CHAPTER

4 Data Handling

Topics to be Covered

- Introduction
- Measure of Central Tendency
- Arithmetic Mean
- Mode
- Median
- Bar Graph (or Bar Chart)
- Double Bar Graph

INTRODUCTION

Data refers to information collected as facts, measurements or observations for analysis. Data analysis enables us to draw conclusions, identify patterns and make informed decisions. In this chapter, we shall study that a single value can be represent entire data. We shall also learn to graphical represent data using bar graphs and double bar graphs.

IMPORTANT TERMS AND CONCEPTS

1. **Data:** The information collected in the form of numerical figures or a set of facts.

   For Example: (*i*) The marks obtained out of 50 by 10 students in Maths test are
   41, 25, 29, 45, 20, 49, 42, 38, 32, 48
   The list of marks given above is a data.

   (*ii*) Total scores of a cricket team in last 5 matches are
   215, 296, 315, 195, 278
   The list of scores given above is a data.

2. **Observation:** Each numerical figure in a data is called observation.

   For Example: Consider the data 210, 110, 219
   In data 210 (or) 110 (or) 219 is an observation.

3. **Types of data:** There are basically two types of data.
   (*i*) Raw Data (*ii*) Arrayed data
   (*i*) **Raw Data:** The data collected directly from the source and is not processed is call raw data.

   For Example: The set of observation as 38°C, 29°C, 32°C, 36°C is a raw data because the observations are arrayed randomly without any order (descending or ascending).

   (*ii*) **Arrayed data:** The data arranged in ascending or descending order is called arrayed data.

   For Example: (*i*) The set of observation as 29, 37, 73, 82 is in ascending order. So, it is an arrayed data.

   (*ii*) The set of observation as 81, 79, 60, 33 is in descending order. So, it is an arrayed data.

4. **Range**: The difference between the maximum and minimum values of the observations is called the range of the data.

   For Example: The weights of 5 students of class 7 of a school are

   41 kg, 46 kg, 39 kg, 40 kg, 36 kg

   $\therefore$ The range of given data = Maximum value – Minimum value

   = 46 kg – 36 kg = 10 kg

5. **Frequency of an Observation**: The number of times a particular observation occurs in a data is called its frequency.

   For Example: Consider the data below:

   8, 2, 7, 2, 6, 4, 5, 8, 5, 2, 6

   Frequency of observation '2' is 3.

   Frequency of observation '4' is 1.

   Frequency of observation '5' is 2.

   Frequency of observation '6' is 2.

   Frequency of observation '7' is 1.

   Frequency of observation '8' is 2.

6. **Tally Marks:** Tally marks are a very simple method of counting of numbers using small vertical lines. They are grouped in sets of five for making counting easier.

   The following table shows how numbers from 1 to 10 are expressed using tally marks.

Number	Tally Marks Representation	Number	Tally Marks Representation
1	𝍸	6	𝍸 𝍸
2	𝍸 𝍸	7	𝍸 𝍸 𝍸
3	𝍸 𝍸 𝍸	8	𝍸 𝍸 𝍸 𝍸
4	𝍸 𝍸 𝍸 𝍸	9	𝍸 𝍸 𝍸 𝍸 𝍸
5	𝍸 𝍸	10	𝍸 𝍸 𝍸 𝍸

7. **Tabular form of Data:** Marks obtained by 30 students in Science test arranged in ascending order are as below:

22, 23, 23, 23, 24, 24, 25, 26, 26, 26, 26, 27, 27, 27, 28, 28, 28, 28, 28, 29, 30, 30, 30, 30, 32, 32, 33, 33, 33, 37.

The above data may be represented in tabular form showing the frequency of each observation as below. Such tables are called frequency distribution tables.

Marks Obtained	Frequency	Tally Marks
22	1	|
23	3	|||
24	2	||
25	1	|
26	4	||||
27	3	|||
28	5	𝍸
29	1	|
30	4	||||
32	2	||
33	3	|||
37	1	|

Question 1: The weights (in kg) of 50 students of class 7 of a school are given below arranged in descending order. Find the range of the data. Prepare a frequency distribution table for the given data.

47, 46, 46, 45, 45, 45, 44, 44, 44, 44, 44, 44, 43, 43, 43, 43, 42, 42, 42, 42, 42, 42, 41, 41, 40, 40, 40, 40, 40, 40, 40, 40, 39, 39, 39, 39, 39, 39, 39, 39, 39, 39, 39, 38, 38, 38, 37, 36

Solution: The maximum and minimum values in the data are 47 kg and 36 kg .

$\therefore$ Range = 47 kg – 36 kg = 11 kg

The frequency distribution table for the given data is give below.

Weight (in kg)	Frequency	Tally Marks
36	1	|
37	1	|
38	3	|||
39	12	𝍸 𝍸 ||
40	9	𝍸 ||||
41	2	||
42	6	𝍸 |

43	4	𝍸
44	6	𝍸 I
45	3	𝍸
46	2	II
47	1	I

Test Your Understanding 1

Q.1. The number of factors of 36 is

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.2. The irreducible factorised form of $15x^3y^2z$ is _____ .

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.3. How many common factors of $12q^2$ and $6q^2$?

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.4. A perfect square number can never have the digit _____ at the units place.

(*a*) 9 (*b*) 8 (*c*) 1 (*d*) 4

MEASURE OF CENTRAL TENDENCY

We often use term 'average' in our day-to-day life. Consider the following statements involving the term 'average'.

Statement 1: Rohit studies on an average for 5 hours daily.

Statement 2: The average height of class 7 students of my school is 150 cm.

