CBSE NCERT Solutions for Class 9 mathematics Chapter 14

Exercise

Q.1. Give five examples of data that you can collect from day-to-day life.

Solution: The facts or figures, which are numerical or otherwise, collected with a definite purpose are called data.

When the information was collected by the investigator herself or himself with a definite objective in her or his mind, the data obtained is called primary data.

When the information was gathered from a source which already had the information stored, the data obtained is called secondary data. In our day-to-day life, we may collect data in various ways, a few of them have been mentioned here. 1. Number of females per 1000 males in various states of our country. 2. Height and weights of students in our class. 3. Temperature of past 10 days in our city. 4. Number of plants in our locality. 5. Rainfalls in our city.

Q.2. Classify the examples of data that you can collect from day-to-day life as primary or secondary data.

Solution: The facts or figures, which are numerical or otherwise, collected with a definite purpose are called data.

When the information was collected by the investigator herself or himself with a definite objective in her or his mind, the data obtained is called primary data.

For example, 1. Height and Weights of students of our class. 2. Number of plants in our locality. 3. Marks obtained by students of the class in a test. 4. Date of birth of students. 5. Subjects taught in various schools in class X

When the information was gathered from a source which already had the information stored, the data obtained is called secondary data.

For example,

1. Number of females per 1000 males in various states of our country. 2. Temperature of past 10 days in our city. 3. Rainfalls in our city.

Q.3. The blood groups of 30 students of Class VIII are recorded 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?

Solution: Given that, the blood groups of 30 students of Class VIII are recorded 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.

Here, 9 students have blood groups A, 6 having B, 3 having AB and 12 having O.
So, the table representing the data as follows:

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

As 12 students have the blood group O and 3 have their blood group as AB, so the most common blood group among these students is O and the rarest blood group among these students is AB.

Q.4. 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?

Solution: We have been given in this question, construct a grouped frequency distribution table of class size 5.

Hence, the class intervals will be as 0-5,5-10,10-15,15-20….

Required grouped frequency distribution table as follows:

Distance (in km)	Tally marks	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

Now, there are only 4 engineers whose homes are at more than or equal to 20 km distance from their workplace.
Most of the engineers are having their work place up to 20 km distance from their homes.

Q.5. The relative humidity (in %) of a certain city for a month of 30 days were 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 Construct a grouped frequency distribution table with classes 84-86, 86-88, etc.

Solution: We construct a grouped frequency distribution table of class size 2 as given below:
Class intervals will be as follows 84-86, 86-88, 88-90…, etc.

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

Q.6. 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 Which season do you think this data is about? (Rainy/Winter/Autumn)
Rainy

Solution: We construct a grouped frequency distribution table of class size 2 as given below.
The class intervals will be as follows :84-86,86-88,88-90…

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

Since relative humidity is high so the data must be of a month of rainy season.

Q.7. 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, 84.9, 90.2, 95.7, 98.3, 97.3, 96.1, 92.1, 89

What is the range of this data? [Write answer without unit]
14.3

Solution: Given values are,

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, 84.9, 90.2, 95.7, 98.3, 97.3, 96.1, 92.1, 89.

The maximum relative humidity (in %) of a certain city for a month 30 days is 99.2. The minimum relative humidity (in %) of a certain city for a month 30 days is 84.9. Range of data = Maximum value - Minimum value =99.2-84.9=14.3 Thus, the range of given data is 14.3.

Q.8. The heights of 50 students, measured to the nearest centimeters, have been found 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

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

Solution: Given that, the class intervals should be as 160-165, 165-170, etc.

By observing the data given above we can construct the required table given as follows:

Heights (in cms)	Number of students (frequency)
150-155	12
155-160	9
160-165	14
165-170	10
175-180	5
Total	50

Q.9. The heights of 50 students, measured to the nearest centimetres, have been found 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

Represent the data given above by a grouped frequency distribution table, taking the class intervals as 160-165,165-170, etc. What can you conclude about their heights from the table?

Solution: Given that, the class intervals should be as 160-165, 165-170, etc.

