CHAPTER 4

Data Handling

Learning Objective

In this chapter, you will learn:-

- *About collection and presentation of Data in various forms.*
- *To represent the data as histograms & pie charts*
- *To interpret the histrograms and pie charts.*
- *To Use the histograms and pie chart in daily life situation.*
- *Introduction of chances and probability.*
- *To relate chances and probability to real life problems.*

4.1 Raw Data / Primary Data:

Statistics has gained very important place in the modern world and **data** is the base on which the structure of statistical investigation is made. The success and failure of investigation mainly depends upon the quality and accuracy of data. The word 'data' means 'information'. **Collection of data** is the first step in any statistical investigation. The numerical observations collected by an observer cannot be put to any use immediately and directly. So it is called **raw data** or **primary data**.

For example, the marks (out of 20) of 10 students of class 8^{th} are 12, 15, 18, 10, 13, 19, 20, 14, 12, 10

Here, each entry in the above list is a numerical fact which is called an **observation.** Such a collection of observations gathered or collected initially is called **raw data.** So *"Primary data or raw data is the data which is originally collected by an investigator or agency for the first time for some specific purpose."*

4.2 Presentation of Data:-

After collecting data, the investigator has to find ways to present them in tabular form. Such an arrangement is called **presentation of data**.

The raw data can be arranged in following ways:

(i) Alphabetical order or Serial order.

(ii) Ascending or Descending order.

The raw data when put in ascending or descending order is called **an array**.

For Example,

The marks obtained by 10 students in a class test, out of 25 marks, according to their roll numbers be.

18, 21, 17, 13, 5, 14, 20, 24, 19, 16

This data in this form is called raw data or primary data or ungrouped data. The above data can be arranged in serial order as follows:-

Roll No.	1	2	3	4	5	6	7	8	9	10
Marks obtained	18	21	17	13	5	14	20	24	19	16

Table 4.1

But data in this group does not give us a clear picture of the standard achievement of the group. If we arrange them in ascending or descending order then it gives us a slighty better picture.

In ascending order:-

5, 13, 14, 16, 17, 18, 19, 20, 21, 24

In descending order:-

24, 21, 20, 19, 18, 17, 16, 14, 13, 5

If the number of observations is large then arranging data in ascending or descending or serial order is very tough and tedious job. To make it easily understandable and clear, we can tabulate data in the form of **Frequency Distribution**

4.3 Frequency Distribution or Frequency Table:-

It is a method to present raw data in the form which we can easily understand. Frequency distributions or tables are of two types:-

(i) Discrete frequency distribution

(ii) Continuous frequency distribution

4.3.1. Discrete frequency Distribution:- The construction of a discrete frequency distribution from the given raw data is done by the use of tally marks.

Tally marks. In tally marks, we use the following symbols.

Numbers	1	2	3	4	5	6	7	8	9	10
Tally Marks	I	II	III	IIII	𝍸	𝍸 I	𝍸 II	𝍸 III	𝍸 IIII	𝍸 𝍸

Table 4.2

Let's discuss some examples:

Example 4.1 : A die was thrown 25 times and following scores were obtained:

1, 5, 2, 4, 3, 6, 1, 4, 2, 5, 1, 6, 2, 6, 3, 5, 4, 1, 3, 2, 3, 6, 1, 5, 2.

Prepare a frequency table for the scores.

Sol.

Number	Tally Marks	Frequency
1	𝍸	5
2	𝍸	5
3	IIII	4
4	III	3
5	IIII	4
6	IIII	4
	Total	**25**

Table 4.3

Example 4.2 : Prepare a frequency distribution of the favourite subject of a group of 22 students which is as follows:

Punjabi, Mathematics, Science, English, Punjabi, English, Mathematics, Mathematics, Science, Punjabi, Punjabi, Science, Science, Mathematics, Punjabi, English, Punjabi, English, Science, Punjabi, Science, Mathematics.

Also answer that which is the most liked subject and the least liked?

Sol. Frequency Distribution of the favourite subjects

Subjects	Tally Marks	(Number of students) Frequency
Punjabi	𝍸 II	7
Mathematics	𝍸	5
Science	𝍸 I	6
English	IIII	4
	Total	**22**

Table 4.4

It is clear from the table that maximum students like Punjabi subject and least number of students like English Subject.

Frequency:- The numbers appearing on a dice in example 4.1 and the number of students liking a subject in example 4.2 corresponding to tally marks gives frequency. "Frequency gives the number of times that a particular occurs".

4.3.2 Continuous Frequency Distribution:-

The above method of presenting the raw data is convenient and easy where the values in the raw data are largely repeating. But If the number of observations are not repeating and difference between the greatest and the smallest observations is large then we arrange the data into classes or groups. Let's discuss with some examples.

Example 4.3 : The weekly wages (in ₹) of 30 workers in a factory are

830, 835, 890, 810, 835, 869, 836, 890, 898, 845, 832, 820, 860, 833, 845, 855, 812, 808, 804, 835, 840, 835, 885, 836, 878, 840, 868, 890, 806, 840.

Using tally marks, make a frequency table with intervals as 800-810, 810-820 and so on.

Sol.

Wages	Tally marks	Frequency
800-810	III	3
810-820	II	2
820-830	I	1
830-840	𝍸 IIII	9
840-850	𝍸	5
850-860	I	1
860-870	III	3
870-880	I	1
880-890	I	1
890-900	IIII	4
	Total	**30**

Table 4.5

Note: Data presented in this manner is said to be **grouped** and the distribution obtained is called **grouped frequency distribution.** It helps us to draw meaningful results.

In Above Example:

(i) The weekly wages of most workers are between ₹ 830 and ₹ 840.

(ii) 4 workers are taking highest wages more than ₹ 890.

Now, here we shall defi2ne some terms related to **grouped frequency distribution.**

* **Class Interval:-** Each of the groups 800-810, 810-820 and so on are called **class-intervals** Here observe that 810 occurs in both classes ie 800-810 and 810-820. But it is not possible that an observation can belong simultaneously to two classes.
"To avoid this, we adopt the convention that the common observation will belong to the higher class i.e. 810 belongs to 810-820 (not to 800-810)." Similarly 820 belongs to 820-830 (not to 810-820)

* **Lower class limit:-** In class interval, smaller value is called **lower class limit.**
For example, in class interval 800-810, the **lower class limit is 800.**
Similarly, In 810-820, the lower class limit is 810.

* **Upper Class limit:-** In class interval, higher value is called **upper class limit.**
For example:- In class interval 800-810, the upper class limit is 810.
Similiarly, in 810-820, the upper class limit is 820.

* **Class width or class size:-** The difference between the upper class limit and the lower class limit is called the **class width or size** of the class interval.
Here in all class interval 800-810, 810-820 and so on, class width is 10.

* **Class Mark:-** Mid value of the each class interval is called class mark.

$$\text{i.e. class mark} = \frac{\text{Lower limit} + \text{Upper limit}}{2}$$

For example the class mark of the class interval 800-810 is as follow

$$\text{Classmark} = \frac{800+810}{2} = \frac{1610}{2} = 805$$

Now we are showing all the above terms in a single table

Class Interval	Lower Class limit	Upper Class limit	Class width of size	Class marks
800-810	800	810	10	805
810-820	810	820	10	815
820-830	820	830	10	825
830-840	830	840	10	835
840-850	840	850	10	845
850-860	850	860	10	855
860-870	860	870	10	865
870-880	870	880	10	875
880-890	880	890	10	885
890-900	890	900	10	895

Table 4.6

Example 4.4 : The marks obtained by 40 students of class VIII in Mathematics test are given below:-

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

Represent the data in the form of a frequency distribution using classes 15-20, 20-25 and so on.

