| CHAPTER 12	IX-MATHEMATICS-NCERT(2023-24)
	12. STATISTICS(Notes)
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Graphical Representation of Data

(A) Bar Graphs:

A bar graph is a pictorial representation of data in which usually bars of uniform width are drawn with equal spacing between them on one axis (say, the x-axis), depicting the variable. The values of the variable are shown on the other axis (say, the y-axis) and the heights of the bars depend on the values of the variable.

Example 1 : In a particular section of Class IX, 40 students were asked about the months of their birth and the following graph was prepared for the data so obtained:
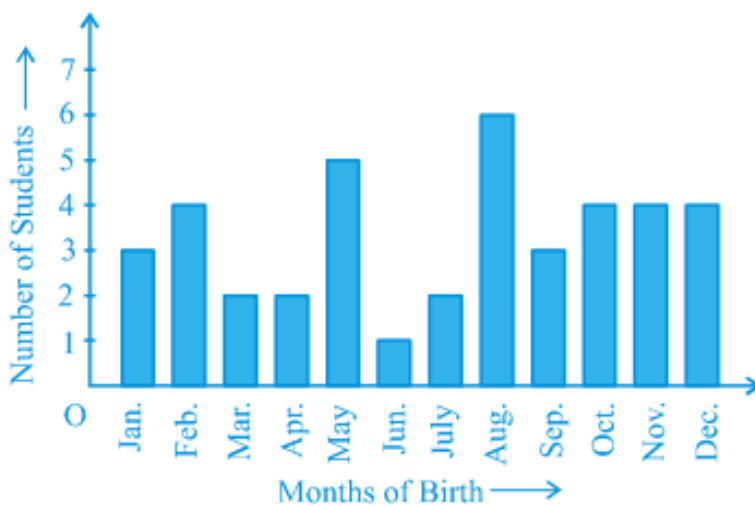
Observe the bar graph given above and answer the following questions:

(i) How many students were born in the month of November?

Sol: 4 .

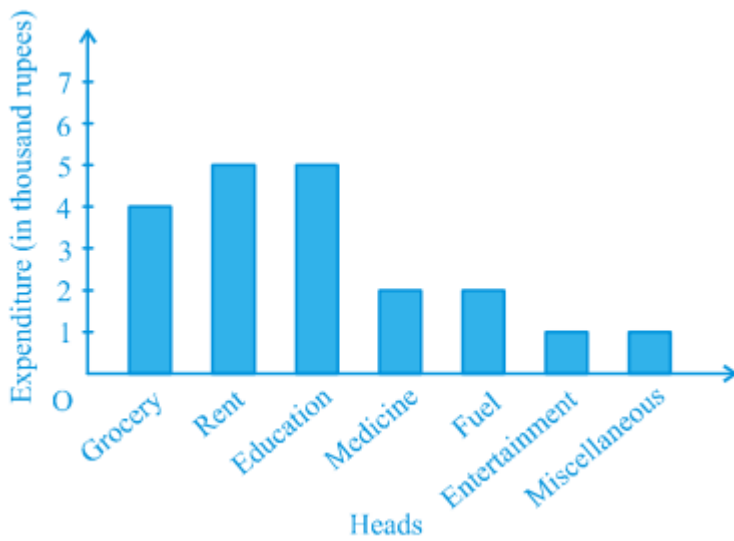**(ii) In which month was the maximum number of students born?**

Sol: August.

Example 2 : A family with a monthly income of ₹ 20,000 had planned the following expenditures per month under various heads:

Heads	Expenditure (in thousand rupees)
Grocery	4
Rent	5
Education of children	5
Medicine	2
Fuel	2
Entertainment	1
Miscellaneous	1

Draw a bar graph for the data above.
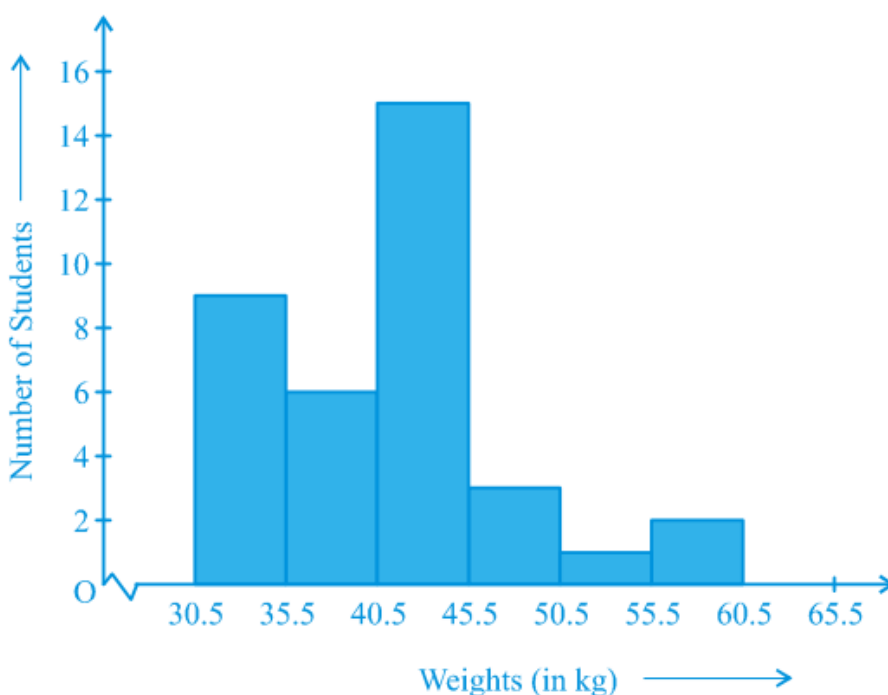
Sol:

(B) Histogram

Histogram is a graphical representation of a grouped frequency distribution with continuous classes.

