

3. Find the difference between median and mode of the following data :

4, 6, 5, 9, 3, 2, 7, 7, 6, 5, 4, 9, 10, 3, 4, 7, 6, 9, 9. [T-II (2011)]

4. Find the arithmetic mean of the following table.

Marks obtained	Number of students
70	3
58	5
60	4
52	7
65	6
75	2
68	3

[T-II (2011)]

5. If the median of the data in ascending order : 30, 32, 49, 50, $2x$, $2x + 2$, 73, 78, 85, 96 is 63, find x . Also, find the mean. [T-II (2011)]

6. Calculate the arithmetic mean of the following data : [T-II (2011)]

Marks obtained	Number of students
40	3
88	5
60	4
52	7
63	6
75	2
70	3

7. The mean of 14 values of a data is 23. If one more value is introduced in the data, the mean of 15 values becomes 25. Find the fifteenth value. [T-II (2011)]

8. The mean of 50 observations of a data was 70. At later stage, it was noted that a value of 85 was wrongly read as 60. Find the value of the correct mean. [T-II (2011)]

9. Find the average daily income of the employees of the company. [T-II (2011)]

Daily income (Rs.)	Number of employees
490 – 510	7
510 – 530	8
530 – 550	12
550 – 570	16
570 – 590	4
590 – 610	3

10. Mean of 50 observations was found to be 80.4. But later on it was discovered that 96 was mis-read as 69 at one place. Find the correct mean. If to each observation a constant value k is added, how is the mean affected ? [T-II (2011)]

11. Find the mean salary of 50 workers of a factory from the following data. [T-II (2011)]

Salary (in Rs.)	Number of workers
2500	10
3000	7
4500	11
5000	12
6500	4
7500	6

12. The numbers 42, 43, 44, 44, $(2x + 3)$, 45, 45, 46, 47, 49 are written in a ascending order and the median is 45. Find x . Hence, find the mode of the above data. [T-II (2011)]

13. Find the mean salary of 60 workers of a factory from the following table : [T-II (2011)]

Salary (in Rs.)	No. of workers
3000	16
4000	12
5000	10
6000	8
7000	6
8000	4
9000	3
10000	1
Total	60

14. The pass percentage of students of Class IX of a school for 5 consecutive years is shown below : [T-II (2011)]

Years	Pass percentage
2004	70
2005	62
2006	76
2007	85
2008	58

Draw a bar graph (use graph sheet) to represent the above data.

15. The mean weight per student in a group of 7 students is 55 kg. The individual weights of 6 of them in kg are 52, 54, 55, 53, 56, 54. Find the weight of the seventh student. [T-II (2011)]

16. If the mean of the following data is 20.2, find the value of p . [T-II (2011)]

p	10	15	20	25	30
f	6	8	p	10	6

17. The mean of 25 observations is 36. Out of these observations, the mean of first 13 observations is 32 and that of the last 13 observations is 40. Find the 13th observation. [T-II (2011)]

18. Find the mean of the following distribution : [T-II (2011)]

x	4	6	9	10	15
f	5	10	10	7	8

19. The marks obtained by 40 students of class IX in an examination are given below :

18, 8, 12, 6, 8, 16, 12, 5, 23, 2, 16, 23, 2, 10, 20, 12, 9, 7, 6, 5, 3, 5, 13, 21, 13, 15, 20, 24, 1, 7, 21, 16, 13, 18, 23, 7, 3, 18, 17, 16.

Present the data in the form of a frequency distribution table of the same class size, one such class being 15–20. (where 20 is not included.) [T-II (2011)]

20. Find the mean for the weekly pocket money (in rupees) using the following data. [T-II (2011)]

Pocket money (in Rs.)	Frequency
55	8
50	3
49	10
81	7
48	3
57	7
65	2

21. Find missing frequency p for the following distribution whose mean is 15. [T-II (2011)]

$x :$	5	10	15	20	25
$f :$	6	p	6	10	5

22. For what value of a the median of the following observation arranged in ascending order is 32?

12, 14, 15, 27, $a + 2$, $a + 4$, 35, 36, 40, 41

[T-II (2011)]

23. In a mathematics test given to 15 students, the following marks out of 100 are recorded : 41, 39, 48, 52, 46, 52, 54, 40, 96, 52, 98, 40, 42, 52, 60. Find the median and mode of this data. [T-II (2011)]
24. The mean of 25 observations is 36. If the mean of the first 13 observation is 32 and that of last 13 observations is 39, find the 13th observation. [T-II (2011)]
25. In a city, the weekly observation made in a study on the cost of living index are given in the following table : [T-II (2011)]

Cost of the living index	No. of weeks
140 – 150	5
150 – 160	10
160 – 170	20
170 – 180	09
180 – 190	06
190 – 200	02
Total	52

Draw the frequency polygon for the data given above.

26. The mean of the following distribution is 50.

x	10	30	50	70	90
f	17	$5p + 3$	32	$7p - 11$	19

Find the value of p . [T-II (2011)]

27. The following are the runs made by 22 players in a one day cricket series played between India and Pakistan.
79, 28, 45, 99, 3, 46, 8, 0, 3, 7, 75, 24, 73, 122, 46, 27, 16, 7, 100, 3, 67, 53. Construct a frequency distribution table for the above data with equal class intervals, one of these being 0–20 (20 not included). [T-II (2011)]
28. The mean of following distribution is 50. Find the value of b and hence find the frequency of 30 and 70. [T-II (2011)]
- | | | | | | |
|-----|----|------------|----|-------------|----|
| x | 10 | 30 | 50 | 70 | 90 |
| f | 17 | $(5b + 3)$ | 32 | $(7b - 11)$ | 19 |
29. The distance (in km) covered by 20 cars in 2 hours are given below :
125, 120, 130, 134, 100, 90, 96, 100, 110, 120, 112, 116, 104, 96, 100, 98, 120, 122, 124, 92.
Represent the data as a continuous frequency distribution table with equal class size, starting from 90 – 95. [T-II (2011)]

30. The following is the distribution of weights (in kg) of 50 persons : [T-II (2011)]

Weights (in kg)	Number of persons
50 – 55	12
55 – 60	10
60 – 65	9
65 – 70	7
70 – 75	5
75 – 80	7

Draw a histogram for the above data.

31. The following table gives the distribution of students of two sections according to the marks obtained by them. [T-II (2011)]

Section A		Section B	
Marks	Frequency	Marks	Frequency
0 – 10	2	0 – 10	5
10 – 20	12	10 – 20	11
20 – 30	18	20 – 30	15
30 – 40	13	30 – 40	12
40 – 50	5	40 – 50	7

Represent the marks of the students of both the sections on the same graph by two frequency polygons.

32. The heights of 50 students, measured to the nearest centimetres, have been found to be as follows: [T-II (2011)]
135, 162, 173, 151, 176, 165, 162, 145, 171, 172, 157, 161, 172, 158, 163, 175, 148, 173, 163, 159, 160, 162, 172, 175, 176, 168, 167, 170, 172, 173, 165, 151, 149, 169, 173, 138, 156, 148, 159, 166, 176, 151, 139, 146, 164, 173, 141, 142, 150, 159.
Represent the data given above by a grouped frequency distribution table, taking class intervals as 160 – 165, 165 – 170 etc.
33. The median of the following observations arranged in ascending order is 27. Find x .
13, 15, 17, 21, $x + 2$, $x + 4$, 32, 41, and 48. [T-II (2011)]
34. Obtain the mean of the following data : [T-II (2011)]

Variable (x_i)	4	6	8	10	12
Frequency (f_i)	4	8	14	11	3

35. Construct a histogram for the following data : [T-II (2011)]

Class interval	Frequency
10 – 19	20
20 – 29	15
30 – 39	45
40 – 49	60
50 – 59	75

36. The mean mark of 8 students is 65. If marks of 7 students are 60, 70, 55, 50, 60, 65 and 85, then find the marks of 8th student. [T-II (2011)]
37. Find the mean of the following frequency distribution showing the marks obtained in a class test by 20 students. [T-II (2011)]

Marks	10	15	20	25
No. Students	4	5	8	3

38. The following data has been arranged in ascending order : 12, 14, 17, 20, 22, x , 26, 28, 32, 36. [T-II (2011)]
If the median of the data is 23, find x . In the above data, if 32 is replaced with 23, find the new median.
39. The weight (in kg) of 10 students of a class are given below : [T-II (2011)]
41, 39, 48, 52, 35, 28, 30, 35, 46, 32.
Find the mean and median for this data.