By observing the data given above we can construct the required table given as follows:

Heights (in cms)	Number of students(frequency)
150-155	12
155-160	9
160-165	14
165-170	10
175-180	5
Total	50

Therefore, from table we see that more than 50% of students are shorter than 165 cm.

Q.10. 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 Make a grouped frequency distribution table for this data with class intervals as 0.00-0.04,0.04-0.08, and so on.

Solution: To construct grouped frequency table, the class intervals to be taken as 0.00-0.04,0.04-0.08,….

Concentration of SO2(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

Q.11. 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 How many days, was the concentration of Sulphur dioxide more than 0.11 parts per million?
8

Solution: To construct grouped frequency table class intervals to be taken as 0.00-0.04,0.04-0.08,….

The required frequency distribution table is as follows:

Concentration of SO2(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

Number of days for which concentration 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. So, the required number of days =2+4+2=8.

Q.12. 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.

Solution: Given that, three coins were tossed 30 times simultaneously and each time the number of heads occurring was noted down.

From the given data, the frequency distribution table can be constructed as shown below:

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

Q.13. The value of π up to 50 decimal places is given below:

3.14159265358979323846264338327950288419716939937510

Make a frequency distribution of the digits from 0 to 9 after the decimal point.

Solution: Given that, the value of π up to 50 decimal places:

3.14159265358979323846264338327950288419716939937510

By observing the digits after the decimal point the following table is constructed:

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

Q.14. The value of π up to 50 decimal places is given below:
3.14159265358979323846264338327950288419716939937510 What are the most and the least frequently occurring digits?

Solution: Given that, the value of π up to 50 decimal places:
3.14159265358979323846264338327950288419716939937510

By observing the digits after the decimal point the following table is constructed:

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

In the above table, 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 occurring digit is 0.

Q.15. 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

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

Solution: The possible class intervals are 0-5, 5-10, 10-15…

The grouped frequency distribution table is as follows:

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

Q.16. Thirty children were asked about the number of hours they watched TV program 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.

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

2

Solution: The possible class intervals are 0-5,5-10,10-15…
The grouped frequency distribution table is as follows:

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

The total number of children, who watched TV for 15 or more hours a week is 2.

Q.17. 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.

Solution: To construct a grouped frequency table of class size 0.5 and starting from class interval 2-2.5. So, our class intervals will be as 2-2.5,2.5-3,3-3.5.....

Required grouped frequency distribution table is as follows:

Lives of Batteries (in hours)	Number of Batteries
2.0-2.5	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

Q.18. A survey conducted by an organization for the cause of illness and death among the women between the ages 15-44 (in years) worldwide, found the following figures (in %):

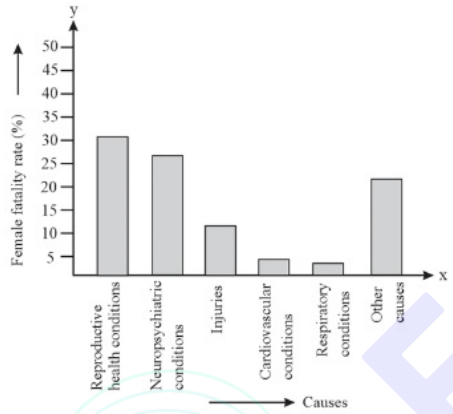
S.No.	Causes	Female fatality rate (%)
1.	Reproductive health conditions	31.8
2.	Neuropsychiatric conditions	25.4
3.	Injuries	12.4
4.	Cardiovascular conditions	4.3
5.	Respiratory conditions	4.1
6.	Other causes	22.0

Represent the information given above graphically.

Solution: We know that, a bar graph is a graph that presents categorised data with rectangular bars with heights or lengths proportional to the values that they represent.

The bars can be plotted vertically or horizontally.

By representing Causes on x-axis and female fatality rate on y-axis and choosing an appropriate scale (1 unit =5% for y-axis), we can draw the bar graph as follows:



All the rectangle bars are of same width and having equal spacing between them.