Ex: consider the frequency distribution Table representing the weights of 36 students of a class:

Weights (in kg)	30.5-35.5	35.5-40.5	40.5-45.5	45.5-50.5	50.5-55.5	55.5-60.5	Total
Number of students	9	6	15	3	1	2	36

Draw a histogram for the data above.

Sol:

Example 3 : A teacher wanted to analyse the performance of two sections of students in a mathematics test of 100 marks. Looking at their performances, she found that a few students got under 20 marks and a few got 70 marks or above. So she decided to group them into intervals of varying sizes as follows: 0 - 20, 20 - 30, . . ., 60 - 70, 70 - 100. Then she formed the following table:

Marks	Number of students
0-20	7
20-30	10
30-40	10
40-50	20
50-60	20
60-70	15
70-above	8
Total	90

Draw a histogram for this table data above.

Sol: All class intervals are not equal.

So, we need to make certain modifications in the lengths of the rectangles.

| Marks	Number of students	Width of the class.	Length of the rectangle.
0-20	7	20	$\frac{7}{20} \times 10 = \frac{7}{2} = 3.5$
20-30	10	10	$\frac{10}{10} \times 10 = 10$
30-40	10	10	$\frac{10}{10} \times 10 = 10$
40-50	20	10	$\frac{20}{10} \times 10 = 20$
50-60	20	10	$\frac{20}{10} \times 10 = 20$
60-70	15	10	$\frac{15}{10} \times 10 = 15$
70-100	8	30	$\frac{8}{30} \times 10 = \frac{8}{3} = 2.67$
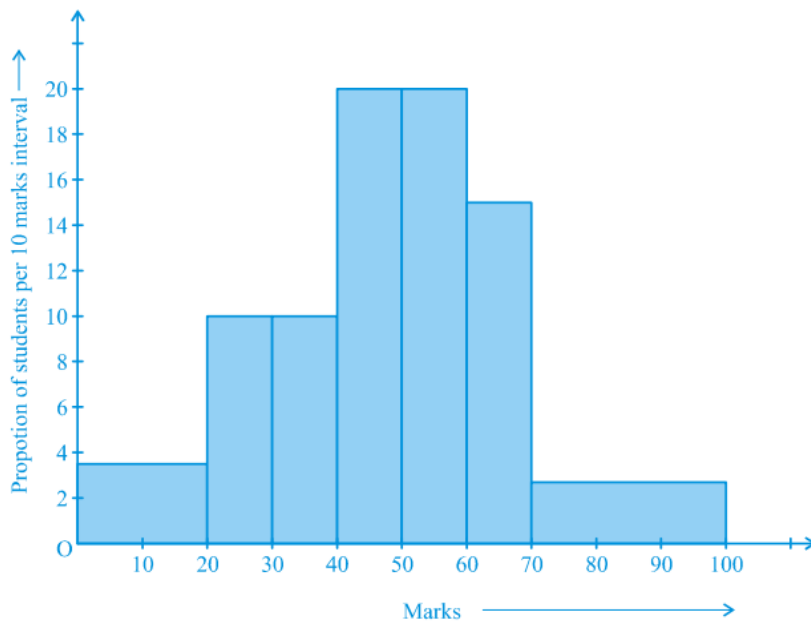
(C) Frequency Polygon

A frequency polygon is a line graph of class frequency plotted against class midpoint. It can be obtained by joining the midpoints of the tops of the rectangles in the histogram.

Example: Draw the frequency of polygon for the given table.

Weights (in kg)	30.5-35.5	35.5-40.5	40.5-45.5	45.5-50.5	50.5-55.5	55.5-60.5	Total
Number of students	9	6	15	3	1	2	36