40. The distribution of weight (in kg) of 100 people is given below : [T-II (2011)]

weight (kg)	Frequency
40 – 45	13
45 – 50	25
50 – 55	28
55 – 60	15
60 – 65	12
65 – 70	5
70 – 75	2
Total	100

Construct a histogram and frequency polygon for the data.

41. Find the missing frequencies f_1 and f_2 in the following frequency distribution, if it is known that the mean of the distribution is 1.46. [T-II (2011)]

x_i	0	1	2	3	4	5	Total
f_i	46	f_1	f_2	25	10	5	200

Find the value of a .

42. The electricity bills (in Rs.) of 25 houses in a certain locality are given below : [T-II (2011)]
500, 440, 100, 180, 150, 560, 300, 220, 300, 240, 150, 180, 120, 270, 420, 450, 450, 240, 200, 220, 140, 160, 250, 360, 470.

Construct a grouped frequency table for this data with one of the class intervals as 100–200 (200 not included).

43. The points scored by a basket ball team in a series of match are follows. [T-II (2011)]

17, 2, 7, 27, 25, 5, 14, 18, 10, 24, 28, 10, 8, 7, 10, 28. Find the median and mode of the data.

44. Find the mean, median and mode of the following data : 15, 14, 19, 20, 14, 15, 16, 14, 15, 18, 14, 19, 15, 17, 15. [T-II (2011)]
45. If the mean of the following distribution is 6, find the value of p . [T-II (2011)]

x	2	4	6	10	$p + 5$
f	3	2	3	1	2

46. Given below are the seats won by different political parties in the following outcome of state assembly elections. [T-II (2011)]

Political party	A	B	C	D	E	F
Seats won	75	55	37	29	10	37

- (i) Draw a bar graph to represent the polling results.
- (ii) Which political party won the maximum number of seats?

47. Find the mean salary of 20 workers of a factory from the table. [T-II (2011)]

Salary (in Rs)	No. of workers
6,000	7
7,000	6
8,000	4
9,000	3
Total	20

48. The marks obtained by 40 students of class IX in mathematics are given below : [T-II (2011)]

81, 55, 68, 79, 85, 43, 29, 68, 54, 74, 47, 35, 72, 64, 95, 44, 55, 77, 64, 35, 79, 52, 45, 54, 70, 83, 62, 64, 72, 92, 84, 76, 63, 43, 54, 38, 73, 68, 52, 54.

Prepare a frequency distribution table with class-size of 10 marks.

49. Find the median of the following data :

19, 25, 59, 48, 35, 37, 30, 32, 51

If 25 is replaced by 52, what will be the new median [T-II (2011)]

50. Find the mean of the following data. [T-II (2011)]

Marks	10	30	50	70	89
Frequency	7	8	10	15	10

A. Important Questions

1. Draw a histogram to represent the following frequency distribution.

Class-interval	Frequency
100-150	60
150-200	100
200-300	100
300-500	80
500-800	180

2. The weights (in grams) of 30 oranges, picked at random from a basket of oranges are given below :

90, 30, 45, 55, 65, 60, 50, 75, 70, 60, 70, 70, 60, 95, 85, 80, 35, 45, 40, 45, 55, 30, 110, 75, 100, 40, 60, 85, 40, 100

Construct a grouped frequency distribution table with equal class intervals, one of them being 30-40.

3. Draw a histogram and frequency polygon (in the same diagram) for the following data :

Class	Frequency
440-460	2
460-480	4
480-500	3
500-520	5
520-540	3
540-560	2
560-580	1
580-600	4

4. The weights (in kg) of 25 employees of an office are given below :

81, 78, 81, 77, 75, 77, 69, 76, 65, 85, 87, 71, 83, 67, 85, 73, 78, 68, 85, 73, 85, 54, 70, 68, 80

Find the mean, median and mode of the above data.

5. Draw a histogram and a frequency polygon from the following data :

Class	Frequency
21-25	21
26-30	22
31-35	50
36-40	110
41-45	87
46-50	51
51-55	18
56-60	23

6. The weights (in kg) of 60 persons are given below. Find the mean weight of a person by (i) direct method (ii) deviation method.

Weight (in kg)	60	61	62	63	64	65
No. of persons	5	8	14	16	10	7

B. Questions From CBSE Examinations Papers

1. Draw a frequency polygon for the following data: [T-II (2011)]

Class	Frequency
1 – 6	2
7 – 12	1
13 – 18	8
19 – 24	9
25 – 30	4
31 – 36	5

2. Draw a histogram for the following data :

[T-II (2011)]

Marks	No. of students
0 – 10	6
10 – 20	14
20 – 30	18
30 – 40	20
40 – 50	22
50 – 60	16
60 – 70	10
70 – 80	5

3. Draw a frequency polygon for the following data: [T-II (2011)]

Cost of living index	No. of weeks
140 – 150	5
150 – 160	10
160 – 170	20
170 – 180	9
180 – 190	6
190 – 200	2

4. Draw a histogram and frequency polygon for the following distribution : [T-II (2011)]

Marks obtained	No. of students
0 – 10	7
10 – 20	10
20 – 30	6
30 – 40	8
40 – 50	12
50 – 60	3
60 – 70	2
70 – 80	2

5. Draw a histogram for the following data : [T-II (2011)]

Age (in years)	No. of children
1 – 2	5
2 – 3	3
3 – 5	6
5 – 7	12
7 – 10	9
10 – 15	10
15 – 17	4

6. The following table presents the number of literate females in a town : [T-II (2011)]

Age group	No. of females
10 – 15	300
15 – 20	980
20 – 25	800
25 – 30	580
30 – 35	290
35 – 40	50

Draw a frequency polygon for the above data.

7. Draw a histogram for the following data : [T-II (2011)]

x	f
10 – 15	7
15 – 20	9
20 – 25	8
25 – 30	5
30 – 40	12
40 – 60	12
60 – 80	6

8. The following table gives the distribution of students of two sections according to the marks obtained by them. [T-II (2011)]

Section A		Section B	
Marks	Frequency	Marks	Frequency
0 – 10	3	0 – 10	5
10 – 20	9	10 – 20	19
20 – 30	17	20 – 30	15
30 – 40	12	30 – 40	10
40 – 50	9	40 – 50	1

Represent the marks of the students of both the sections on the same graph by two frequency polygons. From the two polygons, compare the performance of the two sections.

9. Draw a histogram and frequency polygon on the same graph for the following data : [T-II (2011)]

Marks	No. of students
0 – 10	5
10 – 20	10
20 – 30	4
30 – 40	6
40 – 50	7
50 – 60	3
60 – 70	2
70 – 80	2
80 – 90	3
90 – 100	9

10. The runs scored by two teams A and B in 7 overs in a cricket match are given. [T-II (2011)]

Number of balls	Team A	Team B
1 – 6	2	5
7 – 12	1	6
13 – 18	8	2
19 – 24	9	10
25 – 30	4	5
31 – 36	5	6
37 – 42	6	3

Represent the data of both the teams on the same graph by frequency polygon.

11. Draw a histogram and frequency polygon for the following distribution : [T-II (2011)]

Marks obtained	No. of students
0 – 10	4
10 – 20	8
20 – 40	20
40 – 45	10
45 – 60	12
60 – 70	6
70 – 85	15

12. The daily income of 50 doctors is given below : [T-II (2011)]

Daily income (in Rs)	No. of doctors
0 – 1000	8
1000 – 2000	7
2000 – 3000	12
3000 – 4000	6
4000 – 5000	11
5000 – 6000	6

Draw a histogram for the above data.

13. The monthly salary (in thousand rupees) of 50 workers in a factory are given below : [T-II (2011)]

Salary	No. of workers
5.2	8
6.9	9
8.2	10
10.5	12
12.2	6
14.0	5

Find the mean salary of a worker.

14. Draw a histogram for the following data : [T-II (2011)]

Weight (in kg)	No. of students
40 – 44	2
45 – 49	8
50 – 54	12
55 – 59	10
60 – 64	6
65 – 69	4

15. Following table shows the frequency distribution for the speeds of cars passing through a particular point on a highway : [T-II (2011)]

Class interval	Frequency
30 – 40	3
40 – 50	6
50 – 60	25
60 – 70	65
70 – 80	50
80 – 90	28
90 – 100	14

Draw a histogram and a frequency polygon to represent the above data.