Q.19. 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 table (in %):

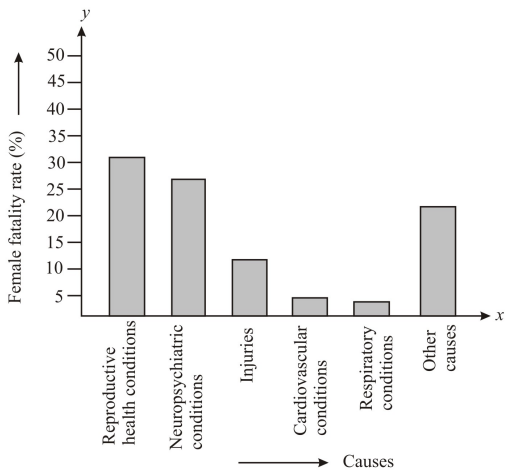
S.No.	Causes/ Health conditions	Female fatality rate (%)
1.	Reproductive	31.8
2.	Neuropsychiatric	25.4
3.	Injuries	12.4
4.	Cardiovascular	4.3
5.	Respiratory	4.1
6.	Other causes	22.0

Which condition is the major cause of women's ill health and death worldwide?

Reproductive

Solution: By representing causes on x-axis and female fatality rate on y-axis and choosing an appropriate scale. (1 unit =5% for y- axis),

We can draw the graph for the given information as shown below:



Here, all the rectangle bars are of same width and having equal spacing between them. So, the bar with the largest height will be the major cause of fatality. Hence, Reproductive health condition is the major cause of women's ill health and death worldwide as 31.8% of women are affected by it.

Q.20. The following data on the number of girls (to the nearest ten) per thousand boys in different sections of Indian society is given below:

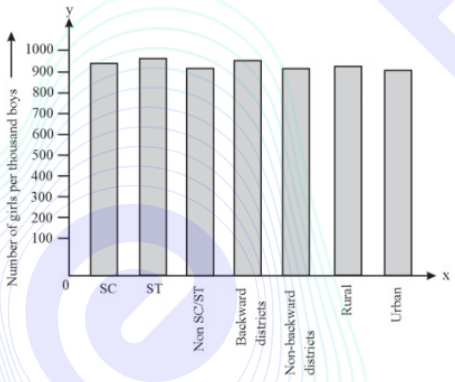
Section	Number of girls per thousand boys
Scheduled Caste (SC)	940
Scheduled Tribe (ST)	970
Non-SC/ST	920
Backward districts	950
Non-backward districts	920
Rural	930
Urban	910

Represent the information above by a bar graph.

Solution: A bar graph that presents categorical data with rectangular bars with heights or lengths proportional to the values that they represent.

The bars can be plotted vertically or horizontally.

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



Q.21. The following data on the number of girls (to the nearest ten) per thousand boys in different sections of Indian society is given below:

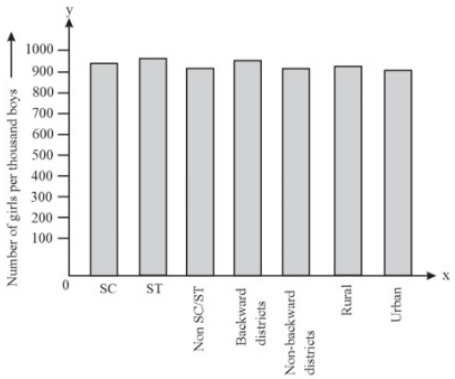
Section	Number of girls per thousand boys
Scheduled Caste (SC)	940
Scheduled Tribe (ST)	970
Non-SC/ST	920
Backward districts	950
Non-backward districts	920
Rural	930
Urban	910

Represent the information above by a bar graph. In the classroom discuss what conclusion can be arrived at from the graph.

Solution: A bar graph that presents categorical data with rectangular bars with heights or lengths proportional to the values that they represent.

The bars can be plotted vertically or horizontally.