Sol:

| Weights (in kg)	Class mark(midpoint)	Number of students
30.5-35.5	33	9
35.5-40.5	38	6
40.5-45.5	43	15
45.5-50.5	48	3
50.5-55.5	53	1
55.5-60.5	58	2
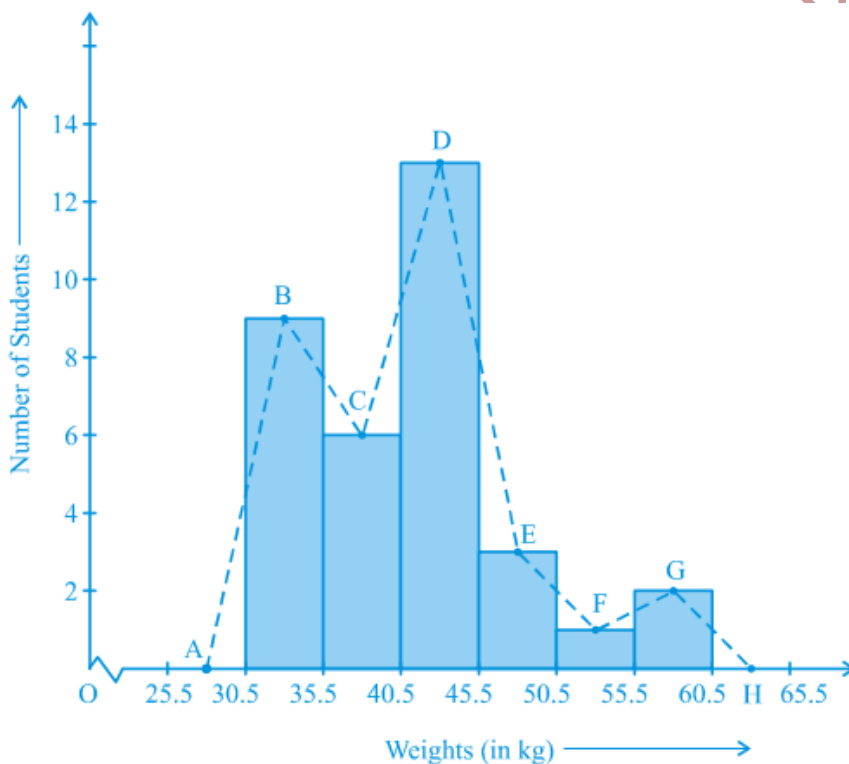
Example 4 : Consider the marks, out of 100, obtained by 51 students of a class in a test, given in Table.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	Total
Number of students	5	10	4	6	7	3	2	2	3	9	51

Draw a frequency polygon corresponding to this frequency distribution table

Sol:

Marks	Class mark	Number of students
0-10	5	5
10-20	15	10
20-30	25	4
30-40	35	6
40-50	45	7
50-60	55	3
60-70	65	2
70-80	75	2
80-90	85	3
90-100	95	9
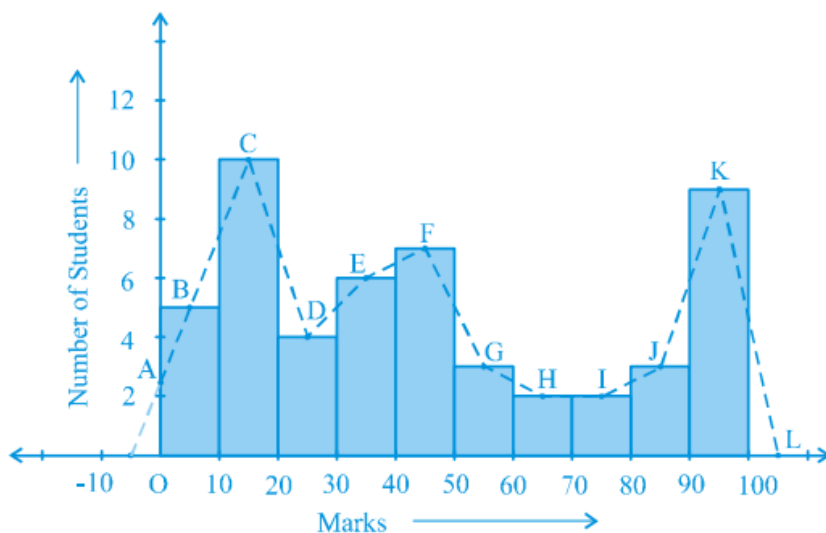
Frequency polygons without drawing histograms:

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

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

Example 5 : In a city, the weekly observations made in a study on the cost of living index are given in the following table:

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

Sol:

| Classes	Class-marks	Frequency
140-150	145	5
150-160	155	10
160-170	165	20
170-180	175	9
180-190	185	6
190-200	195	2
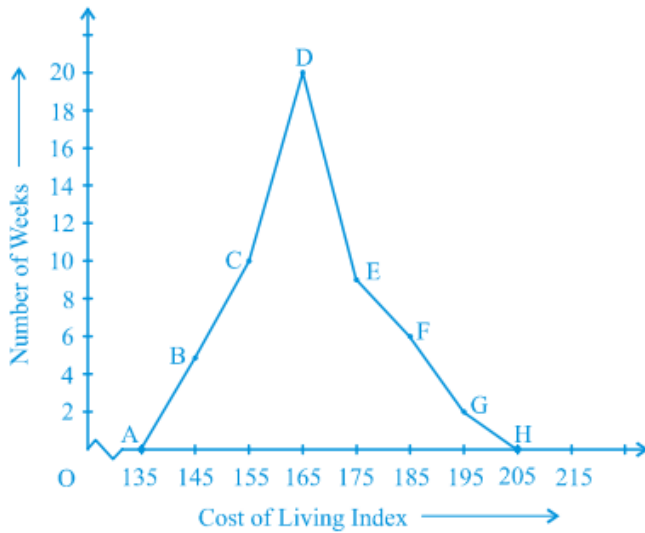
EXERCISE 12.1