16. The distribution of weight (in kgs) of 100 people is given below. [T-II (2011)]

Weight (in kg)	Frequency
40 – 45	13
45 – 50	25
50 – 55	28
55 – 60	15
60 – 65	12
65 – 70	5
70 – 75	2

Construct a histogram for the above distribution.

17. The marks obtained by a class of 80 students are given below : [T-II (2011)]

Marks	No. of students
10 – 20	6
20 – 30	17
30 – 40	10
40 – 50	21
50 – 60	26

Draw a histogram to represent the above data.

18. Make a frequency polygon for given frequency table. [T-II (2011)]

Class interval	Frequency
0 – 5	2
5 – 10	3
10 – 15	4
15 – 20	1
20 – 25	5
25 – 30	3

19. Draw a histogram for the following data : [T-II (2011)]

Class interval	Frequency
10 – 14	300
15 – 19	980
20 – 24	800
25 – 29	600
30 – 34	300
35 – 39	450
40 – 44	530

20. Draw a histogram to represent the following distribution. [T-II (2011)]

Class interval	Frequency
5 – 10	6
10 – 15	12
15 – 25	10
25 – 45	8
45 – 75	15

21. Find mean, mode and median for the following data : [T-II (2011)]

10, 15, 18, 10, 10, 20, 10, 20, 15, 21, 15 and 25.

22. The daily wages of 100 workers (in Rs) in a factory are given below : [T-II (2011)]

Daily wages (in Rs)	No of workers
150 – 200	16
200 – 250	29
250 – 300	37
300 – 350	18

Draw a frequency polygon for given data.

23. The following table presents the number of illiterate females in the age group (10–34) in a town. [T-II (2011)]

Age group	No of females
10 – 14	300
15 – 19	980
20 – 24	800
29 – 29	580
30 – 34	290

Draw a histogram to represent the above data.

24. Construct a frequency polygon for the following data : [T-II (2011)]

Age	Frequency
0 – 2	2
2 – 4	4
4 – 6	6
6 – 8	8
8 – 10	9
10 – 12	6
12 – 14	5
14 – 16	3
16 – 18	1

25. The marks obtained by a class of 80 students (out of 100) are given below. Construct a histogram to represent the data : [T-II (2011)]

Marks	Number of students
10 – 20	6
20 – 30	17
30 – 50	15
50 – 70	16
70 – 100	26

26. Following table gives the distribution of the marks obtained by the students of a class. [T-II (2011)]

Marks	Number of students
0 – 15	5
15 – 30	12
30 – 45	28
45 – 60	30
60 – 75	35
75 – 90	13

Represent the data by frequency polygon.

27. Draw the frequency polygon without constructing the histogram of the following observations : [T-II (2011)]

Cost of living index	Number of weeks
140 – 150	5
150 – 160	10
160 – 170	20
170 – 180	9
180 – 190	6
190 – 200	2
Total	52

FORMATIVE ASSESSMENT

Project 1

Objective : Collection, tabulation of data obtained by an activity. Representing the information diagrammatically.

Materials Required : Chart paper 50 cm × 50 cm, Geometry box, Meter ruler, 10 counters of diameter 2 cm approx, graph sheets.

Procedure :

1. On chart paper, draw horizontal and vertical lines to give squares of 5 cm × 5 cm.

Using sketch pen, write numbers from 1 to 100 as shown in figure 1.

2. Make a table as shown in Table 1.

3. Place the chart paper on the floor.
4. Take all the ten counters and drop them simultaneously on the chart paper from a height of 50 cm (approx) above the centre of chart (approx).
5. Read the numbers written in the squares on the chart over which the counters fall and mark them in the “Tally Marks” column of the table. Keep the following rules :
 - (i) If a counter falls on the boundary of two squares such that more than half of it lies in one square and less than half in the other, record the number which has the bigger portion of the counter. For example, in figure 1 the counter marked I in the diagram should be taken as on the number 87, while the counter marked H should be taken as on the number 79.
 - (ii) If a counter falls almost half on two squares, do not record it and drop the counter again. For example, the counter marked J in figure 1.
 - (iii) If a counter falls on the boundary of more than two squares, reject it and drop it again. For example, counters marked A, B and C.
 - (iv) If a counter falls outside the chart reject it and drop it again.
6. Repeat the process ten times.
7. Complete the frequency table.
8. Draw a histogram to represent the data obtained, in table 1 (see figure 2.)
9. Mark the mid-point of the respective tops of the rectangles in the histogram and join them using a ruler. To complete the polygon, join the mid-points of two classes (called imaginary classes) one at each end. See figure 2.
10. Find the class mark of each class in Table 1. On a graph sheet, represent class marks on the x -axis and frequencies on the y -axis. Plot the corresponding points and complete the polygon (see figure 3).

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Figure 1

Table 1

Class	Tally Marks	Frequency	Class Marks
0 – 10		3	5
10 – 20		5	15
20 – 30		8	25
30 – 40		20	35
40 – 50		15	45
50 – 60		16	55
60 – 70		10	65
70 – 80		17	75
80 – 90		4	85
90 – 100		2	95
Total		100	

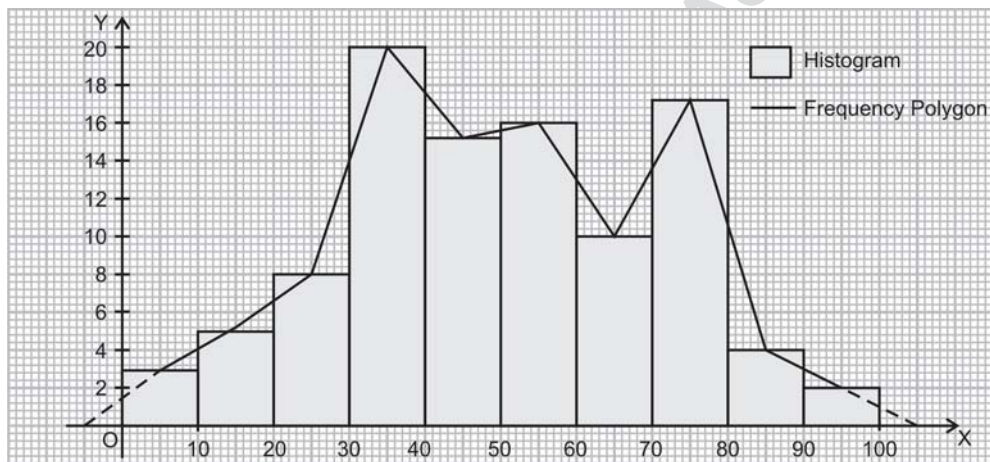


Figure 2

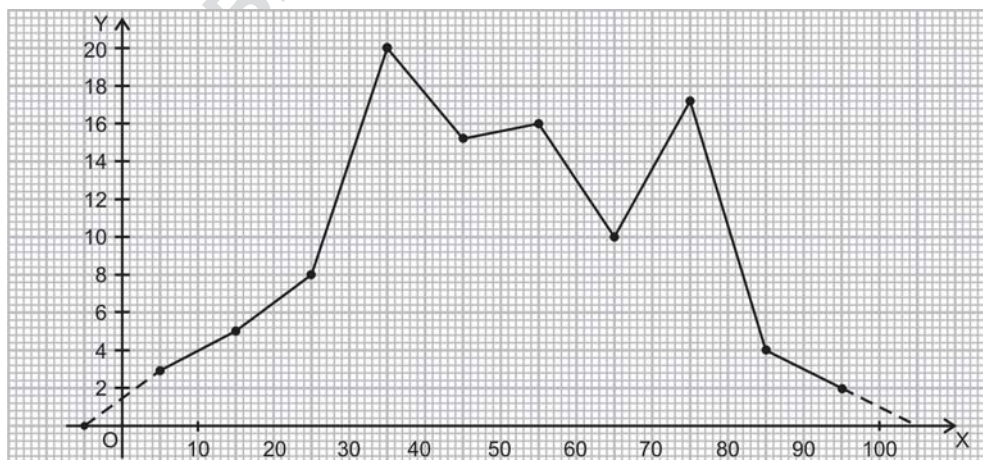


Figure 3

(Here we take class 0–10 to denote “greater than 0 and less than or equal to 10”, 10 – 20 to denote “greater than 10 and less than or equal to 20” and so on).