Sol. The minimum and maximum marks in the given raw data are 1 and 24 respectively. So classes of the above data can be 0-5, 5-10 and so on. Thus, the frequency distribution is as given below:

Frequency Distribution

Marks	Tally Marks	Frequency
0-5	𝍸	5
5-10	𝍸 𝍸 I	11
10-15	𝍸 II	7
15-20	𝍸 IIII	9
20-25	𝍸 III	8
Total		**40**

Table 4.7

Example 4.5 : The heights (in cm) of 30 students of class VIII are given below:-

155, 158, 154, 158, 149, 148, 160, 150, 148, 159, 161, 153, 157, 153, 162, 157, 154, 159, 151, 160, 156, 156, 152, 163, 147, 155, 152, 157, 153, 155.

Prepare frequency table with class size of 3cm.

Sol. The minimum and maximum height in the given raw data are 147 and 163. It is mentioned that class size is 3cm. So classes of the above data be 147-150, 150-153, 153-156 and so on.

Frequency Distribution

Height (in cm)	Tally marks	Frequency
147-150	IIII	4
150-153	IIII	4
153-156	𝍸 III	8
156-159	𝍸 II	7
159-162	𝍸	5
162-165	II	2
	Total	**30**

Table 4.8

Exercise 4.1

1. Following data gives the number of children in 40 families: 1, 2, 1, 5, 6, 2, 1, 3, 5, 4, 2, 6, 3, 0, 2, 4, 0, 0, 2, 3, 2, 0, 4, 1, 4, 2, 2, 3, 2, 1, 0, 5, 4, 2, 4, 3, 6, 2, 1, 2. Represent it in the form of frequency distribution.

2. In a study of number of accidents per day, the observations for 30 days were obtained as follows:-

   6, 5, 6, 3, 5, 2, 4, 3, 4, 2, 4, 2, 1, 2, 0, 2, 5, 1, 6, 4, 3, 0, 6, 5, 5, 1, 5, 6, 2, 6.

   Prepare a frequency distribution table.

3. Prepare a frequency table of the following ages (in years) of 25 students of class VIII in your school:

   13, 14, 12, 13, 14, 13, 15, 14, 13, 13, 14, 14, 12, 16, 14, 13, 14, 16, 15, 14, 13, 13, 17, 12, 13.

4. The shoppers who come to a departmental store are marked as: man (M), woman (W), girl (G) or boy (B). The following list gives the shoppers who came during the first hour in the morning.

   W W G W B M G G W W M M W W W G B M W W B G M G M W M W W W
   W M W B W M G W W W G W W M M W W M W G G M W M M W B W G G

   Prepare a frequency distribution table

5. Construct a frequency distribution table for the data on weights (in kg) of 20 students of a class using interval 30-35, 35-40 and so on

   40, 48, 33, 38, 31, 60, 53, 49, 36, 46, 34, 65, 55, 49, 41, 47, 44, 39, 38, 42.

6. Prepare a frequency distribution table of the marks (out of 50) obtained in test by 60 students of class VIII.

   21, 10, 30, 22, 33, 5, 37, 12, 25, 42, 15, 39, 26, 32, 18, 27, 28, 19, 29, 35, 31, 24, 36, 18, 20, 38, 22, 44, 16, 24, 10, 27, 39, 28, 49, 29, 32, 23, 31, 21, 34, 22, 23, 36, 24, 36, 33, 47, 48, 50, 39, 20, 7, 16, 36, 45, 47, 30, 22, 17.

   Use class interval 0-10, 10-20 and so on.

7. The water tax bills (in ₹) of 30 houses in a locality are given below. Construct a grouped frequency distribution with class size of 10.

   30, 32, 54, 45, 78, 74, 112, 66, 108, 76, 14, 20, 88, 40, 44, 35, 15, 66, 95, 84, 75, 96, 110, 74, 88, 102, 34, 14, 110, 44.

8. Construct a frequency table with class intervals 0-5, 5-10 and so on of the following marks obtained by a group of 30 students in a test.

   10, 7, 5, 12, 0, 15, 25, 20, 22, 27, 17, 11, 8, 9, 6, 17, 23, 19, 31, 21, 29, 37, 31, 35, 45, 40, 49, 42, 50, 16.

9. Multiple Choice Questions :

(i) The upper limit of 20-30 is:

(a) 25 (b) 20 (c) 30 (d) 50

(ii) The lower limit of 25-35 is:

(a) 25 (b) 30 (c) 35 (d) 60

(iii) The class size of 40-60 is:

(a) 10 (b) 20 (c) 40 (d) 60

(iv) The class marks of 100-150 is:

(a) 100 (b) 120 (c) 150 (d) 125

(v) The classes 0-10, 10-20, 20-30 are

(a) Continuous (b) Discontinuous

(c) Insufficient data (d) Ungrouped data

(vi) ..... gives the number of times a particular entry occurs in the given data.

(a) Frequency (b) Lower Limit (c) Upper limit (d) Class mark

(vii) If 50-60 is the class interval of grouped data, then the lower class limt is:

(a) 50 (b) 10 (c) 60 (d) 110

(viii) Tally marks are used to find which of the following?

(a) Frequency (b) Lower limits (c) Upper limits (d) None of these

(ix) Study the following frequency distribution table and answer the following:

Class Interval	Frequency
5-10	8
10-15	10
15-20	25
20-25	10
25-30	12
30-35	6

(A) What is the size of the class intervals?

(a) 5 (b) 10 (c) 15 (d) 20

(B) Which class has the highest frequency?

(a) 5-10 (b) 15-20 (c) 30-35 (d) 20-25

(C) Which class has the lowest frequency?

(a) 5-10 (b) 15-20 (c) 30-35 (d) 10-15

(D) Which two classes have the same frequency?

(a) 5-10 and 10-15 (b) 5-10 and 30-35

(c) 25-30 and 30-35 (d) 10-15 and 20-25

4.4 Graphical Method of Representing the data

In previous section, we have learnt how to prepare a frequency distribution table. We have discussed two types of frequency distributions. Here we shall discuss the graphical representation of the frequency distribution. In previous classes, we have learnt some graphical representations like pictograph and Bar graph. We know "A bar graph is the quickest way to represent a frequency distribution pictorially." In this section, we shall learn how to represent a grouped frequency distribution graphically. The most common graphical representation is the **Histogram.**

4.5 Histogram:- "A histogram is a graphical representation of a frequency distribution in the form of rectangles with class intervals as bases and heights proportional to corresponding frequencies such that there is no gap between any two successive intervals".

In this chapter, we shall learn construction of histogram for a continuous grouped frequency distribution with equal class intervals.

Let's discuss it with some examples!

Example 4.6 : The following table gives the marks scored by 60 students in a test.

Marks	0-10	10-20	20-30	30-40	40-50	Total
No. of students (frequency)	3	10	21	19	7	60

Table 4.9

Represent this data in the form of a histogram

Sol. We represent the marks (class intervals) along x-axis with a suitable scale and the number of students (frequency) along y-axis on a suitable scale.

- Draw the rectangular bars according to their values.

Taking class intervals as bases and the corresponding frequencies as heights we construct rectangles to obtain the histogram (Fig 5.1)

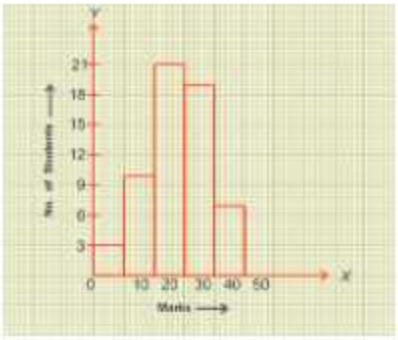


Figure 4.1

Example 4.7 : The following is the distribution of weights (in kg) of 50 persons:-

Weight (in kg)	45-50	50-55	55-60	60-65	65-70	70-75
No of persons	12	8	8	4	10	8

Table 4.10

Draw a histogram of the above data

Sol. Here, We shall represent the weight along X-axis and number of persons along y-axis with a suitable scale.