1. 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.
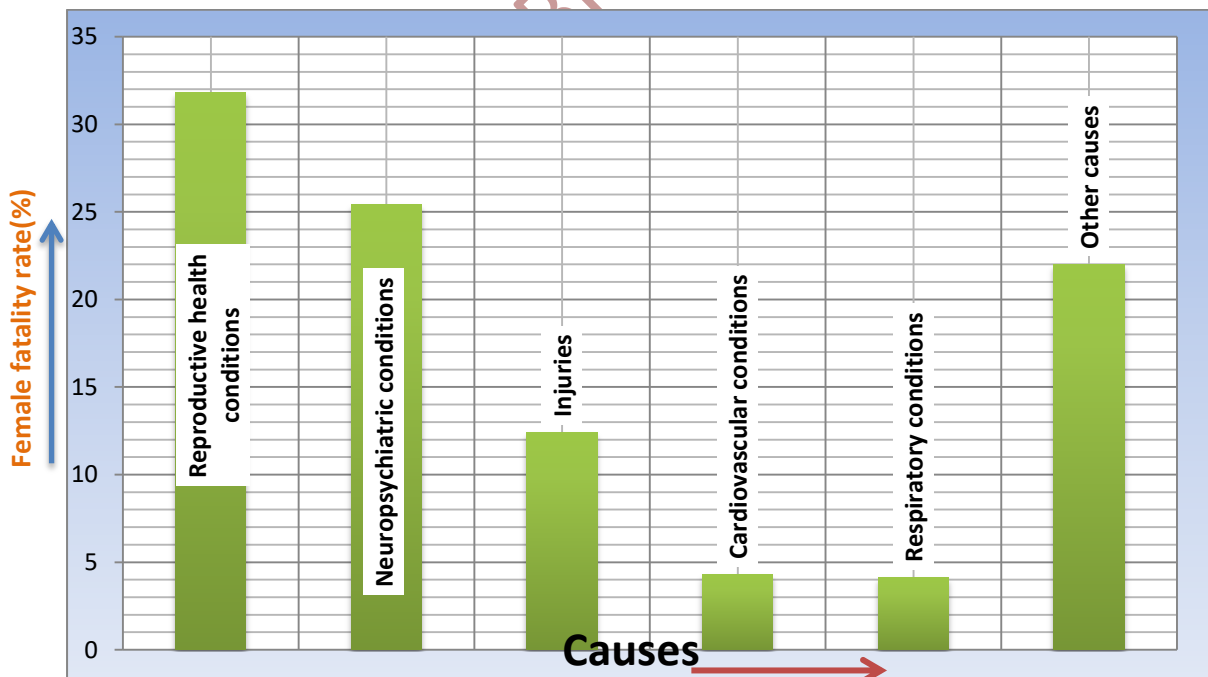
(ii) Which condition is the major cause of women's ill health and death worldwide?

Sol: Reproductive health conditions.

(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.

Sol: Lack of awareness, lack of timely medical care, lack of hygiene and diet.

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.
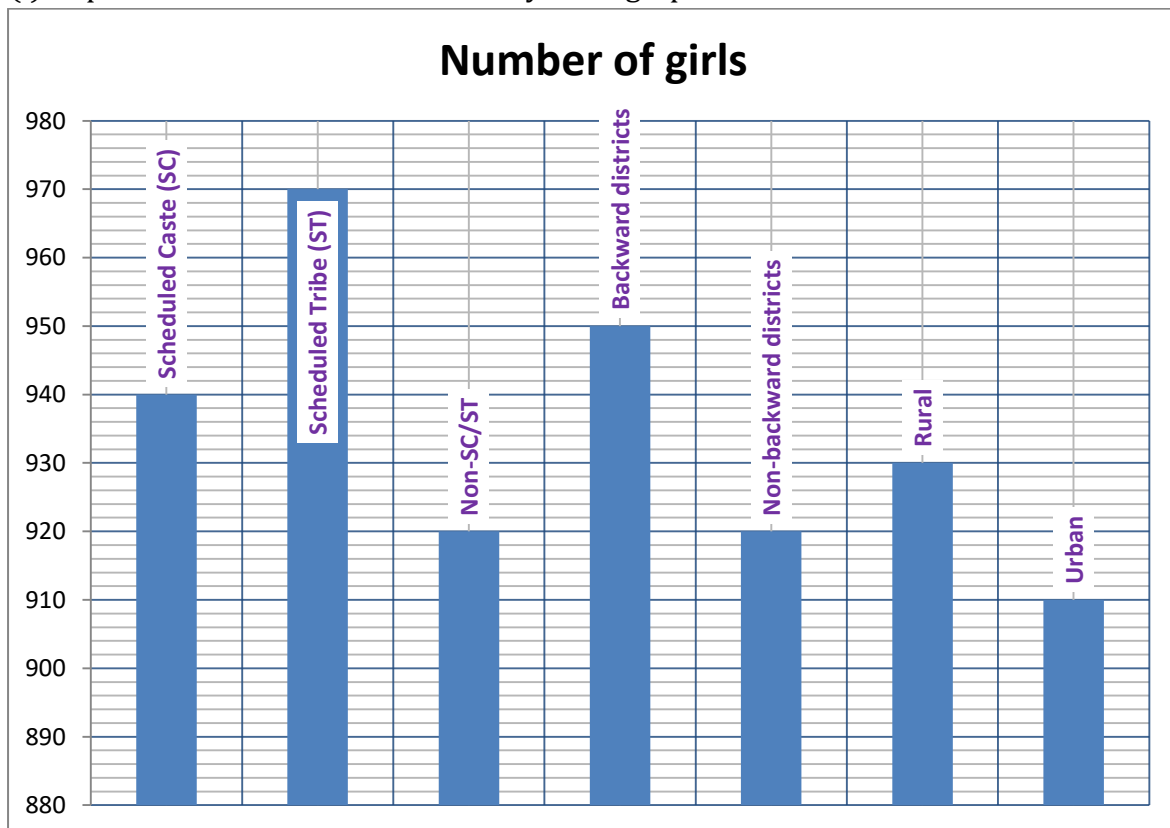
Number of girls