Observations :

1. In figure 2 the rectangle in the histogram are of equal width since the class size is 10 for all the classes.
2. If both a histogram and frequency polygon are to be drawn representing the same data, we use diagram as shown in figure 2.
3. If only the frequency polygon is to be drawn, we need not draw a histogram and directly draw a frequency polygon as shown in figure 3.

Project 2

Objective : Survey of the family members of students in a class.

Project Overview : A survey of the family members of class IX students of St. Thomos Public School was conducted in the month of July 2009. The aim of the survey was to find out the types of students with regard to the number of family members in their families. Such survey has not been conducted so far in this school. The school is situated in an industrial area. Large factories are situated near the school. Some government offices are also situated near the school. Most of the students live in the flats provided to their parents by the factory authorities. This survey is expected to give us a picture of optimum level of tuition fees, transport facility, items to be sold in the school canteen, extra coaching classes and other such things connected to the school curriculum. Such surveys may be helpful in getting an overall view of the type of facilities required at such schools.

Procedure :

The data of the survey was collected by directly asking each student of the class with the help of the class teacher Mr. Kabir Saxena. The students were asked to raise their hands according to the number of family members in their family. Following categories were considered as the members of the family.

- (i) Actual relatives living in their house.
- (ii) Other members like paying guests, servants etc.
- (iii) Brothers, sisters and other relatives who lived in their house during vacation.

Data obtained were recorded as below.

No. of members in the family	2	3	4	5	6	7	8	9
No. of families	2	4	7	16	21	12	3	1

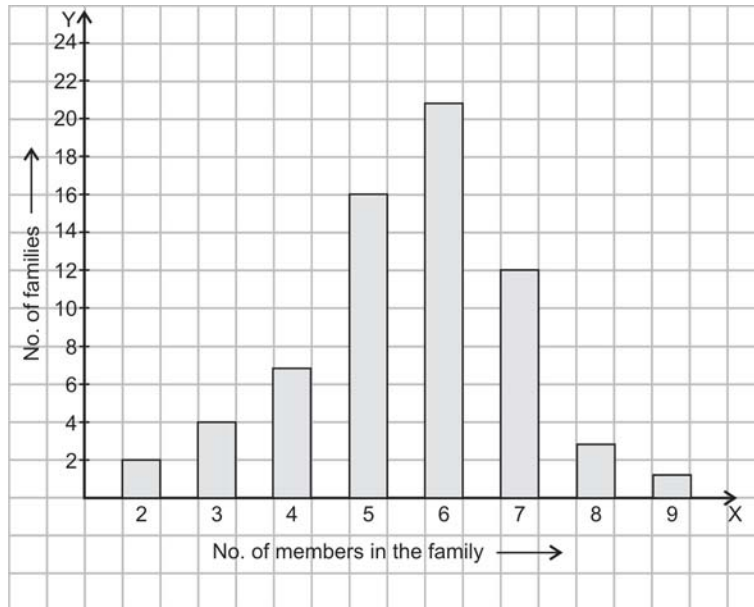
Computation : We can represent the above table as below and calculate the mean.

No. of members in the family (x)	No. of families (f)	fx
2	2	4
3	4	12
4	7	28
5	16	80
6	21	126
7	12	84
8	3	24
9	1	9
Total	66	367

$$\text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{367}{66} = 5.56 \approx 6$$

Diagrams :

We can draw bar diagram to represent the above data.

**Observations :**

From the bar graph, we observed that

- (i) 21 families have 6 members.
- (ii) Only 1 family has 9 members.
- (iii) No family has more than 9 members.

Also, average members in a family = $5.56 \approx 6$

Do Yourself :

- (i) Survey of the pocket money of a class of students.
- (ii) Survey of the different modes of transport used by students of a school.

Class IX Chapter 14 – Statistics

Maths

Exercise 14.1 Question 1:

Give five examples of data that you can collect from day to day life.

Answer:

In our day to day life, we can collect the following data.

1. Number of females per 1000 males in various states of our country
 2. Weights of students of our class
 3. Production of wheat in the last 10 years in our country
 4. Number of plants in our locality
 5. Rainfall in our city in the last 10 years
- Question 2:

Classify the data in Q1 above as primary or secondary data.

Answer:

The information which is collected by the investigator himself with a definite objective in his mind is called as primary data whereas when the information is gathered from a source which already had the information stored, it is called as secondary data. It can be observed that the data in 1, 3, and 5 is secondary data and the data in 2 and 4 is primary data.

Exercise 14.2 Question 1:

The blood groups of 30 students of Class VIII are recoded as follows:

A, B, O, O, AB, O, A, O, B, A, O, B, A, O, O,

A, AB, O, A, A, O, O, AB, B, A, O, B, A, B, O.

Represent this data in the form of a frequency distribution table. Which is the most common, and which is the rarest, blood group among these students?

Answer:

It can be observed that 9 students have their blood group as A, 6 as B, 3 as AB, and 12 as O.

Therefore, the blood group of 30 students of the class can be represented as follows.

Blood group	Number of students
A	9
B	6
AB	3
O	12
Total	30

It can be observed clearly that the most common blood group and the rarest blood group among these students is O and AB respectively as 12 (maximum number of

students) have their blood group as O, and 3 (minimum number of students) have their blood group as AB.

Question 2:

The distance (in km) of 40 engineers from their residence to their place of work were found as follows:

5 3 10 20 25 11 13 7 12 31

19 10 12 17 18 11 32 17 16 2 7 9

7 8 3 5 12 15 18 3

12 14 2 9 6 15 15 7 6 12

Construct a grouped frequency distribution table with class size 5 for the data given above taking the first interval as 0 - 5 (5 not included). What main feature do you observe from this tabular representation?

Answer:

It is given that a grouped frequency distribution table of class size 5 has to be constructed. Therefore, the class intervals will be 0 - 5, 5 - 10, 10 - 15, 15 - 20... By observing the data given as above, a grouped frequency distribution table can be constructed as follows.

Distance (in km)	Tally mark	Number of engineers
0 - 5		5
5 - 10		11
10 - 15		11

15 – 20		9
20 – 25		1
25 – 30		1
30 – 35		2
Total		40

It can be observed that there are very few engineers whose homes are at more than or equal to 20 km distance from their work place. Most of the engineers have their workplace up to 15 km distance from their homes.

Question 3:

The relative humidity (in %) of a certain city for a month of 30 days was as follows:

98.1 98.6 99.2 90.3 86.5 95.3 92.9 96.3 94.2 95.1

89.2 92.3 97.1 93.5 92.7 95.1 97.2 93.3 95.2 97.3

96.2 92.1 84.9 90.2 95.7 98.3 97.3 96.1 92.1 89

(i) Construct a grouped frequency distribution table with classes

84 - 86, 86 - 88

(ii) Which month or season do you think this data is about?

(iii) What is the range of this data?

Answer:

(i) A grouped frequency distribution table of class size 2 has to be constructed. The class intervals will be 84 – 86, 86 – 88, and 88 – 90...

By observing the data given above, the required table can be constructed as follows.

Relative humidity (in %)	Number of days (frequency)
84 – 86	1
86 – 88	1
88 – 90	2
90 – 92	2
92 – 94	7
94 – 96	6
96 – 98	7
98 – 100	4
Total	30

(ii) It can be observed that the relative humidity is high. Therefore, the data is about a month of rainy season.

(iii) Range of data = Maximum value – Minimum value

$$= 99.2 - 84.9 = 14.3$$

4:

The heights of 50 students, measured to the nearest centimeters, have been found to be as follows:

161 150 154 165 168 161 154 162 150 151

162 164 171 165 158 154 156 172 160 170

153 159 161 170 162 165 166 168 165 164

154 152 153 156 158 162 160 161 173 166

161 159 162 167 168 159 158 153 154 159

(i) Represent the data given above by a grouped frequency distribution table, taking the class intervals as 160 - 165, 165 - 170, etc.

(ii) What can you conclude about their heights from the table?

Answer:

(i) A grouped frequency distribution table has to be constructed taking class intervals 160 - 165, 165 - 170, etc. By observing the data given above, the required table can be constructed as follows.

Height (in cm)	Number of students (frequency)
150 – 155	12
155 – 160	9
160– 165	14
165 – 170	10
170 – 175	5
Total	50

(ii) It can be concluded that more than 50% of the students are shorter than 165 cm.