- Since the scale on X-axis starts at 45,so a **kink (break)** is indicated near the origin to signify that the graph is drawn to scale beginning at 45 and not at origin.
- Draw the rectangular bars according to their values.

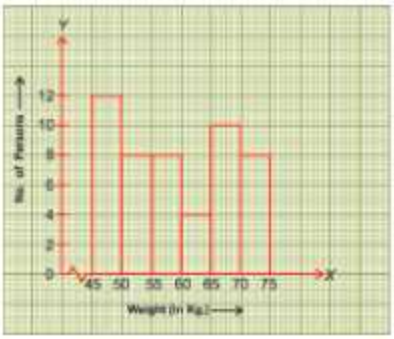


Figure 4.2

Example 4.8 : The weekly wages (in ₹) of 30 workers in a factory are:

830, 835, 890, 810, 835, 836, 869, 845, 898, 890, 820, 860, 832, 833, 855, 845, 804, 808, 812, 840, 885, 835, 835, 836, 878, 840, 868, 890, 806, 840

Prepare a frequency distribution table using intervals 800-810, 810-820 and so on.

(i) Draw a histogram of the above distribution.

(ii) Which group has the maximum number of workers?

(iii) How many workers earn ₹ 850 and more?

(iv) How many workers earn less than ₹ 850?

Sol.

Frequency Distribution

Wages	Tally Marks	No of Workers (Frequency)
800-810	III	3
810-820	II	2
820-830	I	1
830-840	𝍸 IIII	9
840-850	𝍸	5
850-860	I	1
860-870	III	3
870-880	I	1
880-890	I	1
890-900	IIII	4
Total		**30**

Table 4.11

(i) Now we shall draw histogram for the above table. For this, we represent wages along x-axis and number of workers along y-axis on a suitable scale. since the scale on x-axis starts at 800. So a kink (⩘) is indicated near the origin. Now, draw the rectangular bars according to the values.

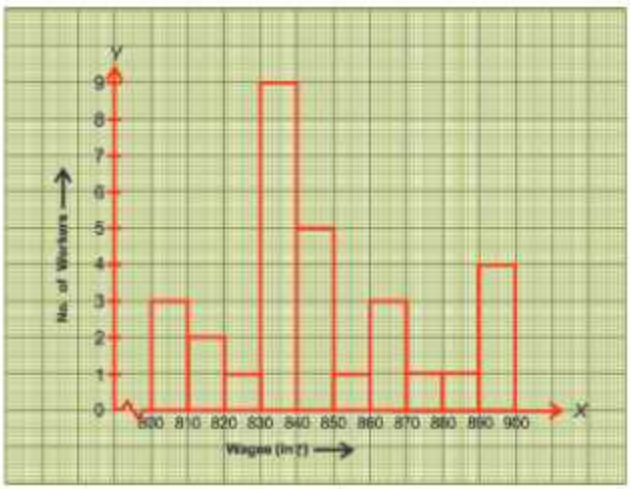


Figure 4.3

(ii) Clearly, the bar of 830-840 is highest. So group 830-840 has the maximum number of workers.

(iii) Number of workers earn ₹850 and more = 1 + 3 + 1 + 1 + 4 = 10

(iv) Number of workers earn less than ₹850 = 3 + 2 + 1 + 9 + 5 = 20

Example 4.9 : The following histogram shows the number of literate females in the age group of 10 to 40 years in a town.

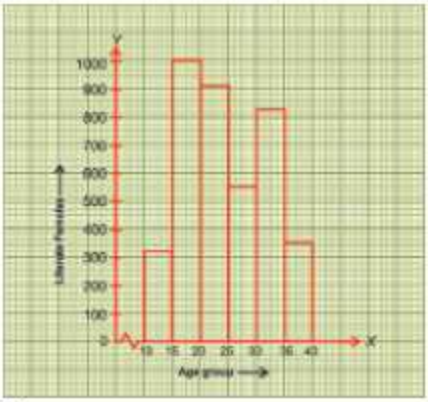


Figure 4.4

(i) Write the age group in which the number of literate female is the highest?

(ii) What is the class width?

(iii) What is the lowest frequency?

(iv) In which group literate females are least?

(v) Which information does this histrogram represents?

Sol. (i) The number of literate females is highest in 15-20.

(ii) Class width of all class intervals is 5.

(iii) The lowest frequency is 320.

(iv) Literate females are least in group 10-15.

(v) The Histogram represents the number of Literate females in different age group.

Example 4.10 : The number of hours for which students of a particular class watched television during holidays is shown through the given graph.

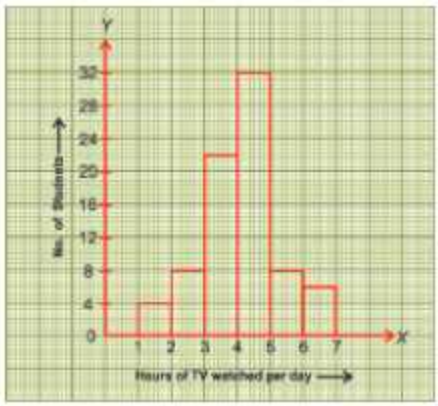


Figure 4.5

Answer the following questions:

(i) For how many hours did the maximum number of students watch TV?

(ii) How many students watch TV for less than 4 hours?

(iii) How many students spent more than 5 hours in watching TV?

Sol. (i) The maximum number of students watch TV = 4-5 hours.

(ii) The number of students watch TV for less than 4 hours = 4 + 8 + 22 = 34

(iii) The number of students watch TV for more than 5 hours = 8 + 6 = 14

Exercise 4.2

Draw Histogram of the Following:-

1.

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	6	9	12	8	10	5

2.

Class Interval	0-20	20-40	40-60	60-80	80-100
Frequency	15	12	18	24	21

3.

Weight (in kg)	25-30	30-35	35-40	40-45	45-50	50-55
No. of persons	4	8	13	15	10	12

4.

Class Intervals	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	26	18	30	15	24	35

5.

Daily earnings (in ₹)	450-500	500-550	550-600	600-650	650-700	700-750
Number of persons	16	10	12	20	25	12

6. In a survey of 20 people, the amount of money with them is found to be as follows:-
104, 98, 98, 88, 91, 99, 107, 109, 116, 121, 121, 133, 146, 159, 172, 185, 197, 209, 225, 108.

Draw a histogram of the frequency distribution of above data (taking one of class intervals 50-100)

7. The marks obtained by 40 students of class VIII in an examination are given below:-
18, 8, 12, 6, 8, 16, 12, 5, 23, 16, 2, 23, 7, 12, 20, 16, 9, 7, 5, 6, 5, 3, 13, 21, 13, 20, 15, 7, 1, 21, 20, 18, 13, 23, 15, 18, 7, 17, 16, 3.

Prepare a frequency distribution using one of the class as 15-20. Draw histogram also.

8. The following histogram depicts the marks obtained by 46 students of a class.

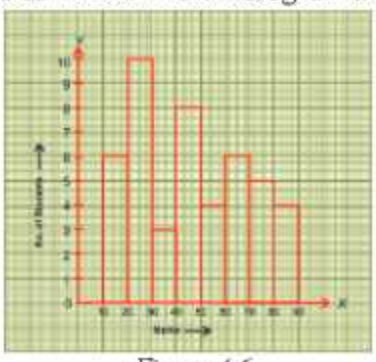


Figure 4.6

Observe the histogram and answer the following :

(i) What is the class size?

(ii) How many students obtained less than 20 marks?

(iii) How many students obtained 30 or more marks but less than 60?

(iv) If passing marks are 30. What is the number of failures?

9. Observe the following histogram and answer the questions given below:-

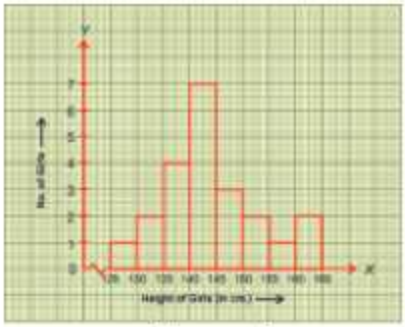


Figure 4.7

(i) What information is given by the graph?