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



Here, all the rectangle bars are of same length and have equal spacing in between them. It can be observed that, the maximum number of girls per thousand boys is 970, which belongs to the section ST. The minimum number of girls per thousand boys is 910, which belongs to the section Urban. Now, the range of the data =970-910=60.

Q.22. Given below are the seats won by different political parties in the polling outcome of a state assembly election:

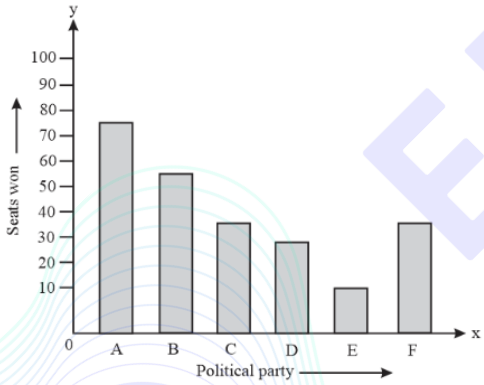
Political Party	A	B	C	D	E	F
Seats Won	75	55	37	29	10	37

Draw a bar graph to represent the polling results.

Solution: A bar graph is a graph that presents categorical data with rectangular bars with heights or lengths proportional to the values that they represent.

The bars can be plotted vertically or horizontally.

We take polling results on x-axis and the number of seats won on y-axis and choose an appropriate scale (1 unit =10 seats for y-axis) so that we are able to draw the required graph of representing the given information as below:



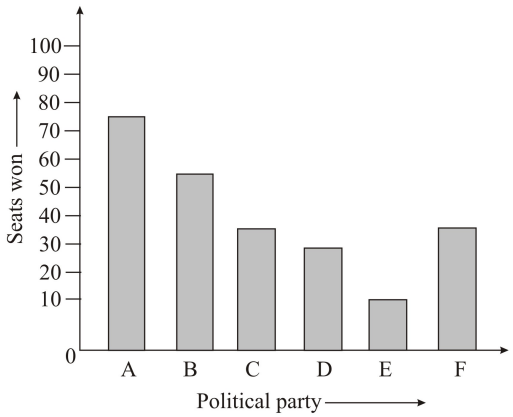
Q.23. Given below are the seats won by different political parties in the polling outcome of a state assembly elections:

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

Which political party won the maximum number of seats? [Write alphabet only]

A

Solution: We take polling results on x-axis and seats won as y-axis and choose an appropriate scale, (1 unit=10 seats for y-axis), so that we are able to draw the required graph for representing information as below:



The rectangle bars are of same width and have equal space in between them.
We find that political party 'A' won maximum number of seats.

Q.24. The length of 40 leaves of a plant are measured correct to one millimeter 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

Draw a histogram to represent the given data.

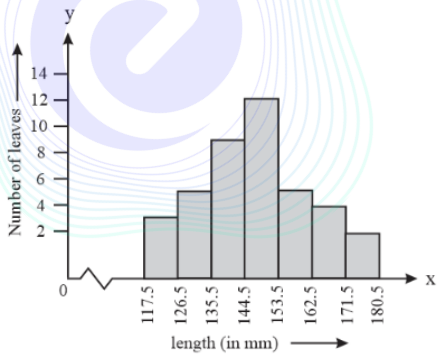
Solution: Histogram: a graphical display of data using bars of different heights.

Length of leaves is represented in a discontinuous class interval having a difference of 1 in between them.

So, we must add 0.5 to each upper-class limit and also have to subtract 0.5 from the lower-class limits to make our 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

Now, taking the length of leaves on x-axis and the number of leaves on y-axis where 1 unit on y-axis represents 2 leaves, we can draw the histogram of the given information as below:



Q.25. The length of 40 leaves of a plant are measured correct to one millimeter 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

Is there any other suitable graphical representation for the same data?

Solution: Length of leaves is represented in a discontinuous class interval having a difference of 1 in between them.

So, we must add 0.5 to each upper-class limit and also have to subtract 0.5 from the lower-class limits to make our 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

Frequency polygons can also be drawn independently without drawing histograms. Other suitable graphical representation of this data could be frequency polygon as the maximum number of leaves (i.e. 12) have their length in between144.5 mm and 153.5 mm.

