CBSE NCERT Solutions for Class 9 Mathematics Chapter 14

Back of Chapter Questions

Exercise: 14.1

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

Solution:

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 of our class.
3. Temperature of past 10 days in our city.
4. Number of plants in our locality.
5. Rain falls in our city.
6. Marks obtained by students of the class in a test.
7. Date of birth of students.
8. Subjects taught in various schools in class X.

2. Classify the data in day to day life as primary or secondary data.

Solution:

Primary Data:

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.

Secondary Data:

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

Exercise: 14.2

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?

Solution:

Here, 9 students have blood groups A, 6 as B, 3 as AB and 12 as O.

So, the table representing the data is 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, clearly that the most common blood group and the rarest blood group among these students is O and AB respectively.

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?

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 following

Distance (in km)	Tally marks	Number of engineers
$0-5$		5
$5-10$	𝍸 𝍸 |	11
$10-15$	𝍸 𝍸 |	11
$15-20$	𝍸 ||||	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 workplace up to 15 km distance, from their homes.

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?

Solution:

We construct a grouped frequency distribution table of class size 2 as given below,

Class intervals will be as follows $84-86, 86-88, 88-90\ldots$

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.

Range of data given above = maximum value − minimum value

$= 99.2 - 84.9 = 14.3$

5. 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

(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?

Solution:

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

We must construct a grouped frequency distribution table taking class intervals as $160 - 165, 165 - 170$, etc. On observing the data given as above we can construct the required table as below

(ii) Clearly from table we see that 50% of students are shorter than 165 cm.

6. 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) or how many days, was the concentration of Sulphur dioxide more than 0.11 parts per million?

Solution:

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

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

Number of days for which concentration SO_2 is more than 0.11 is number of days for which concentration is in between $0.12 - 0.16, 0.16 - 0.20, 0.20 - 0.24$.

So, required number of days $= 2 + 4 + 2 = 8$

7. 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:

The data given above following frequency distribution table can be constructed as shown below:

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

8. 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?

Solution:

(i) On observation of 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

(ii) 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.

9. Thirty children were asked about the number of hours they watched TV programmers 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?

Solution:

(i) 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

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

10. 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 below

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

Exercise: 14.3

1. 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 %):

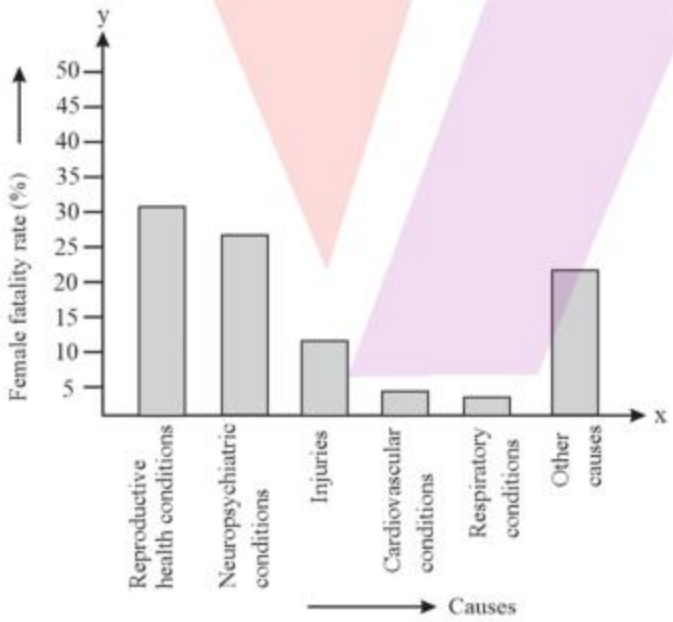
S.No.	Causes	Female fatality rate (%)
1.	Reproductive health conditions	31.8
2.	Neuropsychiatric conditions	25.4
3.	Injuries	12.4
4.	Cardiovascular conditions	4.3
5.	Respiratory conditions	4.1
6.	Other causes	22.0

(i) Represent the information given above graphically.