(ii) Which group has maximum girls?

(iii) How many girls have a height of 145 cm and more?

10. The following histogram shows the frequency distribution of the ages of teachers in a school :

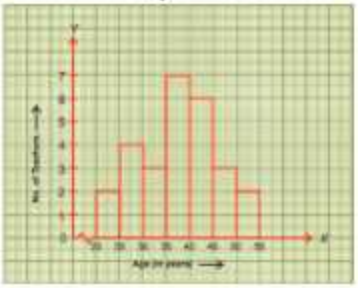


Figure 4.8

(i) What is the number of eldest and youngest teachers in the school?

(ii) Which age group teachers are more in the school and which least?

(iii) What is the class size?

11. Multiple Choice Questions :

(A) Below is the histrogram depicting marks obtained by 44 students of a class?

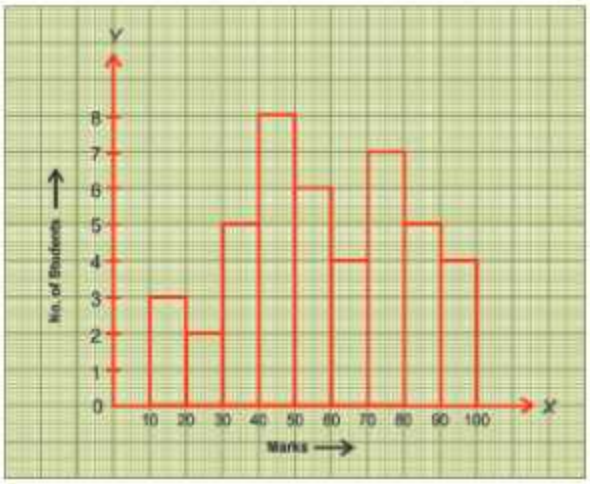


Figure 4.9

Choose the correct answer of the following:-

(i) What is the class size?

(a) 5 (b) 10 (c) 20 (d) 43

(ii) Write the number of students getting highest marks?

(a) 1 (b) 2 (c) 3 (d) 4

(iii) How many students get more than 60 marks?

(a) 20 (b) 21 (c) 22 (d) 24

(iv) How many students get less than 40 marks?

(a) 13 (b) 18 (c) 8 (d) 10

(v) In which class interval number of students are maximum?

(a) 20-30 (b) 30-40 (c) 40-50 (d) 90-100

(B) In a histogram, if all the intervals are of same size, then area of each bar is equal to

(a) Frequency (b) Height of bar

(c) Class Size (d) Class Size × frequency

12. State whether the following statements are True or False:

(i) There is no difference between bar graphs and histograms. (T/F)

(ii) Histogram is a bar graph with gap between two adjacent rectangles. (T/F)

(iii) In histogram the height of rectangle is meaningless. (T/F)

4.6 Circle Graph or Pie Chart:-

In previous section, we have learnt about classification and tabulation of data and their graphical representation by using histograms. In this section, we shall learn diagramatic representation of data.

The diagramatic representation has more preference than the graphic representatian as we can draw diagrams on any type of paper but for graphical representation, we generally need a graph paper.

In this section, we shall discuss a particular type of diagram, known as **circle-graphs** or **pie chart** to represent the given data.

"A pie chart is a pictorial representation of the numerical data by non-intersecting adjacent sectors of the circle such that area of each sector is proportional to the magnitude of the data represented by the sector.

4.6.1 Drawing a Pie Chart:- Pie Chart shows the relationship between a whole and its parts. The whole is divided into sectors. The size of each sector is proportional to the information it represents.

We know that the area of a sector is proportional to the angle subtended by it at the centre by its arc. So, sector angles or central angles are proportional to the component values of the components represented by the sectors. The total angle of a circle is 360°.

$$\text{Thus, central angle of the components} = \frac{\text{Value of the component}}{\text{Sum of the Component values}} \times 360°$$

Let's discuss some examples for construction of a pie chart.

Example 4.11 : The favourite flavours of ice-creams for students of a school are given in percentage as follows:-

Flavours	Vanilla	Chocolate	Other Flavours
Percentage of students	50%	25%	25%

Represent this data in a pie chart.

Sol. The total angle at the centre of the circle is 360°. The central angles of the sectors will be a fraction of 360°.

$$\therefore \text{ Central angle of the components} = \frac{\text{Value of the component}}{\text{Sum of the Component values}} \times 360°$$

Flavours	**Percentage of Students**	**Fraction = $\frac{\text{components}}{\text{sum of components}}$**	**Central Angle**
Vanilla	50%	$\frac{50}{100} = \frac{1}{2}$	$\frac{1}{2} \times 360° = 180°$
Chocolate	25%	$\frac{25}{100} = \frac{1}{4}$	$\frac{1}{4} \times 360° = 90°$
Others	25%	$\frac{25}{100} - \frac{1}{4}$	$\frac{1}{4} \times 360° - 90°$
Total	100		360°

Table 4.12

Steps for construction of a Pie Chart

1. Draw a circle with any convenient radius. Mark its centre O and radius OA.

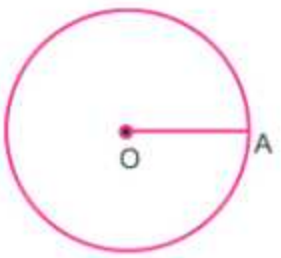


Figure 4.10

2. The angle of the sector of Ist component (Vanilla) is 180°. Use the protractor to draw $\angle AOB = 180°$ with base OA.

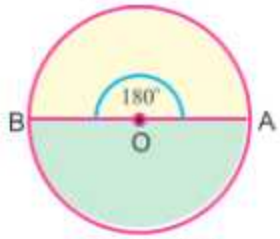


Figure 4.11

3. The angle of the sector of 2nd component (chocolate) is 90°. Use the protractor to draw $\angle BOC = 90°$ with base OB.

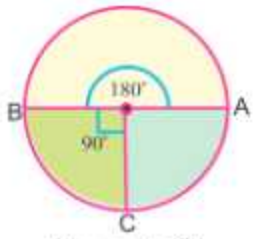


Figure 4.12

4. Now, we observe that the remaining angle of the sector $\angle COA = 90°$ with base OC, which represents the last component. It is our required Pie chart

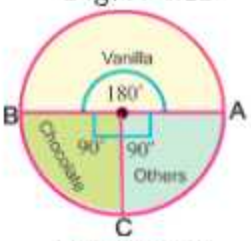


Figure 4.13

Example 4.12 : Draw a pie chart showing the following information. The table shows the colour preferred by a group of people.

Colours	Blue	Green	Red	Yellow	Total
No. of People	9	18	6	3	36

Sol. We know that

$$\text{Central angle of a component} = \frac{\text{component's value}}{\text{sum of all the values}} \times 360°$$

Colours	**No. of People**	**Fractions**	**Central angle**
Blue	9	$\frac{9}{36} = \frac{1}{4}$	$\frac{1}{4} \times 360° = 90°$
Green	18	$\frac{18}{36} = \frac{1}{2}$	$\frac{1}{2} \times 360° = 180°$
Red	6	$\frac{6}{36} - \frac{1}{6}$	$\frac{1}{6} \times 360° - 60°$
Yellow	3	$\frac{3}{36} = \frac{1}{12}$	$\frac{1}{12} \times 360° = 30°$
Total	**36**		**360°**

Table 4.13

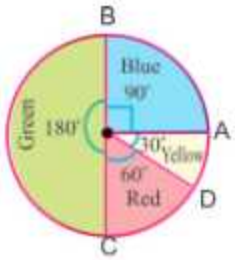


Figure 4.14

Example 4.13 : The number of hours spent by a school boy on different activities in a working day, is given below:-

Activity	Sleep	School time	Home work	Play	Others	Total
No. of hours	8	7	4	2	3	24

Draw a pie chart for this data.