(ii) In the classroom discuss what conclusions can be arrived at from the graph.
Sol: (a) The number of girls per thousand boys is lowest for urban category.
(b) The number of girls per thousand boys is highest for ST category.

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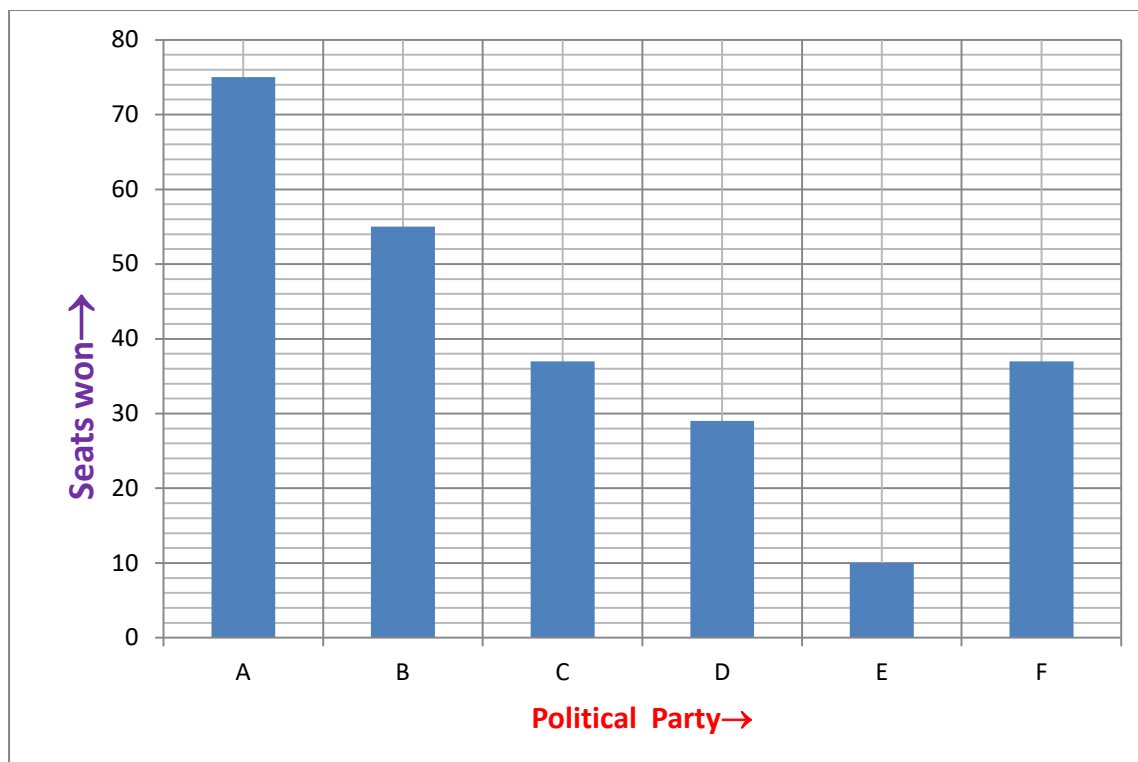
 (ii) Which political party won the maximum number of seats?