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

Solution:

By representing causes on x axis and family fatality rate on y axis and choosing an appropriate scale (1 unit = 5% for y axis) we can draw the graph of information given above, as following



All the rectangle bars are of same width and having 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.

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.

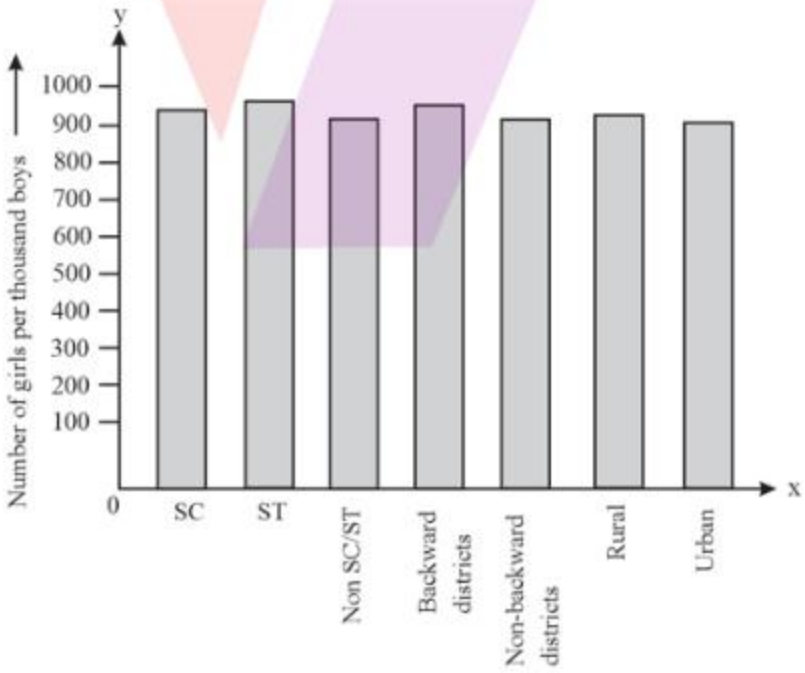
Section	Number of girls per thousand boys
Scheduled Caste (SC)	940
Scheduled Tribe (ST)	970
Non-SC/ST	920
Backward districts	950
Non-backward districts	920
Rural	930
Urban	910

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

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

Solution:

(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 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

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

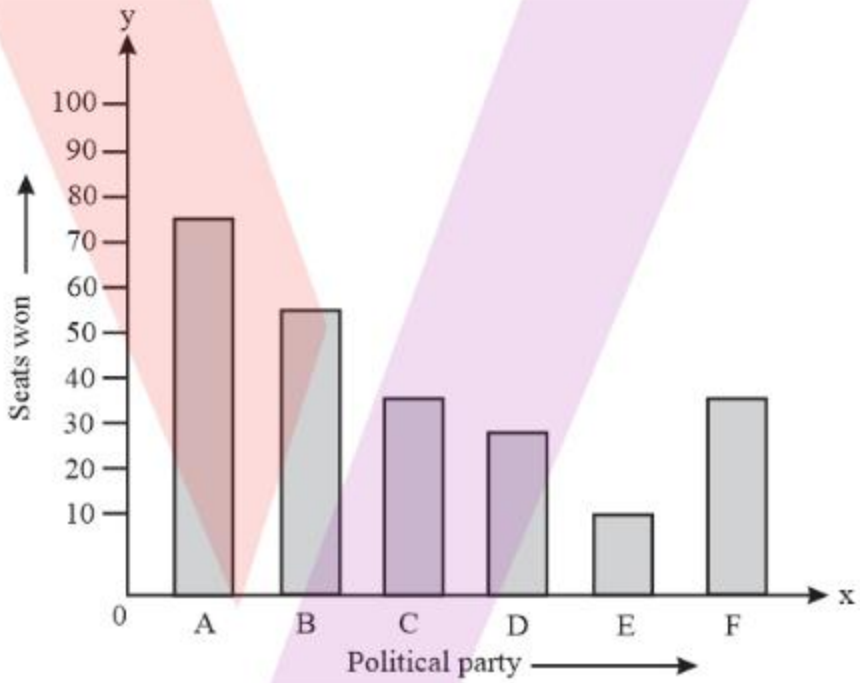
Political Party	A	B	C	D	E	F
Seats Won	75	55	37	29	10	37