Sol. We know

$$\text{Central angle of a component} = \frac{\text{Component's value}}{\text{Sum of all values}} \times 360°$$

Activity	No. of hours	Fraction Part	Central angle
Sleep	8	$\frac{8}{24} = \frac{1}{3}$	$\frac{1}{3} \times 360° = 120°$
School time	7	$\frac{7}{24}$	$\frac{7}{24} \times 360° = 105°$
Home work	4	$\frac{4}{24} = \frac{1}{6}$	$\frac{1}{6} \times 360° = 60°$
Play	2	$\frac{2}{24} = \frac{1}{12}$	$\frac{1}{12} \times 360° = 30°$
Others	3	$\frac{3}{24} = \frac{1}{8}$	$\frac{1}{8} \times 360° = 45°$
Total	**24**		**360°**

Table 4.14

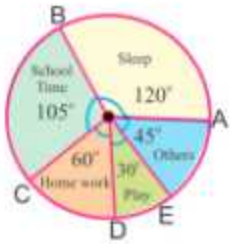


Figure 4.15

Example 4.14 : The following data shows the expenditure of a person on different items during a month. Represent the data by a pie chart

Items	Rent	Education	Food	Clothing	Others
Amount (in ₹)	2700	1800	2400	1500	2400

Sol.

Items	Amount	Fraction	Central angle
Rent	2700	$\frac{2700}{10800} = \frac{1}{4}$	$\frac{1}{4} \times 360° = 90°$
Education	1800	$\frac{1800}{10800} = \frac{1}{6}$	$\frac{1}{6} \times 360° = 60°$
Food	2400	$\frac{2400}{10800} = \frac{2}{9}$	$\frac{2}{9} \times 360° = 80°$
Clothing	1500	$\frac{1500}{10800} = \frac{5}{36}$	$\frac{5}{36} \times 360° = 50°$
Others	2400	$\frac{2400}{10800} = \frac{2}{9}$	$\frac{2}{9} \times 360° = 80°$
Total	**10800**		**360°**

Table 4.15

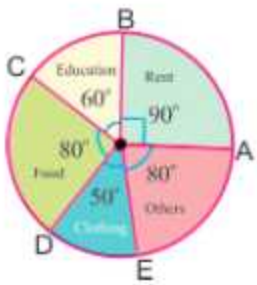


Figure 4.16

4.6.2 Reading of Pie Chart:-

In previous section, we have learnt about construction of a pie chart. In this section, we shall obtain information related to given data from the given pie chart.

We know,

$$\text{Central Angle} = \frac{\text{Value of Component}}{\text{Sum of all values}} \times 360^\circ$$

$$\text{Or} \quad \text{Value of Component} = \frac{\text{Central angles} \times \text{sum of values of all components}}{360^\circ}$$

$$\text{and Percentages value of a component} = \frac{\text{Central angle of component}}{360^\circ} \times 100$$

These formulae will be used to find the values of various components of the data from pie chart.

Example 4.15 : The given pie chart shows the marks obtained by Anita in differnt subjects. If the total marks is 540 then find the marks obtained in each subject

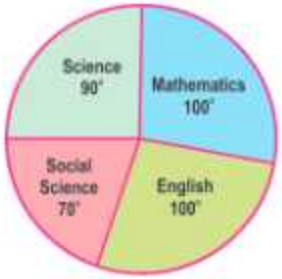


Figure 4.17

Sol. Here total marks = 540

We know that

$$\text{Marks obtained in each subject} = \frac{\text{Central angle of subject}}{360^\circ} \times \text{Total marks}$$

$$= \frac{\text{Central angle of subject}}{360^\circ} \times 540$$

Subject	Central Angle	Fraction	Marks
Mathematics	100°	$\frac{100^\circ}{360^\circ} = \frac{5}{18}$	$\frac{5}{18} \times 540 = 150$
Science	90°	$\frac{90^\circ}{360^\circ} = \frac{1}{4}$	$\frac{1}{4} \times 540 = 135$
Social Science	70°	$\frac{70^\circ}{360^\circ} = \frac{7}{36}$	$\frac{7}{36} \times 540 = 105$
English	100°	$\frac{100^\circ}{360^\circ} = \frac{5}{18}$	$\frac{5}{18} \times 540 = 150$
Total	**360°**		**540**

Table 4.16

Example 4.16 : The pie chart shows the marks obtained by a student in various subjects. If the student scored 180 marks in Mathematics. Find the

(i) Total Marks obtained

(ii) Marks obtained in each subject

Figure 4.18

Sol. (i) Marks obtained in Mathematics = 180

We know that

$$\text{Value of a Component} = \frac{\text{Central angle}}{360°} \times \text{Sum of all values}$$

$$\Rightarrow 180 = \frac{\text{Central Angle of Mathematics}}{360°} \times \text{Total marks}$$

$$\Rightarrow 180 = \frac{90°}{360°} \times \text{Total marks}$$

$$\Rightarrow \text{Total marks} = 180 \times \frac{360°}{90°} = 720$$

(ii)

Subject	Central Angle	Marks
Hindi	60°	$\frac{60°}{360°} \times 720 = 120$
Science	75°	$\frac{75°}{360°} \times 720 = 150$
Social Science	70°	$\frac{70°}{360°} \times 720 = 140$
English	65°	$\frac{65°}{360°} \times 720 = 130$
Mathematics	90°	$\frac{90°}{360°} \times 720 = 180$
Total	**360°**	**720**

Table 4.17

Exercise 4.3

Draw a pie chart for the following (1-5) :-

1. The number of Students in a hostel speaking different languages is given below:-

Language	Hindi	Punjabi	English	Marathi	Tamil	Bengali	Total
No. of students	10	30	12	9	7	4	72

2. The number of students admitted in different faculties of a college are given below:-

Faculty	Science	Arts	Commerce	Law	Education	Total
No. of Students	1000	1200	650	450	300	3600

3. The following data represents the expenditure of a family in different items:

Items	Food	Clothing	Rent	Education	Others
Expenditure (in ₹)	4000	2000	1500	1500	1000

4. In one day, the sales (in ₹) of different items of a bakery are given below:-

Items	Ordinary Bread	Fruit Bread	Cakes	Biscuits	others
Sales (in ₹)	260	40	100	60	20

5. The following data gives the amount spent on the construction of a house.

Items	Cement	Timber	Bricks	Labour	Steel	others
Expenditure (in thousand rupees)	60	30	45	75	45	45

6. The given pie chart shows the annual agricultural production of an Indian state. If the production of all the commodities is 8100 tonnes, find the production of each product.

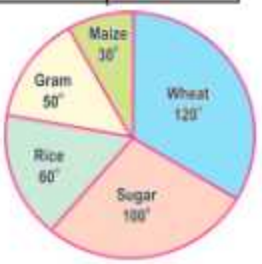


Figure 4.19

7. The given pie chart shows the marks obtained by a student in an examination. If the student secure 880 marks in all, calculate her marks in each subject.

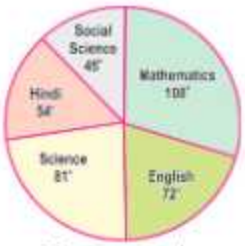


Figure 4.20

8. The following pie chart shows the monthly expenditure of a family. If the family spends ₹1650 on clothing. Answer the following question.
(i)What is the total monthly expenditure of family?
(ii) Find expenditure on each item.

Figure 4.21

9. The given pie chart shows the marks obtained by a student in various subjects. If the student scored 135 marks in mathematics , find the
(i) Total Marks obtained
(ii) Marks obtained in each subject

Figure 4.22

10. **Multiple Choice Questions :**
(i) A diagram which is used to represent data by dividing a circle into sectors is called

(a) Bar Graph (b) Histogram (c) Pie Chart (d) None of these

(ii) Sum of all central angles in a pie chart is

(a) 90° (b) 180° (c) 360° (d) 270°

(iii) In a class of 40 students, if 8 students take gardening as a hobby, the central angle of the sector representing the students who have taken gardening as a hobby.