Question 5:

A study was conducted to find out the concentration of sulphur dioxide in the air in parts per million (ppm) of a certain city. The data obtained for 30 days is as follows:

0.03 0.08 0.08 0.09 0.04 0.17

0.16 0.05 0.02 0.06 0.18 0.20

0.11 0.08 0.12 0.13 0.22 0.07

0.08 0.01 0.10 0.06 0.09 0.18

0.11 0.07 0.05 0.07 0.01 0.04

- (i) Make a grouped frequency distribution table for this data with class intervals as 0.00 - 0.04, 0.04 - 0.08, and so on.
- (ii) For how many days, was the concentration of sulphur dioxide more than 0.11 parts per million?

Answer:

Taking class intervals as 0.00, -0.04, 0.04, -0.08, and so on, a grouped frequency table can be constructed as follows.

Concentration of SO ₂ (in ppm)	Number of days (frequency)
0.00 – 0.04	4
0.04 – 0.08	9
0.08 – 0.12	9
0.12 – 0.16	2
0.16 – 0.20	4
0.20 – 0.24	2
Total	30

The number of days for which the concentration of SO₂ is more than 0.11 is the number of days for which the concentration is in between 0.12 – 0.16, 0.16 – 0.20,

0.20 – 0.24.

Required number of days = $2 + 4 + 2 = 8$

Therefore, for 8 days, the concentration of SO_2 is more than 0.11 ppm.

Question 6:

Three coins were tossed 30 times simultaneously. Each time the number of heads occurring was noted down as follows:

0 1 2 2 1 2 3 1 3 0

1 3 1 1 2 2 0 1 2 1

3 0 0 1 1 2 3 2 2 0

Prepare a frequency distribution table for the data given above.

Answer:

By observing the data given above, the required frequency distribution table can be constructed as follows.

Number of heads	Number of times (frequency)
0	6
1	10
2	9
3	5
Total	30

Question 7:

The value of π up to 50 decimal places is given below:

3.14159265358979323846264338327950288419716939937510

- (i) Make a frequency distribution of the digits from 0 to 9 after the decimal point.
- (ii) What are the most and the least frequently occurring digits?

Answer:

- (i) By observation of the digits after decimal point, the required table can be constructed as follows.

Digit	Frequency
0	2
1	5
2	5
3	8
4	4
5	5
6	4
7	4
8	5
9	8
Total	50

- (ii) It can be observed from the above table that the least frequency is 2 of digit 0, and the maximum frequency is 8 of digit 3 and 9. Therefore, the most frequently occurring digits are 3 and 9 and the least frequently occurring digit is 0.

Question 8:

Thirty children were asked about the number of hours they watched TV programmes in the previous week. The results were found as follows:

1 6 2 3 5 12 5 8 4 8

10 3 4 12 2 8 15 1 17 6

3 2 8 5 9 6 8 7 14 12

(i) Make a grouped frequency distribution table for this data, taking class width 5 and one of the class intervals as 5 - 10.

(ii) How many children watched television for 15 or more hours a week?

Answer:

(i) Our class intervals will be 0 - 5, 5 - 10, 10 - 15.....

The grouped frequency distribution table can be constructed as follows.

Hours	Number of children
0 - 5	10
5 - 10	13
10 - 15	5
15 - 20	2
Total	30

(ii) The number of children who watched TV for 15 or more hours a week is 2 (i.e., the number of children in class interval 15 - 20).

Question 9:

A company manufactures car batteries of a particular type. The lives (in years) of 40 such batteries were recorded as follows:

2.6 3.0 3.7 3.2 2.2 4.1 3.5 4.5

3.5 2.3 3.2 3.4 3.8 3.2 4.6 3.7

2.5 4.4 3.4 3.3 2.9 3.0 4.3 2.8

3.5 3.2 3.9 3.2 3.2 3.1 3.7 3.4

4.6 3.8 3.2 2.6 3.5 4.2 2.9 3.6

Construct a grouped frequency distribution table for this data, using class intervals of size 0.5 starting from the intervals 2 – 2.5.

Answer:

A grouped frequency table of class size 0.5 has to be constructed, starting from class interval 2 – 2.5.

Therefore, the class intervals will be 2 – 2.5, 2.5 – 3, 3 – 3.5...

By observing the data given above, the required grouped frequency distribution table can be constructed as follows.

Lives of batteries (in hours)	Number of batteries
2 – 2.5	2
2.5 – 3.0	6
3.0 – 3.5	14
3.5 – 4.0	11
4.0 – 4.5	4
4.5 – 5.0	3
Total	40

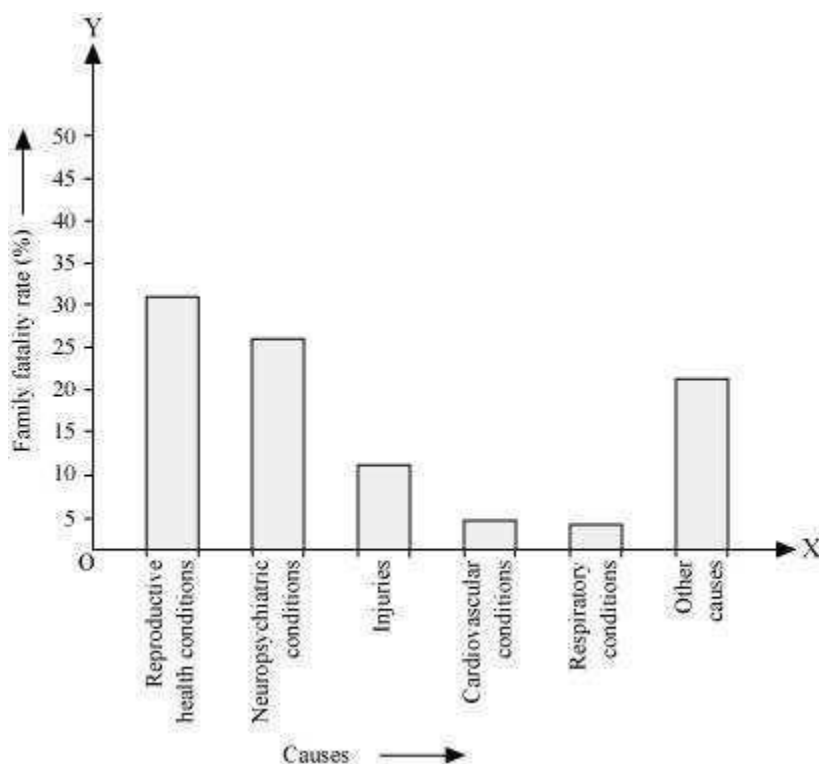
A survey conducted by an organisation for the cause of illness and death among the women between the ages 15 – 44 (in years) worldwide, found the following figures (in %):

S.No.	Causes	Female fatality rate (%)
1.	Reproductive health conditions	31.8
2.	Neuropsychiatric conditions	25.4
3.	Injuries	12.4
4.	Cardiovascular conditions	4.3
5.	Respiratory conditions	4.1
6.	Other causes	22.0

- (i) Represent the information given above graphically.
- (ii) Which condition is the major cause of women's ill health and death worldwide? (iii) Try to find out, with the help of your teacher, any two factors which play a major role in the cause in (ii) above being the major cause.

Answer:

(i) By representing causes on x-axis and female fatality rate on y-axis and choosing an appropriate scale (1 unit = 5% for y axis), the graph of the information given above can be constructed as follows.



All the rectangle bars are of the same width and have equal spacing between them.
(ii) Reproductive health condition is the major cause of women's ill health and death worldwide as 31.8% of women are affected by it.

(iii) The factors are as follows.

1. Lack of medical facilities
2. Lack of correct knowledge of treatment

Question 2:

The following data on the number of girls (to the nearest ten) per thousand boys in different sections of Indian society is given below.