(i) Draw a bar graph to represent the polling results.

(ii) Which political party won the maximum number of seats?

Solution:

(i) 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 of representing information as below



The rectangle bars are of same width and have equal space in between them.

(ii) We may find that political party 'A' won maximum number of seats.

4. 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

(i) Draw a histogram to represent the given data.

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

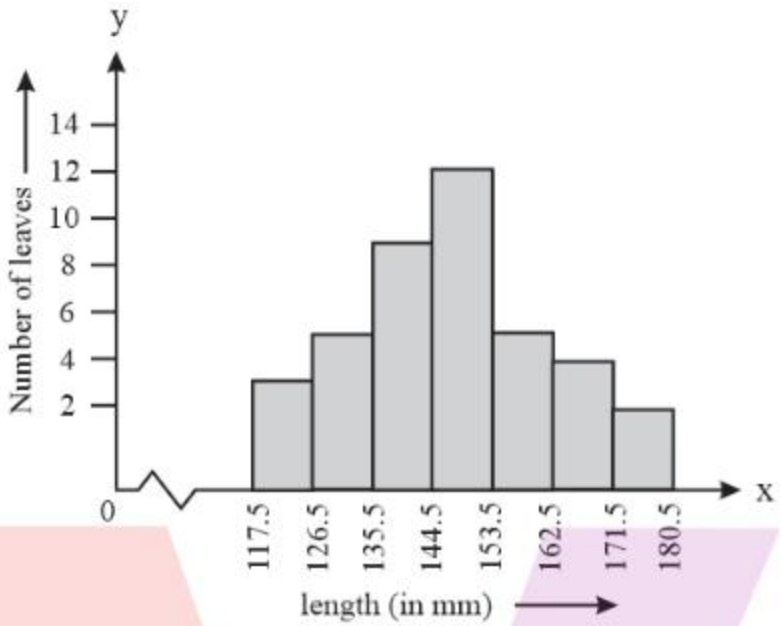
(iii) Is it correct to conclude that the maximum number of leaves are 153 mm long? Why?

Solution:

(i) Length of leaves are represented in a discontinuous class interval having a difference of 1 in between them. So, we must add to each upper-class limit and also have to subtract 0.5 from the lower-class limits so as 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 length of leaves on x axis and number of leaves on y axis we can draw the histogram of this information as below



Here 1 unit on y axis represents 2 leaves.

(ii) Other suitable graphical representation of this data could be frequency polygon.

(iii) No as maximum number of leaves (i.e. 12) have their length in between of 144.5 mm and 153.5 mm. It is not necessary that all have their lengths as 153 mm.