(a) 72° (b) 90° (c) 50° (d) 30°

(iv) If 60% of students of a school speak Punjabi, then what is the central angle of the sector representing the students who speak punjabi.

(a) 126° (b) 216° (c) 144° (d) 162°

(v) If the central angle of a sector representing the playing cricket in a particular school is 108°, the percentage of the students playing cricket in a school?

(a) 30% (b) 45% (c) 90% (d) 72%

11. Multiple Choice Questions :

The following pie chart shows the monthly expenditure of Shikha on various items. If she spends ₹ 36000 per month, then choose the correct option of the following questions:

Figure 4.23

(i) How much does she spend on food?

(a) ₹ 8100 (b) ₹ 3600

(c) ₹ 13500 (d) ₹ 10800

(ii) How much does she spend on rent?

(a) ₹ 8100 (b) ₹ 3600 (c) ₹ 13500 (d) ₹ 10800

(iii) How much does she spend on others?

(a) ₹ 8100 (b) ₹ 3600 (c) ₹ 13500 (d) ₹ 10800

(iv) How much does she spend on Education?

(a) ₹ 8100 (b) ₹ 3600 (c) ₹ 13500 (d) ₹ 10800

4.7 Chance and Probability:-

In our daily life, we come across many statements like

(i) Probably you are right

(ii) It may rain today

(iii) Indian team has good chance of winning.

In such statements, we generally use the terms: May, probable, likely, chance etc. All these terms represent the same sense that the event is not certain to take place. Such examples where the chances of a certain thing happening or not happening are not equal, This is the rough idea of meaning of 'probability'. However, in the theory of probability, we assign numerical value to the degree of uncertainity. The concept of probability originated in the beginning of 18th century in problems like throwing a die, tossing a coin, drawing a card from a pack of cards etc. Starting with game of chance, Now it is commonly used in our day-to-day conversation.

Getting a Result:- We know that before a cricket match starts, captains of the two teams go out to toss a coin to decide that which team will bat first.

- When a coin is tossed then the possible results are head or tail.

Such an experiment is called a **random experiment** and Head or Tail are the two outcomes of this experiment and getting a head or tail is called an **event**.

For example:- When a die is thrown then outcomes are 1, 2, 3, 4, 5 or 6 and throwing a die is called a random experiment.

Random experiment or Event	Outcomes
1. Tossing a coin	Head or tail
2. Throwing a die	1, 2, 3, 4, 5, or 6

4.7.1 Linking chances to probability:-

- Consider the experiment of tossing a coin once. The outcomes are head or tail. Since both outcomes has same chance of occuring. Such outcomes are called **'equally likely outcomes'**. Here, total number of outcomes = 2.

  Now, getting a head is one out of two outcomes i.e. $\frac{1}{2}$, we say that the probability of getting a head = $\frac{1}{2}$ and getting a tail is one out of two outcomes, i.e. $\frac{1}{2}$, we say that the probability of getting a tail = $\frac{1}{2}$

Total outcomes	Events	Probability
2	Number of heads = 1	1 out of 2 i.e. $\frac{1}{2}$
	Number of tails = 1	1 out of 2 i.e. $\frac{1}{2}$

Table 4.18

- Consider the experiment of throwing a die once. The outcomes are 1, 2, 3, 4, 5, or 6. All outcomes are equally likely outcomes.

Total outcomes	Events		Probability
6	Number 1	1	1 out of 6, i.e. $\frac{1}{6}$
	Number 2	1	1 out of 6, i.e. $\frac{1}{6}$
	Number 3	1	1 out of 6, i.e. $\frac{1}{6}$
	Number 4	1	1 out of 6, i.e. $\frac{1}{6}$
	Number 5	1	1 out of 6, i.e. $\frac{1}{6}$
	Number 6	1	1 out of 6, i.e. $\frac{1}{6}$

Table 4.19

From the above table, it is clear that probability of an event is

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes of the experiment}}$$

Let's discuss some examples :

Example 4.17 : A coin is tossed once. What is the probability of getting a (i) Head (ii) Tail.

Sol. In a single toss of a coin, we can get any one of two faces, head or tail

So, total number of outcomes of the experiment = 2

(i) Getting a head is 1 out of 2 outcomes i.e. P (getting a head) $= \frac{1}{2}$

(ii) Getting a tail is 1 out of 2 outcomes i.e. P (getting a tail) $= \frac{1}{2}$

Figure 4.24

Example 4.18 : A bag has 5 red balls and 3 blue balls. A ball is drawn from the bag without looking into the bag. What is the probability of getting

(i) a red ball (ii) a blue ball?

Sol. Total number of balls (outcomes) in the bag = 5 + 3 = 8

(i) Number of Red balls = 5 out of 8

$\therefore$ P (getting a red ball) $= \frac{5}{8}$

(ii) Number of Blue balls = 3 out of 8

$\therefore$ P (getting a blue ball) $= \frac{3}{8}$

Example 4.19 : In the given figure a square is divided into 9 equal parts. One part is selected at random, find the probability that selected part is

(i) Shaded part (ii) Unshaded part

Sol. Total boxes = 9

(i) Number of shaded boxes = 5 out of 9

$\therefore$ P (shaded part) $= \frac{5}{9}$

(ii) Number of unshaded boxes = 4 out of 9

$\therefore$ P (unshaded part) $= \frac{4}{9}$

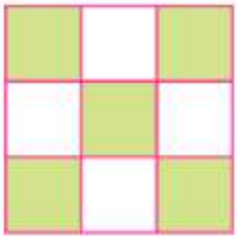


Figure 4.25

Example 4.20 : In the given figure, a circle is divided into 8 equal parts where, R represents red colour and G represents green colour. One part is selected at random then find the probability of getting

(i) A green colour (ii) A red colour

Figure 4.26

Sol. Total parts = 8

(i) Number of parts having G = 5 out of 8

$$\therefore \text{P (green colour)} = \frac{5}{8}$$

(ii) Number of parts having R = 3 out of 8

$$\therefore \text{P (red colour)} = \frac{3}{8}$$

Example 4.21 A die is thrown, Find the probability of getting

(i) a prime number (ii) number 2 or 4

(iii) number greater than 4 (iv) an odd number

Figure 4.27

Sol. Total outcomes = 6

(i) Prime numbers = 2, 3, 5

Number of prime numbers = 3 out of 6

$$\therefore \text{P (prime number)} = \frac{3}{6} = \frac{1}{2}$$

(ii) Number of outcomes of 2 or 4 = 2 out of 6

$$\therefore \text{P (getting 2 or 4)} = \frac{2}{6} = \frac{1}{3}$$

(iii) Number greater than 4 = 5, 6

so number of outcomes of greater than 4 = 2 out of 6

$$\therefore \text{P (number greater than 4)} = \frac{2}{6} = \frac{1}{3}$$

(iv) Odd numbers = 1, 3, 5

Number of odd numbers = 3 out of 6

$$\therefore \text{P (an odd number)} = \frac{3}{6} = \frac{1}{2}$$

Example 4.22 A bag contains 5 red marbles, 7 white marbles, 3 blue marbles. What is the probability that if one marble is taken out of the bag at random, it will be

(i) red (ii) white (iii) blue (iv) not white

Sol. Total marbles in the bag = 5 + 7 + 3 = 15

(i) Number of red marbles = 5 out of 15

$$\therefore \text{P (a red marble)} = \frac{5}{15} = \frac{1}{3}$$

(ii) Number of white marbles = 7 out of 15

$$\therefore \text{P (a white marble)} = \frac{7}{15}$$

(iii) Number of blue marbles = 3 out of 15

$\therefore$ P (a blue marble) $= \frac{3}{15} = \frac{1}{5}$

(iv) Number of marbles which are not white = 5 + 3 = 8 (out of 15)