Section	Number of girls per thousand boys
Scheduled Caste (SC)	940
Scheduled Tribe (ST)	970

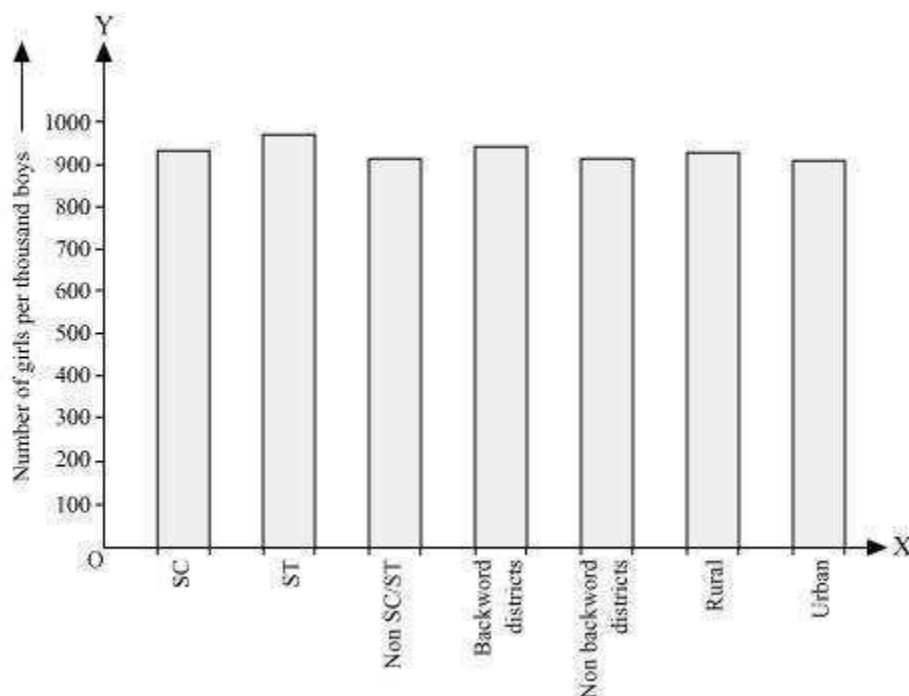
Non SC/ST	920
Backward districts	950
Non-backward districts	920
Rural	930
Urban	910

(i) Represent the information above by a bar graph.

(ii) In the classroom discuss what conclusions can be arrived at from the graph.

Answer:

(i) By representing section (variable) on x-axis and number of girls per thousand boys on y-axis, the graph of the information given above can be constructed by choosing an appropriate scale (1 unit = 100 girls for y-axis)



Here, all the rectangle bars are of the same length and have equal spacing in between them.

(ii) It can be observed that maximum number of girls per thousand boys (i.e., 970) is for ST and minimum number of girls per thousand boys (i.e., 910) is for urban. Also,

the number of girls per thousand boys is greater in rural areas than that in urban areas, backward districts than that in non-backward districts, SC and ST than that in nonSC/ST.

Question 3:

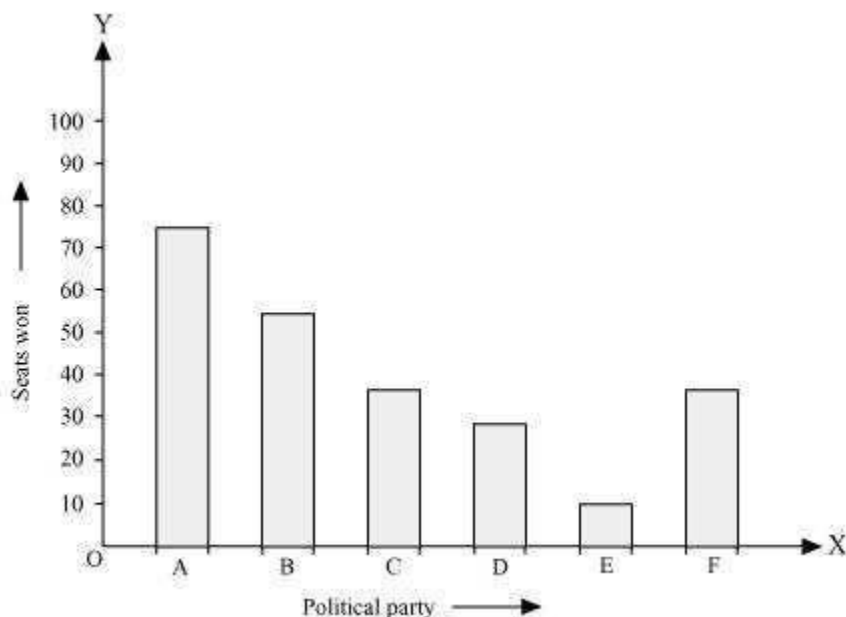
Given below are the seats won by different political parties in the polling outcome of a state assembly elections:

Political Party	A	B	C	D	E	F
Seats Won	75	55	37	29	10	37

- (i) Draw a bar graph to represent the polling results.
(ii) Which political party won the maximum number of seats?

Answer:

- (i) By taking polling results on x-axis and seats won as y-axis and choosing an appropriate scale (1 unit = 10 seats for y-axis), the required graph of the above information can be constructed as follows.



Here, the rectangle bars are of the same length and have equal spacing in between them.

(ii) Political party 'A' won maximum number of seats.

Question 4:

The length of 40 leaves of a plant are measured correct to one millimetre, and the obtained data is represented in the following table:

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

- (i) Draw a histogram to represent the given data.
(ii) Is there any other suitable graphical representation for the same data?
(iii) Is it correct to conclude that the maximum number of leaves are 153 mm long?
Why?

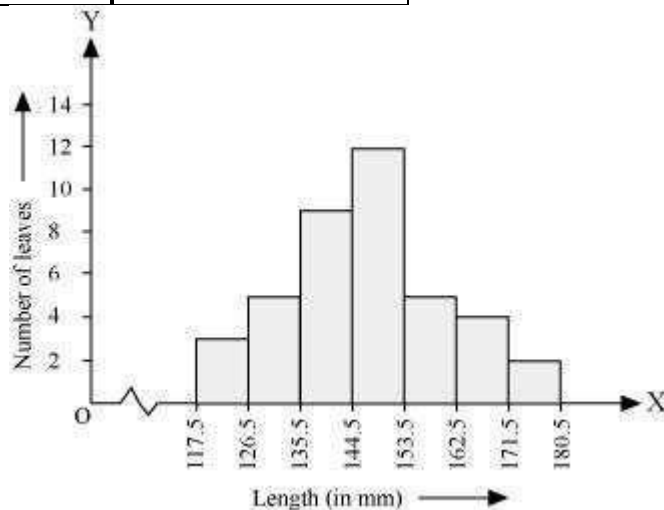
Answer:

- (i) It can be observed that the length of leaves is represented in a discontinuous

class interval having a difference of 1 in between them. Therefore, $\frac{1}{2} = 0.5$ has to be added to each upper class limit and also have to subtract 0.5 from the lower class limits so as to make the class intervals continuous.

Length (in mm)	Number of leaves
117.5 – 126.5	3
126.5 – 135.5	5

135.5 – 144.5	9
144.5 – 153.5	12
153.5 – 162.5	5
162.5 – 171.5	4
171.5 – 180.5	2



Taking the length of leaves on x-axis and the number of leaves on y-axis, the histogram of this information can be drawn as above.

Here, 1 unit on y-axis represents 2 leaves.

- (ii) Other suitable graphical representation of this data is frequency polygon. (iii) No, as maximum number of leaves (i.e., 12) has their length in between 144.5 mm and 153.5 mm. It is not necessary that all have their lengths as 153 mm.

Question 5:

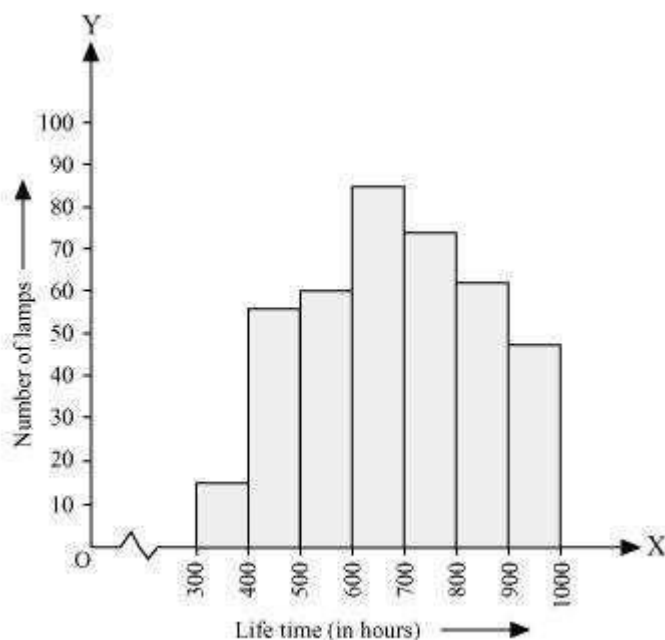
The following table gives the life times of neon lamps:

Length (in hours)	Number of lamps
300 – 400	14
400 – 500	56
500 – 600	60
600 – 700	86
700 – 800	74
800 – 900	62
900 – 1000	48

(i) Represent the given information with the help of a histogram.