5. The following table gives the lifetimes of neon lamps:

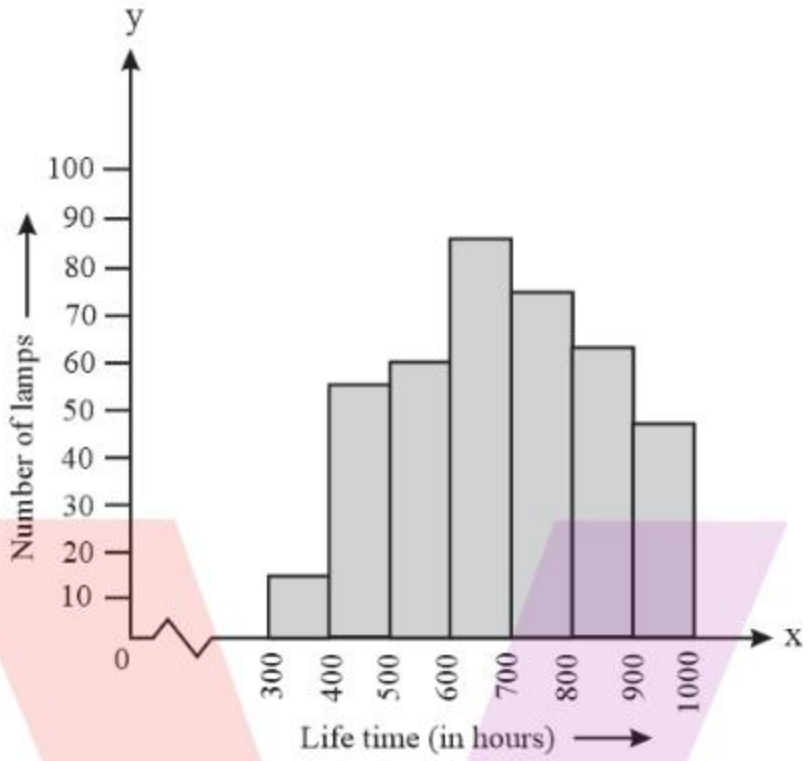
Length (in hours)	Number of lamps
300 – 400	14
400 – 500	56
500 – 600	60
600 – 700	86
700 – 800	74
800 – 900	62
900 – 1000	48

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

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

Solution:

(i) By taking lifetime (in hours) of neon lamps on x axis and number of lamps on y axis we can draw the histogram of the given information as below



In the histogram above 1 unit on y axis represent 10 lamps.

(ii) Number of neon lamps having their lifetime more than 700 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 is 184. $(74+62+48=184)$

10. 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.

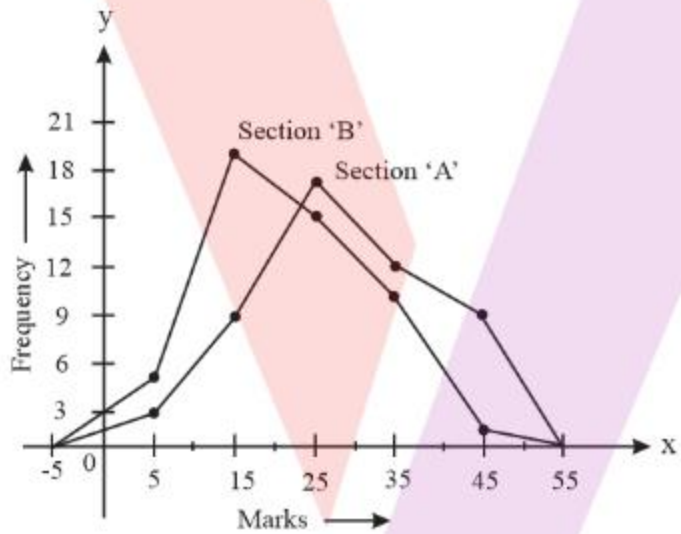
Solution:

Class marks of given classes can be calculated by using 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

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



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

11. 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:

We can observe from given data that its class intervals are not continuous. There is a gap of 1 in between of them. So, we must add $\frac{1}{2} = 0.5$ to upper class limits and subtract 0.5 from

lower class limits.