Q.26. The length of 40 leaves of a plant are measured correct to one millimeter 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

Is it correct to conclude that the maximum number of leaves are 153 mm long? Why?

Solution: Length of leaves is represented in a discontinuous class interval having a difference of 1 in between them.

So, we must add 0.5 to each upper-class limit and also have to subtract 0.5 from the lower-class limits to make our 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

The highest number of leaves 12 corresponds to the length 144.5-153.5 mm. It is not correct to conclude that the maximum number of leaves are 153 mm long because it is not necessary that all have their lengths as 153 mm.

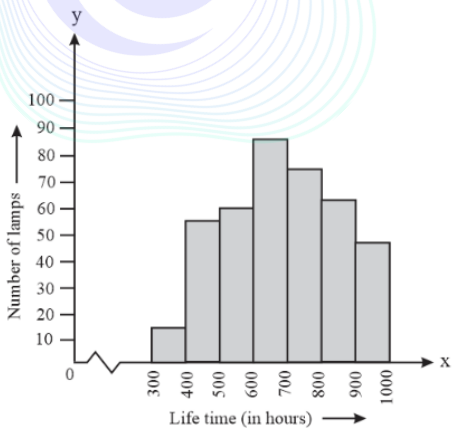
Q.27. The following table gives the lifetimes of neon lamps:

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

Represent the given information with the help of a histogram.

Solution: The histogram is a graphical representation of a grouped frequency distribution with continuous classes.

By taking the lifetime (in hours) of neon lamps on x-axis and the number of lamps on y-axis where 1 unit on y-axis represents 10 lamps, we can draw the histogram of the given information as below:



Q.28. The following table gives the lifetimes 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

How many lamps have a lifetime of more than 700 hours?

184

Solution: From the given table:

Number of neon lamps having their lifetime more than 700 hours are sum of number of neon lamps having their lifetime as 700-800, 800-900 and 900-1000

Therefore, total number of neon lamps having their lifetime more than 700 hours=74+62+48=184.

Q.29. The following table gives the distribution of students of two sections according to the marks 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.

Solution: Frequency polygons can also be drawn independently without drawing histograms. For this, we require the mid-points of the class-intervals used in the data.

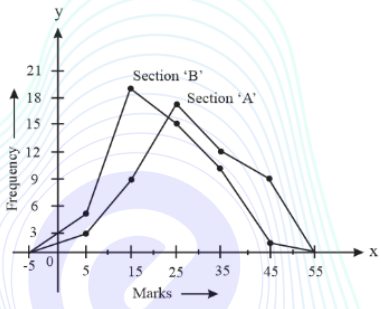
These mid-points of the class-intervals are called class-marks.

Class-marks of given classes can be calculated by using formula: Class-mark=upper-class limit + lower-class limit2

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

Frequency polygons are used when the data is continuous and very large. It is very useful for comparing two different sets of data of the same nature. For example, comparing the performance of two different sections of the same class.

We take class marks on x-axis and the frequency on y-axis and choose an appropriate scale (1 unit=3 for y-axis) to draw frequency polygon as below:



From the graph drawn above, we can clearly see the performance of students of section 'A' is better than the students of section 'B' as for good marks.

Q.30. 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
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.

Solution: Frequency polygons can also be drawn independently without drawing histograms.

For this, we require the mid-points of the class-intervals used in the data. These mid-points of the class-intervals are called class-marks.