$\therefore$ P (not white) $= \frac{8}{15}$

Example 4.23 20 cards numbered 1,2,3, ___, 20 are put in a box and mixed thoroughly. One person draws a card from the box. Find the probability that the number on the card is

(i) an odd number (ii) a prime number

(iii) divisible by 3 (iv) single digit

Sol. Total number of cards = 20

(i) Odd numbers = 1, 3, 5, 7, 9, 11,13, 15, 17, 19

Number of odd numbers = 10 out of 20

$\therefore$ P (an odd number) $= \frac{10}{20} = \frac{1}{2}$

(ii) Prime numbers =2,3,5,7,11,13,17,19

Number of prime numbers = 8 out of 20

$\therefore$ P (a prime number) $= \frac{8}{20} = \frac{2}{5}$

(iii) Numbers divisible by 3 = 3, 6, 9, 12, 15, 18

Number of numbers divisible by 3 = 6 out of 20

$\therefore$ P (a number divisible by 3) $= \frac{6}{20} = \frac{3}{10}$

(iv) Single Digits = 1, 2, 3, 4, 5, 6, 7, 8, 9

Number of single digits = 9 out of 20.

$\therefore$ P (single digit) $= \frac{9}{20}$

Exercise 4.4

1. A die is thrown, Find the probability of getting a number (i) less than 3 (ii) greater than 5 (iii) number 4.
2. An urn contains 7 green balls and 5 red balls. One ball is selected at random. Find the probability of getting (i) a green ball (ii) a red ball.
3. A Bag contains 5 blue marbles, 8 green marbles, 4 red marbles and 7 yellow marbles. One marble is selected at random and find the probability of getting

(i) a blue marble (ii) a green marble (iii) a red marble

(iv) a yellow marble (v) not blue (vi) not red

4. In a class, there are 15 girls and 12 boys, one student is selected as a monitor. Find the probability that monitor is a (i) boy (ii) girl

5. One letter is selected from English alphabets. Find the probability that it is a (i) Vowel (ii) consonant

6. Following plane figures are divided into equal parts and one part is selected at random. Find the probability that selected part is (i) shaded (ii) unshaded part

(a) (b) (c)

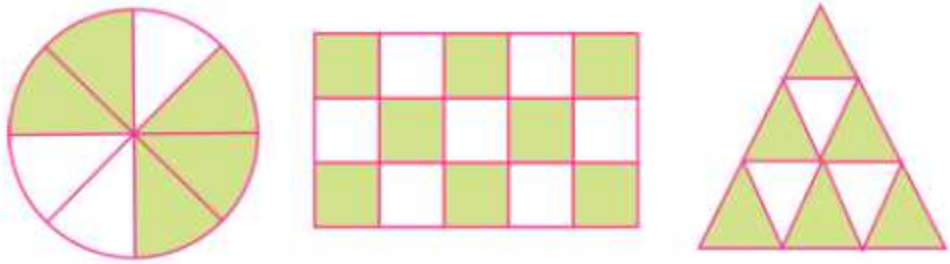


Figure 4.29

7. 25 cards numbered 1, 2, 3, ___, 25 are put in a box and mixed thoroughly. One person draws a card from the box. Find the probability that the number on the card is :
(i) an odd number (ii) an even number (iii) divisible by 5 (iv) a prime number

8. **Multiple Choice Questions :**

(i) The probability of getting a head in tossing of a coin is

(a) $\frac{1}{3}$ (b) $\frac{2}{3}$ (c) 1 (d) $\frac{1}{2}$

(ii) The probability of getting an even number in throwing a die is

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{2}{5}$ (d) $\frac{1}{4}$

(iii) The probability of selecting a vowel from the English alphabets is

(a) $\frac{1}{5}$ (b) $\frac{5}{26}$ (c) $\frac{2}{5}$ (d) $\frac{5}{18}$

(iv) Which of the following is a random experiment?

(a) Rolling a die (b) Throwing a coin
(c) Choosing a marble from a Jar (d) All of them

(v) The probability of getting a red ball from a bag containing 10 blue balls.

(a) $\frac{1}{10}$ (b) 0 (c) 1 (d) $\frac{1}{5}$

Learning Outcomes

After completion of the chapter, the students are now able to

- *Collect and present data in various forms.*
- *Present the data in histograms and pie charts.*
- *Interpret the histograms and pie charts.*
- *Use histograms and pie charts in daily life situations.*
- *Understand the concept of probability.*
- *Relate chances and probability so real life problems.*

Answers

Exercise 4.1

1.

No. of Children	Tally Marks	Frequency
0	𝍸	5
1	𝍸 I	6
2	𝍸 𝍸 II	12
3	𝍸	5
4	𝍸 I	6
5	III	3
6	III	3
	Total	40

2.

Accident per day	Tally Marks	Frequency
0	II	2
1	III	3
2	𝍸 I	6
3	III	3
4	IIII	4
5	𝍸 I	6
6	𝍸 I	6
	Total	30

3.

Ages (in years)	Tally Marks	Frequency
12	III	3
13	𝍸 IIII	9
14	𝍸 III	8
15	II	2
16	II	2
17	I	1
	Total	25

4.

Shoppers	Tally Marks	Frequency
M	𝍸 𝍸 𝍸	15
W	𝍸 𝍸 𝍸 𝍸 𝍸 III	28
B	𝍸	5
G	𝍸 𝍸 II	12
	Total	60

5.

Interval	Tally Marks	Frequency
30-35	III	3
35-40	IIII	4
40-45	IIII	4
45-50	𝍸	5
50-55	I	1
55-60	I	1
60-65	I	1
65-70	I	1
	Total	20

6.

Marks obtained	Tally Mark	Frequency
0-10	II	2
10-20	𝍸 𝍸	10
20-30	𝍸 𝍸 𝍸 𝍸 I	21
30-40	𝍸 𝍸 𝍸 IIII	19
40-50	𝍸 II	7
50-60	I	1
	Total	60

7.

Tax Bills (in ₹)	Tally Mark	Frequency
10-20	III	3
20-30	I	1
30-40	IIII	4
40-50	IIII	4
50-60	I	1
60-70	II	2
70-80	𝍸	5
80-90	III	3
90-100	II	2
100-110	II	2
110-120	III	3
	Total	30

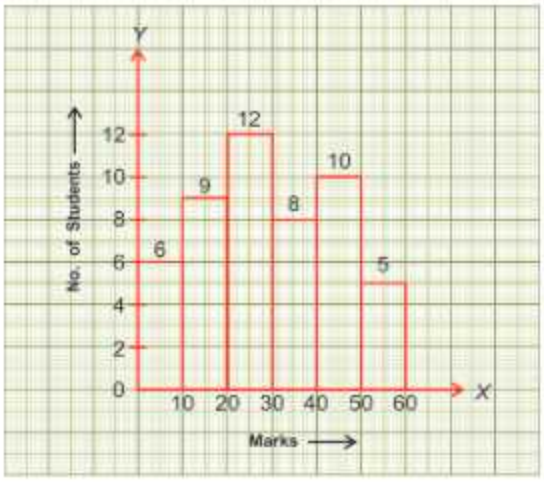
8.

Marks	Tally Mark	Frequency
0-5	I	1
5-10	𝍸	5
10-15	III	3
15-20	𝍸	5
20-25	IIII	4
25-30	III	3
30-35	II	2
35-40	II	2
40-45	II	2
45-50	II	2
50-55	I	1
	Total	30

9. (i) c (ii) a (iii) b (iv) d (v) a (vi) a
(vii) a (viii) a
(ix) (A) (a)
(B) (b)
(C) (c)
(D) (d)

Exercise 4.2

1.