Sol: Party A

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

(i) Draw a histogram to represent the given data. [Hint: First make the class intervals continuous]

Sol:

Length (in mm)	Continuous class intervals	Number of leaves
118-126	117.5-126.5	3
127-135	126.5-135.5	5
136-144	135.5-144.5	9
145=153	144.5-153.5	12
154-162	153.5-162.5	5
163-171	162.5-171.5	4
172-180	171.5-180.5	2
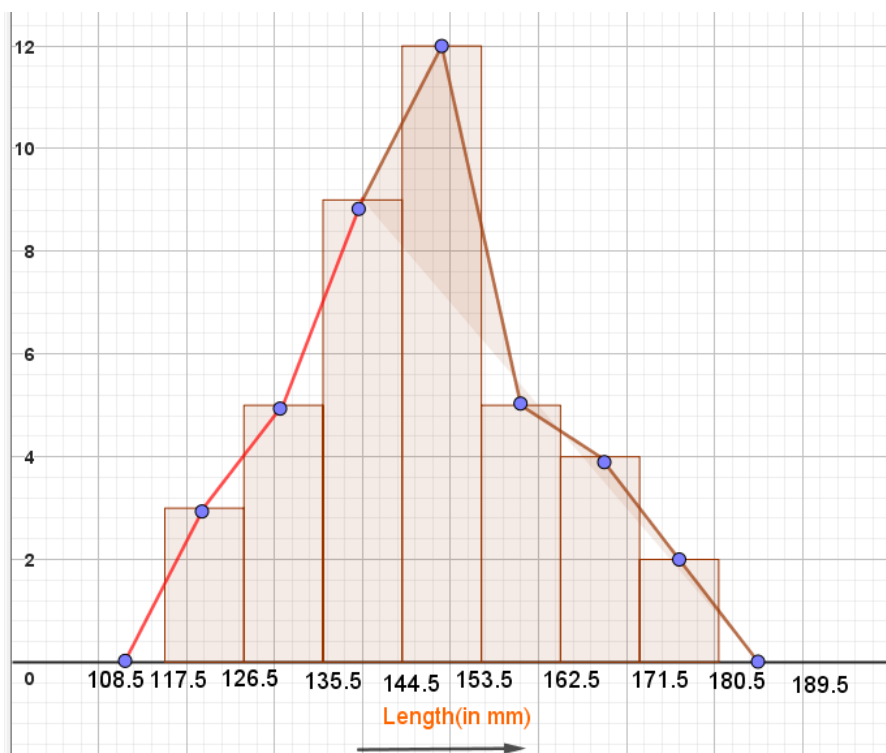
(ii) Is there any other suitable graphical representation for the same data?

Sol: Frequency polygon.

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

Sol: No, The maximum number of leaves have their length lie between 144.5 mm and 153.5 mm.

5.   The following table gives the life times of 400 neon lamps:

Life time (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.
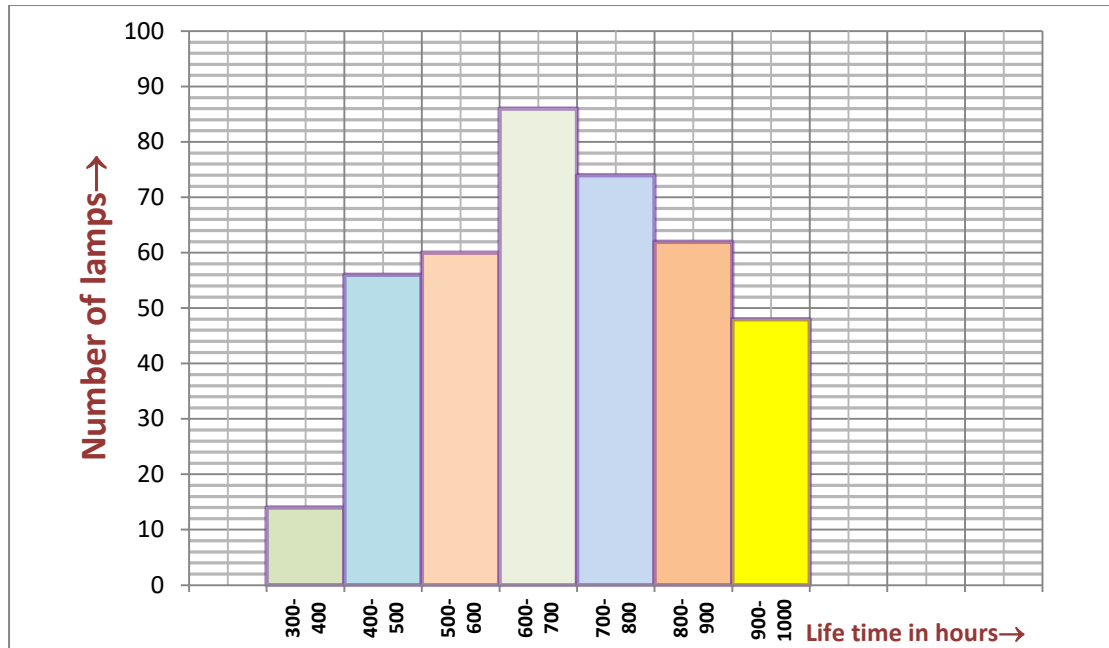
(ii) How many lamps have a life time of more than 700 hours?

Sol: Number of lamps a life time of more than 700 hours=74+62+48=184

6. 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.