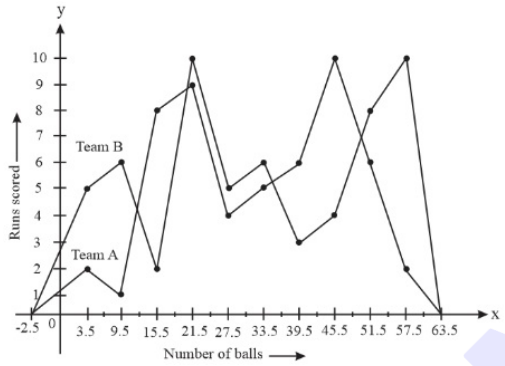
We can observe from the given data that its class intervals are not continuous. There is a gap of 1 in between of them. So, we must add an adjustment factor =12=0.5 to upper-class limits and subtract 0.5 from lower-class limits. We can find the class mark of each interval by using the formula: Class mark=upper-class limit+lower-class limit2 Now continuous data with the 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

Frequency polygons are used when the data is continuous and very large.

It is very useful for comparing two different sets of data of the same nature, for example, comparing the performance of two different sections of the same class.

Now by taking the class marks on x-axis and runs scored on y-axis (where 1 unit=1 run on y-axis), we can construct frequency polygon as following:



Q.31. 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.

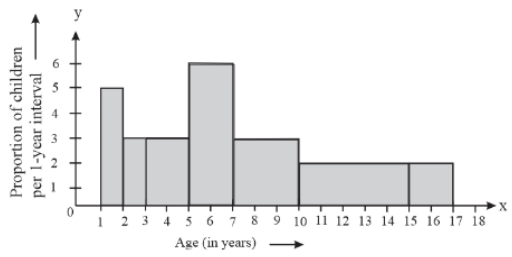
Solution: The histogram is a graphical representation of a grouped frequency distribution with continuous classes.

Here, the given data is having class intervals of varying width.

The minimum class size is 1. So, we need to find the proportion of children per 1 year interval as follows:

Age (in years)	Frequency (Number of children)	Width of class	Length of rectangle
1-2	5	1	5×11=5
2-3	3	1	3×11=3
3-5	6	2	6×12=3
5-7	12	2	12×12=6
7-10	9	3	9×13=3
10-15	10	5	10×15=2
15-17	4	2	4×12=2

Now taking age of children on x-axis and proportion of children per 1 year interval on y-axis (where 1 unit=1 year on y-axis), we can draw histogram as below:



Q.32. 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

Draw a histogram to depict the given information.

Solution: Histogram: a graphical display of data using bars of different heights.

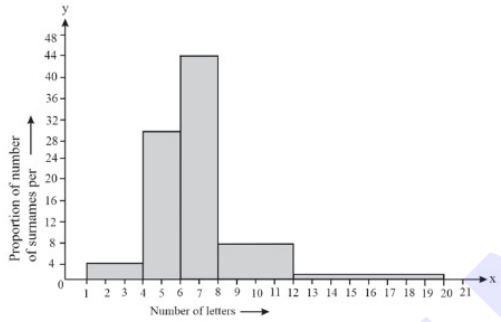
Given data is having class intervals of varying width.

The minimum class size is 2. We need to compute the adjusted frequency as follows:

Number of letters	Frequency (Number of surnames)	Width of class	Length of rectangle
1-4	6	3	6×23=4
4-6	30	2	30×22=30
6-8	44	2	44×22=44
8-12	16	4	16×24=8
12-20	4	8	4×28=1

Here, we take the number of letters on x-axis and the proportion of the number of surnames per 2 letters interval on y-axis with an appropriate scale (1 unit=4 surnames on y-axis).

Now, we will construct the histogram as below:



Q.33. 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

If the class interval in which the maximum number of surnames lie is a-b, then find a+b.

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Solution: Given data is having class intervals of varying width.

We need to compute the adjusted frequency.

Number of letters	**Frequency (Number of surnames)**	**Width of class**	**Adjusted frequency with minimum size of interval 2.**
1-4	6	3	6×23=4
4-6	30	2	30×22=30
6-8	44	2	44×22=44
8-12	16	4	16×24=8
12-20	4	8	4×28=1

The class interval in which the maximum number of surnames lie is 6-8 as there are 44 number of surnames in it.
i.e. maximum for this data. Comparing it with a-b : We get, a=6, b=8 Hence, a+b=14.

Q.34. 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.