(ii) How many lamps have a lifetime of more than 700 hours? Answer:

(i) By taking life time (in hours) of neon lamps on x-axis and the number of lamps on y-axis, the histogram of the given information can be drawn as follows.



Here, 1 unit on y-axis represents 10 lamps.

- (ii) It can be concluded that the number of neon lamps having their lifetime more than 700 is the sum of the number of neon lamps having their lifetime as 700 – 800, 800 – 900, and 900 – 1000.

Therefore, the number of neon lamps having their lifetime more than 700 hours is

184. ($74 + 62 + 48 = 184$) Question

6:

The following table gives the distribution of students of two sections according to the mark obtained by them:

Section A		Section B	
Marks	Frequency	Marks	Frequency
0 – 10	3	0 – 10	5
10 – 20	9	10 – 20	19
20 – 30	17	20 – 30	15
30 – 40	12	30 – 40	10
40 – 50	9	40 – 50	1

Represent the marks of the students of both the sections on the same graph by two frequency polygons. From the two polygons compare the performance of the two sections.

Answer:

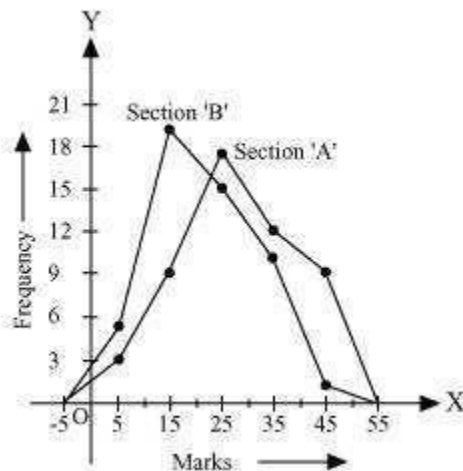
We can find the class marks of the given class intervals by using the following formula.

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

Section A			Section B		
Marks	Class marks	Frequency	Marks	Class marks	Frequency
0 – 10	5	3	0 – 10	5	5
10 – 20	15	9	10 – 20	15	19
20 – 30	25	17	20 – 30	25	15
30 – 40	35	12	30 – 40	35	10

40 – 50	45	9	40 – 50	45	1
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Taking class marks on x-axis and frequency on y-axis and choosing an appropriate scale (1 unit = 3 for y-axis), the frequency polygon can be drawn as follows.



It can be observed that the performance of students of section 'A' is better than the students of section 'B' in terms of good marks.

Question 7:

The runs scored by two teams A and B on the first 60 balls in a cricket match are given below:

Number of balls	Team A	Team B
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1 – 6	2	5
7 – 12	1	6
13 – 18	8	2
19 – 24	9	10
25 – 30	4	5
31 – 36	5	6
37 – 42	6	3
43 – 48	10	4
49 – 54	6	8
55 – 60	2	10

Represent the data of both the teams on the same graph by frequency polygons.

[Hint: First make the class intervals continuous.] Answer:

It can be observed that the class intervals of the given data are not continuous.

There is a gap of 1 in between them. Therefore, $\frac{1}{2} = 0.5$ has to be added to the upper class limits and 0.5 has to be subtracted from the lower class limits.

Also, class mark of each interval can be found by using the following formula.

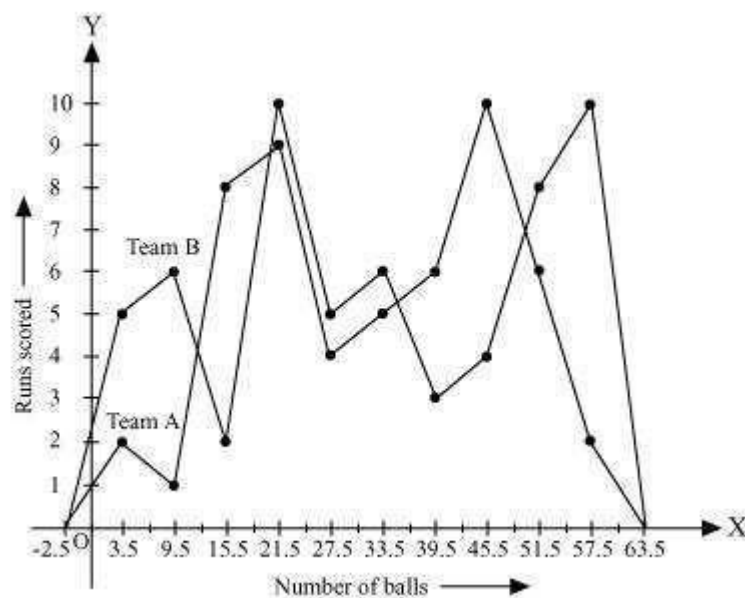
$$\text{Class mark} = \frac{\text{Upper class limit} + \text{Lower class limit}}{2}$$

Continuous data with class mark of each class interval can be represented as follows.

Number of balls	Class mark	Team A	Team B
0.5 – 6.5	3.5	2	5
6.5 – 12.5	9.5	1	6

12.5 – 18.5	15.5	8	2
18.5 – 24.5	21.5	9	10
24.5 – 30.5	27.5	4	5
30.5 – 36.5	33.5	5	6
36.5 – 42.5	39.5	6	3
42.5 – 48.5	45.5	10	4
48.5 – 54.5	51.5	6	8
54.5 – 60.5	57.5	2	10

By taking class marks on x-axis and runs scored on y-axis, a frequency polygon can be constructed as follows.



Question 8:

A random survey of the number of children of various age groups playing in park was found as follows:

Age (in years)	Number of children
1 – 2	5
2 – 3	3
3 – 5	6
5 – 7	12
7 – 10	9
10 – 15	10
15 – 17	4

Draw a histogram to represent the data above.

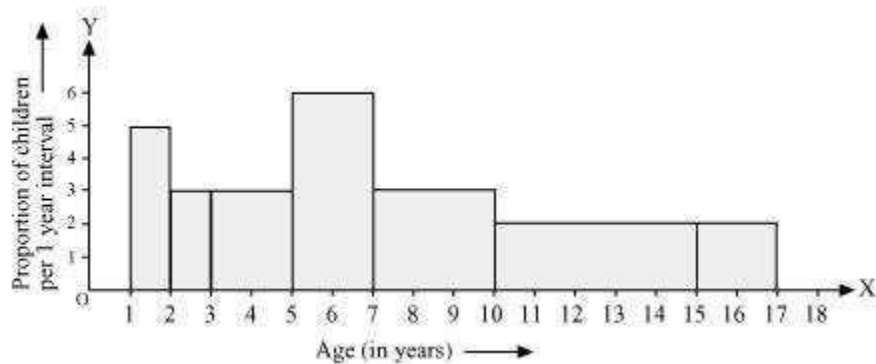
Answer:

Here, it can be observed that the data has class intervals of varying width. The proportion of children per 1 year interval can be calculated as follows.

Age (in years)	Frequency (Number of children)	Width of class	Length of rectangle
1 – 2	5	1	$\frac{5 \times 1}{1} = 5$
2 – 3	3	1	$\frac{3 \times 1}{1} = 3$

3 – 5	6	2	$\frac{6 \times 1}{2} = 3$
5 – 7	12	2	$\frac{12 \times 1}{2} = 6$
7 – 10	9	3	$\frac{9 \times 1}{3} = 3$
10 – 15	10	5	$\frac{10 \times 1}{5} = 2$
15 – 17	4	2	$\frac{4 \times 1}{2} = 2$

Taking the age of children on x-axis and proportion of children per 1 year interval on y-axis, the histogram can be drawn as follows.



Question 9:

100 surnames were randomly picked up from a local telephone directory and a frequency distribution of the number of letters in the English alphabet in the surnames was found as follows:

Number of letters	Number of surnames
1 – 4	6
4 – 6	30
6 – 8	44
8 – 12	16
12 – 20	4

(i) Draw a histogram to depict the given information.