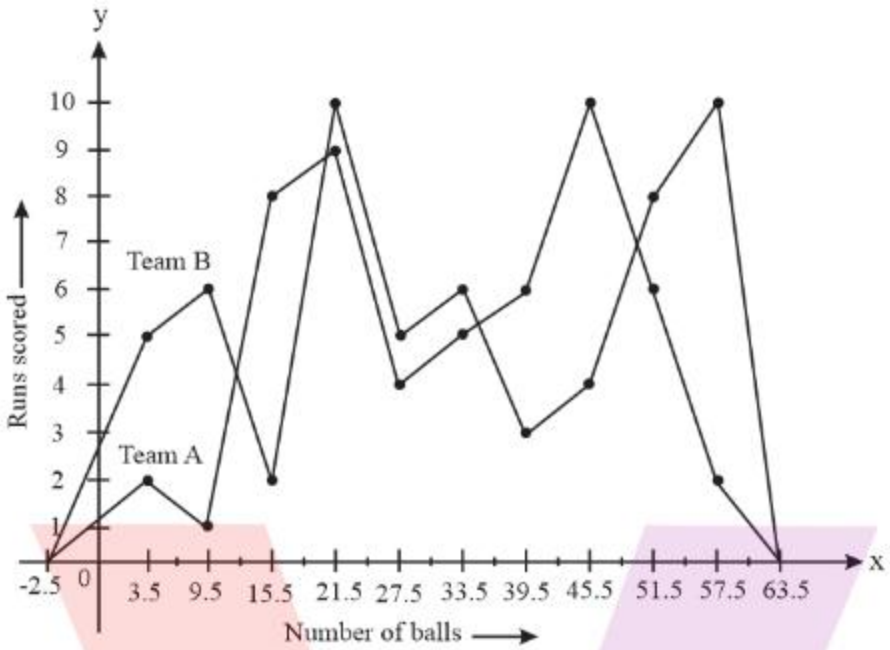
We can find class mark of each interval by using formula

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

Now continuous data with class mark of each class interval can be represented as following

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

Now by taking class marks on x axis and runs scored on y axis we can construct frequency polygon as following -



12. 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.

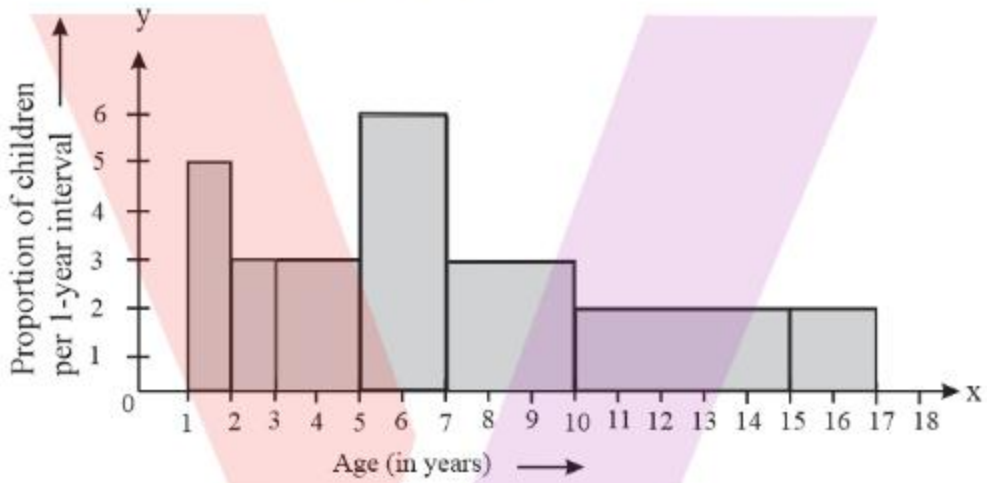
Solution:

Here data is having class intervals of varying width. We may find proportion of children per 1-year interval as following

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	$\frac{4 \times 1}{2} = 2$

Now taking age of children on x axis and proportion of children per 1-year interval on y axis we may draw histogram as below



13. 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.