Solution: The number of goals scored by team are 2, 3, 4, 5, 0, 1, 3, 3, 4, 3

Mean of data=Sum of all observationsTotal number of observations

Mean score=2+3+4+0+1+3+3+4+310 =2810=2.8
∴ Mean score =2.8 goals

Arranging the number of goals in ascending order 0, 1, 2, 3, 3, 3, 3, 4, 4, 5.

The number of observations is 10.

10 is an even number. So, median score =5thobservation+6thobservation2=3+32=62=3
∴ Median score =3 Mode of data is the observation with the maximum frequency in data.
So, the mode score of data is 3 as it is having maximum frequency as 4 in the data.

Q.35. 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.

Solution: The number of marks scored by the students are

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

Mean of data=Sum of all observationsTotal number of observations Mean Score=41+39+48+52+46+62+54+40+96+52+98+40+42+52+6015 =82215
∴ Mean score=54.8

Arranging the number of marks in ascending order as 39, 40, 40, 41, 42, 46, 48, 52, 52, 52, 54, 60, 62, 96, 98

As the number of observations is 15 and 15 is an odd number, so, the median score will be n+12th=8th term.

Therefore, the median is 52. Mode of data is the observation whose frequency is maximum. Therefore, the mode score of data is 52 as it's maximum frequency is 3 in the data. ∴ The mean, median and mode scores are 54.8, 52 and 52 respectively.

Q.36. 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

Solution: Given,
Median of 29, 32, 48, 50, x, x+2, 72, 78, 84, 95 is 63
As the number of observations is 10.10 is an even number. So, median score is given by,
Median score=5thobservation+6thobservation2
=x+x+22
=x+1
Given, x+1=63

∴ x=62 Therefore, value of x=62.

Q.37. Find the mode of 14, 25, 14, 28, 18, 17, 18, 14, 23, 22, 14, 18

Solution: The given observations are 14, 25, 14, 28, 18, 17, 18, 14, 23, 22, 14, 18.
Mode of a data is the observation with maximum frequency value. Here observation 14 is having the highest frequency i.e. 4 in given data. So, mode of given data is 14.

Q.38. 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

Solution: We know that,

Mean=∑fixi∑fi

To calculate the mean, we construct the following table:

Salary (in ₹) (xi)	Number of workers (fi)	fixi
3000	16	3000×16=48000
4000	12	4000×12=48000
5000	10	5000×10=50000
6000	8	6000×8=48000
7000	6	7000×6=42000
8000	4	8000×4=32000
9000	3	9000×3=27000
10000	1	10000×1=10000
Total	∑fi=60	∑fixi=305000

Mean salary =30500060=5083.33 (approx.) Hence, the mean salary of 60 workers of the factory is ₹5083.33 (approx.).

Q.39. Give one example of a situation in which the mean is an appropriate measure of central tendency.

Solution: When the observations of data are very close to each other, the mean is an appropriate measure of central tendency.

Consider the following example, the following data represents the heights of the members of a family:154.9 cm, 158.8 cm, 160.2 cm, 162.8 cm, 163.3 cm, 166.8 cm, 170.7 cm

In this case, it can be observed that the observations in the given data are close to each other. Now, mean =Sum of all observationsTotal number of observations =154.9+158.8+160.2+162.8+163.3+166.8+170.77=1137.57=162.5 Therefore, the mean is an appropriate central tendency for this given data.

Q.40. Give one example of a situation in which the mean is not an appropriate measure of central tendency, but the median is an appropriate measure of central tendency.

Solution: When the observations of data are very far from each other, it is better to calculate the median than the mean of the data, as median gives a better estimate of average in this case.

For example, the following data represents the marks obtained by 11 students in a test:

42, 46, 48, 49, 52, 54, 88, 89, 95, 97, 99 In this case, it can be observed that there are some observations which are very far from other observations. Now, mean =42+46+48+49+52+54+88+89+95+97+9911 =75911=69

The number of observations is 11 (odd number).

Median =n+12th term =11+12th=6th term =54.

Therefore, the median is the appropriate measure of central tendency for this data.