(ii) Write the class interval in which the maximum number of surname lie.

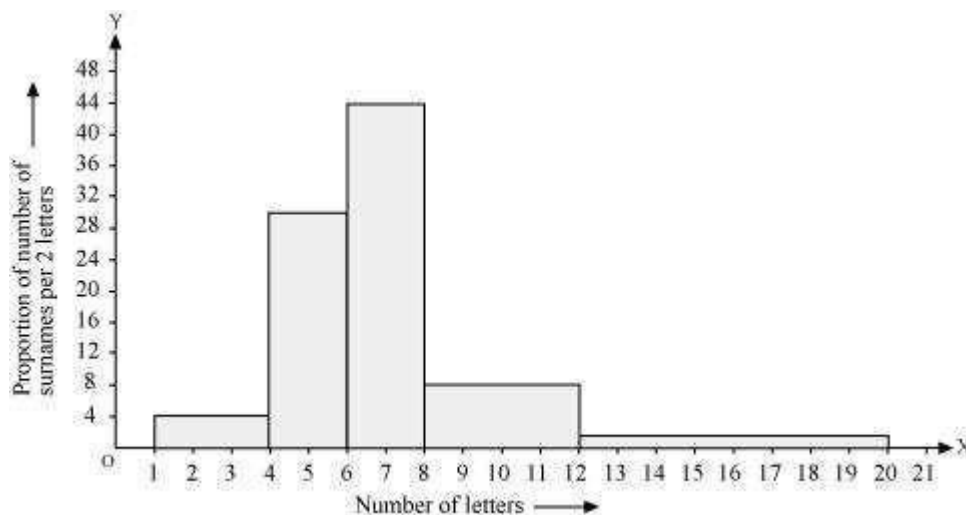
Answer:

(i) Here, it can be observed that the data has class intervals of varying width. The proportion of the number of surnames per 2 letters interval can be calculated as follows.

Number of letters	Frequency (Number of surnames)	Width class	Length of rectangle
1 – 4	6	3	$\frac{6 \times 2}{3} = 4$
4 – 6	30	2	$\frac{30 \times 2}{2} = 30$
6 – 8	44	2	$\frac{44 \times 2}{2} = 44$

8 – 12	16	4	$\frac{16 \times 2}{4} = 8$
12 – 20	4	8	$\frac{4 \times 2}{8} = 1$

By taking the number of letters on x-axis and the proportion of the number of surnames per 2 letters interval on y-axis and choosing an appropriate scale (1 unit = 4 students for y axis), the histogram can be constructed as follows.



(ii) The class interval in which the maximum number of surnames lies is 6 – 8 as it has 44 surnames in it i.e., the maximum for this data.

Exercise 14.4 Question 1:

The following number of goals was scored by a team in a series of 10 matches: 2, 3, 4, 5, 0, 1, 3, 3, 4, 3

Find the mean, median and mode of these scores.

Answer:

The number of goals scored by the team is

2, 3, 4, 5, 0, 1, 3, 3, 4, 3

$$\begin{aligned}\text{Mean of data} &= \frac{\text{Sum of all observations}}{\text{Total number of observations}} \\ \text{Mean score} &= \frac{2+3+4+5+0+1+3+3+4+3}{10} \\ &= \frac{28}{10} = 2.8 \\ &= 2.8 \text{ goals}\end{aligned}$$

Arranging the number of goals in ascending order,

0, 1, 2, 3, 3, 3, 3, 4, 4, 5

The number of observations is 10, which is an even number. Therefore, median

score will be the mean of $\frac{10}{2}$ i.e., 5th and $\frac{10}{2}+1$ ascending or descending order.

$$\begin{aligned}\text{Median score} &= \frac{5^{\text{th}} \text{ observation} + 6^{\text{th}} \text{ observation}}{2} \\ &= \frac{3+3}{2} \\ &= \frac{6}{2} \\ &= 3\end{aligned}$$

i.e., 6th observation while arranged in

Mode of data is the observation with the maximum frequency in data.

Therefore, the mode score of data is 3 as it has the maximum frequency as 4 in the data.

Question 2:

In a mathematics test given to 15 students, the following marks (out of 100) are recorded:

41, 39, 48, 52, 46, 62, 54, 40, 96, 52, 98, 40, 42, 52, 60 Find the mean, median and mode of this data.

Answer:

The marks of 15 students in mathematics test are

41, 39, 48, 52, 46, 62, 54, 40, 96, 52, 98, 40, 42, 52, 60

$$\begin{aligned}\text{Mean of data} &= \frac{\text{Sum of all observation}}{\text{Total number of observation}} \\ &= \frac{41+39+48+52+46+62+54+40+96+52+98+40+42+52+60}{15} \\ &= \frac{822}{15} = 54.8\end{aligned}$$

Arranging the scores obtained by 15 students in an ascending order,

39, 40, 40, 41, 42, 46, 48, 52, 52, 52, 54, 60, 62, 96, 98

As the number of observations is 15 which is odd, therefore, the median of data will

be $\frac{15+1}{2} = 8^{\text{th}}$ observation whether the data is arranged in an ascending or descending order.

Therefore, median score of data = 52

Mode of data is the observation with the maximum frequency in data. Therefore, mode of this data is 52 having the highest frequency in data as 3.

Question 3:

The following observations have been arranged in ascending order. If the median of the data is 63, find the value of x.

29, 32, 48, 50, x, x + 2, 72, 78, 84, 95

Answer:

It can be observed that the total number of observations in the given data is 10 (even

number). Therefore, the median of this data will be the mean of $\frac{10}{2}$ i.e., 5th

and $\frac{10}{2} + 1$ i.e., 6th observation.

Therefore, median of data = $\frac{5^{\text{th}} \text{ observation} + 6^{\text{th}} \text{ observation}}{2}$

$$\Rightarrow 63 = \frac{x + x + 2}{2}$$

$$\Rightarrow 63 = \frac{2x + 2}{2}$$

$$\Rightarrow 63 = x + 1$$

$$\Rightarrow x = 62$$

Question 4:

Find the mode of 14, 25, 14, 28, 18, 17, 18, 14, 23, 22, 14, 18.

Answer:

Arranging the data in an ascending order,

14, 14, 14, 14, 17, 18, 18, 18, 22, 23, 25, 28

It can be observed that 14 has the highest frequency, i.e. 4, in the given data.

Therefore, mode of the given data is 14.

Question 5:

Find the mean salary of 60 workers of a factory from the following table:

Salary (in Rs)	Number of workers
3000	16

4000	12
5000	10
6000	8
7000	6
8000	4
9000	3
1000	1
Total	60

Answer: can be calculated as follows.

We know that

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

The value of $\sum f_i x_i$ and $\sum f_i$

Salary (in Rs) (x_i)	Number of workers (f_i)	$f_i x_i$
3000	16	$3000 \times 16 = 48000$
4000	12	$4000 \times 12 = 48000$
5000	10	$5000 \times 10 = 50000$
6000	8	$6000 \times 8 = 48000$
7000	6	$7000 \times 6 = 42000$
8000	4	$8000 \times 4 = 32000$
9000	3	$9000 \times 3 = 27000$
10000	1	$10000 \times 1 = 10000$
Total	$\sum f_i = 60$	$\sum f_i x_i = 305000$

$$\begin{aligned} \text{Mean salary} &= \frac{305000}{60} \\ &= 5083.33 \end{aligned}$$

Therefore, mean salary of 60 workers is Rs 5083.33.

Question 6:

Give one example of a situation in which

- (i) The mean is an appropriate measure of central tendency.
- (ii) The mean is not an appropriate measure of central tendency but the median is an appropriate measure of central tendency.

Answer:

When any data has a few observations such that these are very far from the other observations in it, it is better to calculate the median than the mean of the data as median gives a better estimate of average in this case.

- (i) Consider the following example – the following data represents the heights of the members of a family.

154.9 cm, 162.8 cm, 170.6 cm, 158.8 cm, 163.3 cm, 166.8 cm, 160.2 cm In this case, it can be observed that the observations in the given data are close to each other. Therefore, mean will be calculated as an appropriate measure of central tendency.

- (ii) The following data represents the marks obtained by 12 students in a test.

48, 59, 46, 52, 54, 46, 97, 42, 49, 58, 60, 99

In this case, it can be observed that there are some observations which are very far from other observations. Therefore, here, median will be calculated as an appropriate measure of central tendency.