Sol:

| Section A			Section B		
Marks	Class Mark	Frequency	Marks	Class Mark	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
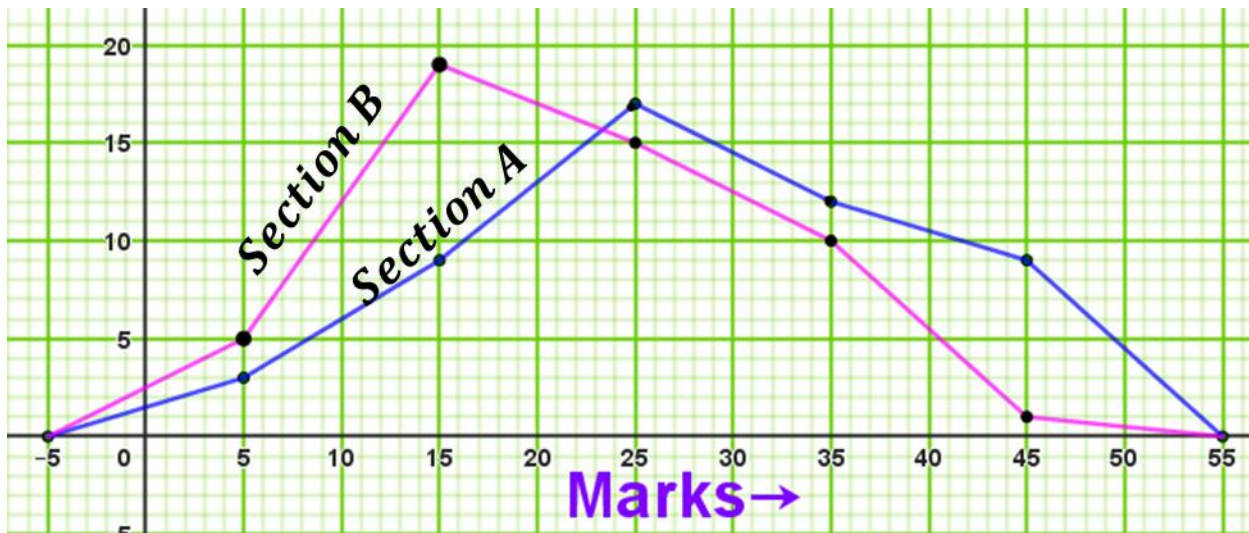
7. The runs scored by two teams A and B on the first 60 balls in a cricket match are given below:

Number of balls	Team A	Team B
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.]

Sol:

| Number of balls	Continuous class intervals	Class Mark	Team A	Team B
1-6	0.5-6.5	3.5	2	5
7-12	6.5-12.5	9.5	1	6
13-18	12.5-18.5	15.5	8	2
19-24	18.5-24.5	21.5	9	10
25-30	24.5-30.5	27.5	4	5
31-36	30.5-36.5	33.5	5	6
37-42	36.5-42.5	39.5	6	3
43-48	42.5-48.5	45.5	10	4
49-54	48.5-54.5	51.5	6	8
55-60	54.5-60.5	57.5	2	10
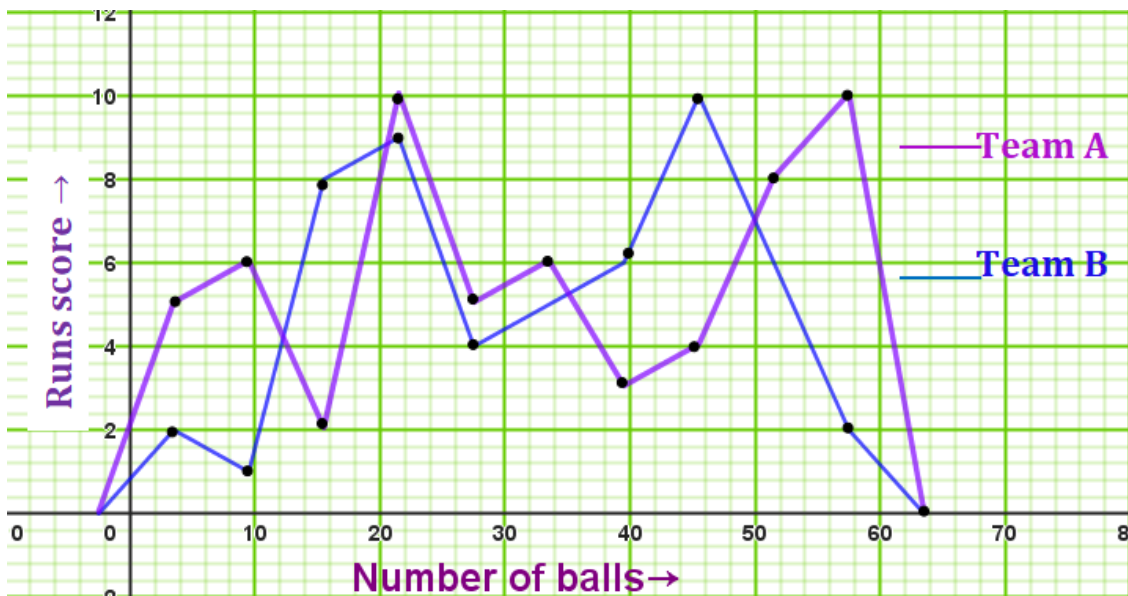
8. A random survey of the number of children of various age groups playing in a park was found as follows:

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

Draw a histogram to represent the data above.