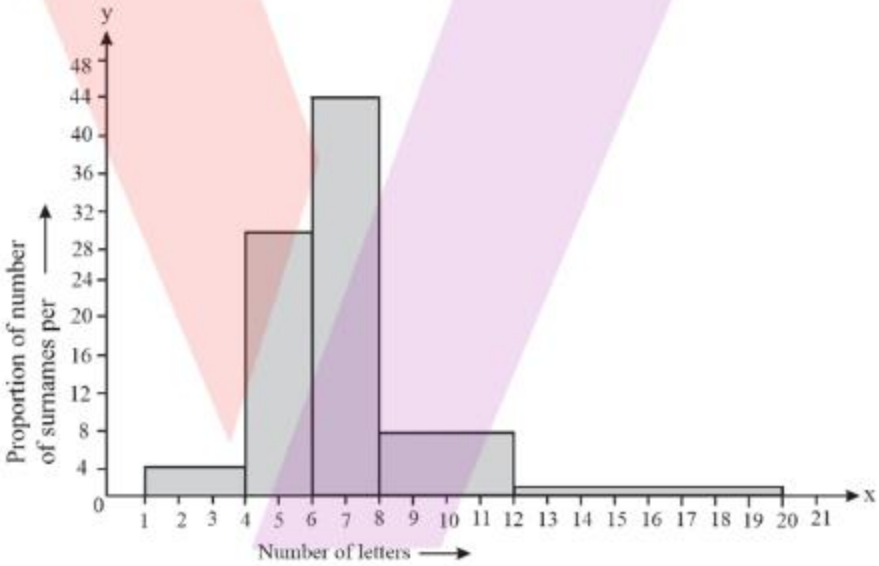
(ii) Write the class interval in which the maximum number of surnames lie.

Solution:

(i) 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	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	$\frac{4\times 2}{8}=1$

Here we take number of letters on x axis and proportion of number of surnames per 2 letters interval on y axis and choosing an appropriate scale (1 unit = 4 students in y axis) we will construct the histogram as below



(ii) 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.

Exercise: 14.4

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.

Solution:

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

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

$$\text{Mean Score} = \frac{2+3+4+0+1+3+3+4+3}{10}$$

$$= \frac{28}{10} = 2.8$$

$\therefore$ Mean Score $= 2.8$ goals

Arranging the number of goals in ascending order

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

As the number of observations is 10. 10 is an even number. So, median score will be

$$\text{Median score} = \frac{5^{th}\text{observation} + 6^{th}\text{ observation}}{2}$$

$$= \frac{3+3}{2}$$

$$= \frac{6}{2}$$

$\therefore$ Median score $= 3$

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

So, mode score of data is 3 as it is having maximum frequency as 4 in the data.

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.

Solution:

The number of goals scored by team is

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

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

$$\text{Mean Score} = \frac{41+39+48+52+46+62+54+40+96+52+98+40+42+52+60}{15}$$

$$= \frac{822}{15}$$

$\therefore$ Mean score $= 54.8$

Arranging the number of goals in ascending order

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

As the number of observations is 15. 15 is an even number. So, median score will be 8^{th} term.

Median score = 8^{th} term = 52

Mode of a data is the observation with maximum frequency value.

Therefore, mode score of data is 52 as it is having maximum frequency as 3 in the data.

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

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

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

$$\text{Median score} = \frac{5^{th}\text{observation} + 6^{th}\text{ observation}}{2}$$

$$= \frac{x + (x+2)}{2}$$

$$= x + 1$$

Given, $x + 1 = 63$

$\therefore x = 62$

Therefore, value of $x = 62$.

4. 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.

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

Solution:

We know,

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

Values of $\sum f_i x_i$ and $\sum f_i$ can be computed

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	$\sum f_i = 60$	$\sum f_i x_i = 305000$

$$\text{Mean salary} = \frac{305000}{60}$$

$$= 5083.33$$

So, mean salary of 60 workers is Rs 5083.33.

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

Solution:

(i) Mean is appropriate measure of central tendency in all the cases where it is important to take all observations into account and data does not have any extreme values for example in case of temperature of a month

(ii) Mean is not suitable in cases where there are very high and low values for example salary in a company.