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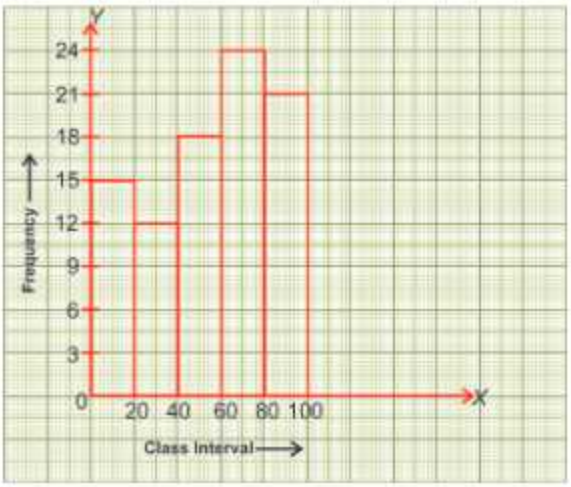
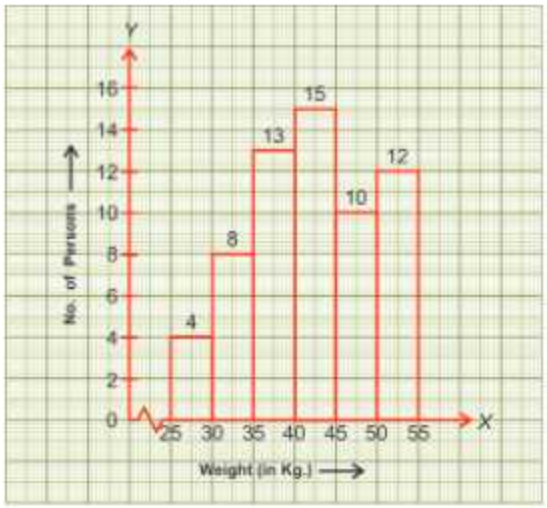


3.



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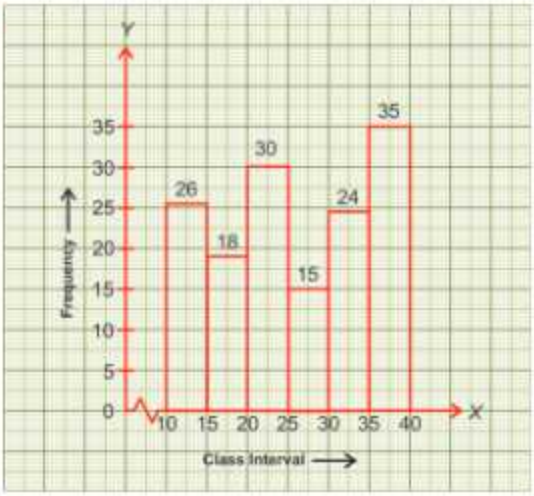
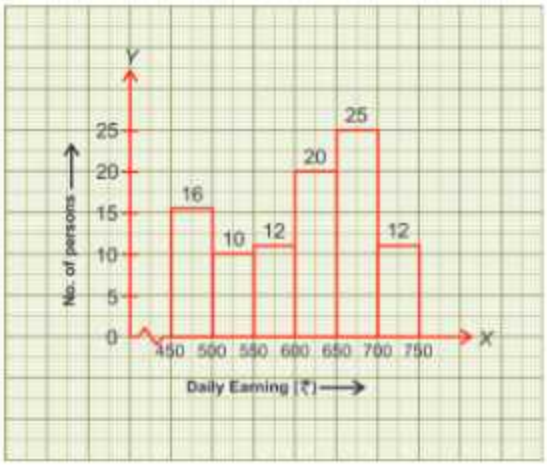
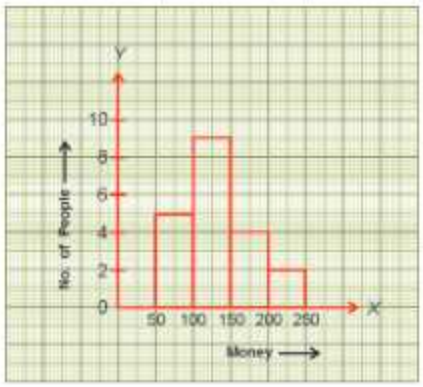


5.



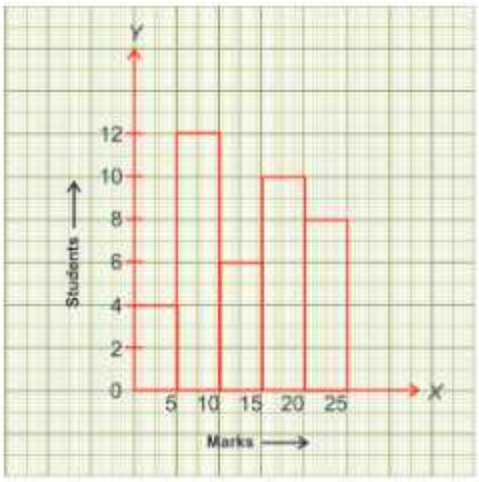
6. Frequency Distribution

Money	Tally Mark	No. of People
50-100	𝍸	5
100-150	𝍸 IIII	9
150-200	IIII	4
200-250	II	2
	Total	20



7. Frequency Distribution

Marks	Tally Mark	Students
0-5	IIII	4
5-10	𝍸 𝍸 II	12
10-15	𝍸 I	6
15-20	𝍸 𝍸	10
20-25	𝍸 III	8
	Total	40



8. (i) 10 (ii) 6 (iii) 15 (iv) 16

9. (i) Number of girls with different height (ii) 140-145 (iii) 8

10. (i) 2, 2 (ii) More age group 35-40, least 20-25, 50-55 (iii) 5

11. (A) (i) b (ii) d (iii) a (iv) d (v) c (B) d

12. (i) False (ii) False (iii) False

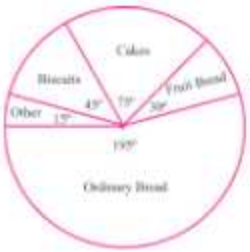
Exercise 4.3

1.

2.

3.

4.



5.

6. Wheat = 2700 tonnes, Sugar = 2250 tonnes, Rice = 1350 tonnes, Gram = 1125 tonnes, Maize = 675 tonnes.

7. Mathematics = 264, English = 176, Science = 198, Hindi = 132, Social Science = 110

8. (i) ₹ 16500 (ii) Food = ₹ 4950, Rent = ₹ 4125, Saving = ₹ 2475, Clothing = ₹ 1650, others = ₹ 3300

9. (i) 540 (ii) English = 93, Hindi = 90, Social Science = 108, Science = 114, Mathematics = 135

10. (i) c (ii) c (iii) a (iv) b (v) a

11. (i) c (ii) a (iii) c (iv) c

Exercise 4.4

1. (i) $\frac{1}{3}$ (ii) $\frac{1}{6}$ (iii) $\frac{1}{6}$ 2. (i) $\frac{7}{12}$ (ii) $\frac{5}{12}$

3. (i) $\frac{5}{24}$ (ii) $\frac{1}{3}$ (iii) $\frac{1}{6}$ (iv) $\frac{7}{24}$ (v) $\frac{19}{24}$ (vi) $\frac{5}{6}$

4. (i) $\frac{4}{9}$ (ii) $\frac{5}{9}$ 5. (i) $\frac{5}{26}$ (ii) $\frac{21}{26}$

6. (a) (i) $\frac{5}{8}$ (ii) $\frac{3}{8}$ (b) (i) $\frac{8}{15}$ (ii) $\frac{7}{15}$

(c) (i) $\frac{2}{3}$ (ii) $\frac{1}{3}$

7. (i) $\frac{13}{25}$ (ii) $\frac{12}{25}$ (iii) $\frac{1}{5}$ (iv) $\frac{9}{25}$

8. (i) d (ii) b (iii) b (iv) d (v) b