Sol:

Age (in years)	Number of children	Width of the Class	Length of the rectangle
1-2	5	1	$\frac{5}{1} \times 1 = 5$
2-3	3	1	$\frac{3}{1} \times 1 = 3$
3-5	6	2	$\frac{6}{2} \times 1 = 3$
5-7	12	2	$\frac{12}{2} \times 1 = 6$
7-10	9	3	$\frac{9}{3} \times 1 = 3$
10-15	10	5	$\frac{10}{5} \times 1 = 2$
15-17	4	2	$\frac{4}{2} \times 1 = 2$
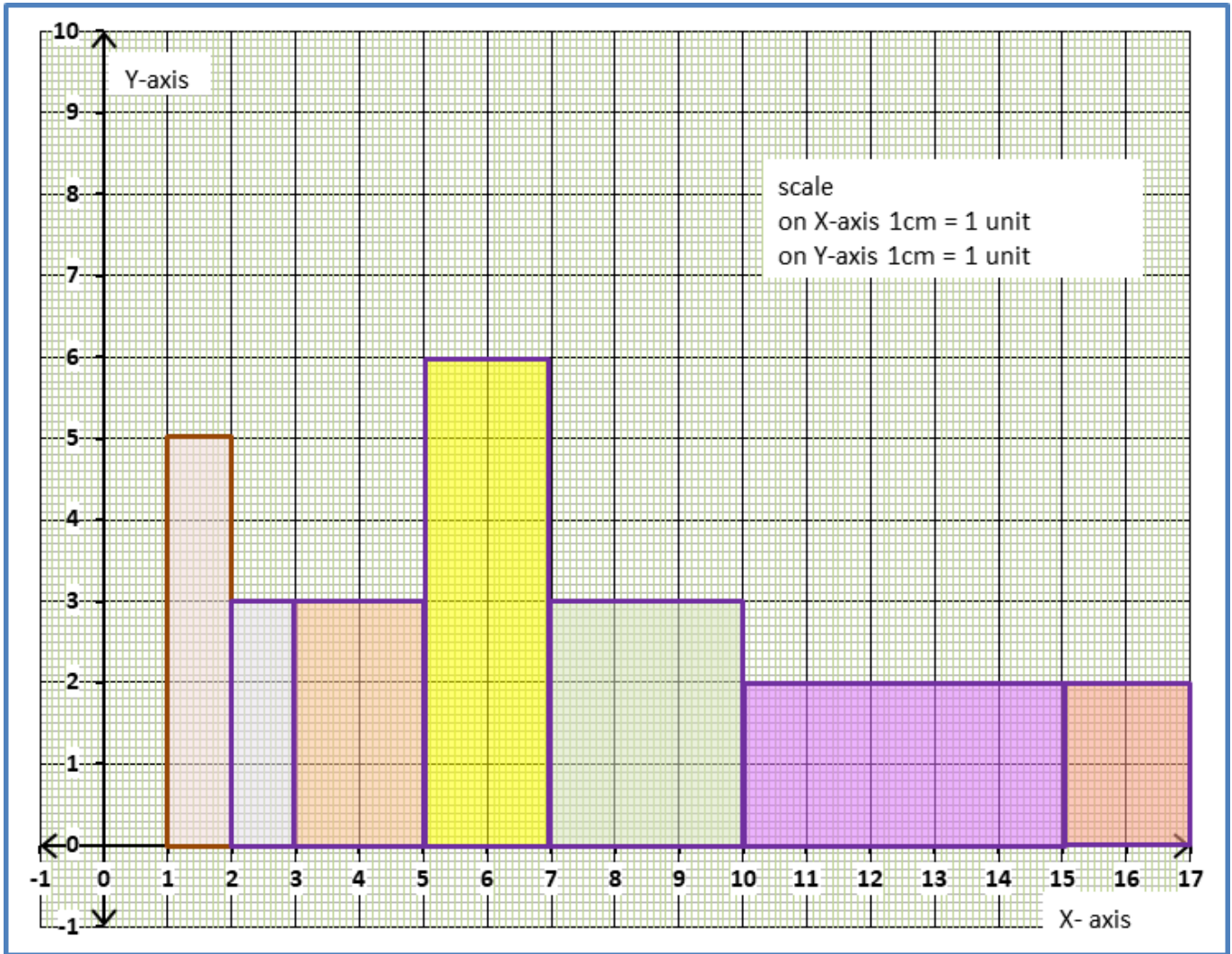
9. 100 surnames were randomly picked up from a local telephone directory and a frequency distribution of the number of letters in the English alphabet in the surnames was found as follows:

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

(i) Draw a histogram to depict the given information. (ii) Write the class interval in which the maximum numbers of surnames lie.

Sol:

Number of letters	Number of surnames	Width of the class	Length of rectangle
1-4	6	3	$\dfrac{6}{3} \times 2 = 2 \times 2 = 4$
4-6	30	2	$\dfrac{30}{2} \times 2 = 15 \times 2 = 30$
6-8	44	2	$\dfrac{44}{2} \times 2 = 22 \times 2 = 44$
8-12	16	4	$\dfrac{16}{4} \times 2 = 4 \times 2 = 8$

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