Statement 3: Delhi receives an average annual rainfall of 774 mm.

Think about the statements given above.

Do you think that the child, Rohit, in the first statement studies exactly for 5 hours daily?

Or, is the height of each student in that class is 150 cm?

Or, does Delhi receives rainfall of 774 mm every year? Obviously not.

By average, we understand that Rohit, usually, spends 5 hour studying. On some days, he may study for less time and on the other days he may study longer.

Similarly, height of some students in that class may be less than 150 cm and some students may be taller than 150 cm and from the third statement, we understand that Delhi usually receives annual rainfall of 774 mm. In a given year, it may be less than 774 mm and in some other year, it may be more than 774 mm.

We understand that the average is a number that represents or shows the central tendency of a data. Different forms of data need different types of representative value or central value to describe it better.

A single numerical value that gives us an idea or perspective about the entire data by identifying the 'center' of the data is called the representative value or the measure of central tendency. There are three representative values or measures of central tendency, within the scope of this class. These are:

(*i*) Arithmetic mean (*ii*) Median (*iii*) Mode

ARITHMETIC MEAN

The most common representative value of a set of observations or a data is the arithmetic mean or the mean. It is also called the average.

Mathematically, the arithmetic mean (A.M.) or the mean is defined as follows:

$$\text{A.M. (Mean)} = \frac{\text{Sum of all observations}}{\text{Total number of observations}}$$

If $x_1, x_2, x_3, \ldots\ldots\ldots, x_n$ are n observations, then their mean, $\overline{x}$, is given by

$$\text{Mean } (\overline{x}) = \frac{x_1 + x_2 + x_3 + \ldots\ldots + x_n}{n}$$

or $$\overline{x} = \frac{\sum_{i=1}^{n} x_i}{n}, \text{ where } \sum_{i=1}^{n} x_i = x_1 + x_2 + x_3 + \ldots\ldots + x_n$$

Let us take two examples to understand the concept better.

Example 1: Rohit studies for 4.5 hours, 5.5 hours, 6.5 hours, 5 hours and 3.5 hours on five consecutive days. How many hours does he study daily on an average?

Explanation: Here, we have asked to find average or arithmetic mean of a data.

$$\therefore \text{Average or Mean} = \frac{\text{Sum of all observations}}{\text{Total number of observations}}$$

$$= \frac{4.5 + 5.5 + 6.5 + 5 + 3.5}{5} = \frac{25}{5} = 5 \text{ hours}$$

So, Rohit studies for 5 hours daily on an average.

Example 2: Monthly electricity consumption of a household in first six months of an years is as follows: 250 units, 246 units, 212 units, 236 units, 532 units, 584 units. The average monthly consumption in these six months can be obtained using the below explanation.

Explanation: Average monthly electricity consumption $= \frac{250 + 246 + 212 + 236 + 532 + 584}{6}$

$= 343.33$ units.

So, the household has consumed 343.33 units per month on an average.

NOTE

(*i*) Arithmetic mean (or mean) always lies between maximum and minimum value in the data.

(*ii*) Arithmetic mean is not necessarily equal to any observation or value in the data.

Question 1: The ages of five players in a basketball team are 20, 24, 22, 26 and 28 years. What is the average age of the five players of the team?

Solution: We have to calculate the arithmetic mean of the ages of five players as below.

$$\therefore \text{ Average age of five players} = \frac{\text{Sum of ages of all players}}{\text{Number of players}}$$

$$= \frac{20 + 24 + 22 + 26 + 28}{5}$$

$$= \frac{120}{5} = 24 \text{ years}$$

Hence, the average age of five players of the team is 24 years.

Question 2: The average weight of five students is 48 kg. If the weight of four students are 51 kg, 46 kg, 49 kg and 47 kg, then what is the weight of fifth student?

Solution: Let the weight of the fifth student be x kg.

$$\therefore \text{ Average weight} = \frac{\text{Sum of weight of all students}}{\text{Number of students}}$$

$$\Rightarrow \quad 48 = \frac{51 + 46 + 49 + 47 + x}{5}$$

$$\Rightarrow \quad 48 = \frac{193 + x}{5}$$

$$\Rightarrow \quad 240 = 193 + x$$

$$\Rightarrow \quad x = 240 - 193$$

$$\Rightarrow \quad x = 47$$

Hence, the weight of the fifth student is 47 kg .

Question 3: The average age of 6 members in a dance group is 14 years. A new member aged 16 years, joins the group. What is the new average age of the group?

Solution: Average age of original 6 group members is 14 years.

$$\therefore \quad 14 = \frac{\text{Sum of ages of original 6 group members}}{6}$$

$\Rightarrow$ Sum of ages of original 6 group members = 84 years

Now, a new student aged 16 years joins the group. The average age of group, now, is given by

$$\text{New average age} = \frac{\text{Sum of ages of original 7 group members}}{7}$$

$$= \frac{\text{Sum of ages of original 6 group members + Age of new member}}{7}$$

$$= \frac{84+16}{7}\text{ years} = \frac{100}{7}\text{ years} = 14.28\text{ years.}$$

Hence, the new average age of the group is 14.28 years.

Question 4: The average weight of 8 players in a team is 65 kg. One player weighing 72 kg leaves the team. Find the average weight of the remaining players.

Solution: For original team of 8 players,

$$\text{Average weight} = \frac{\text{Sum of weight of 8 players}}{8}$$

$$\Rightarrow \quad 65 = \frac{\text{Sum of weight of 8 players}}{8}$$

$\Rightarrow$ Sum of weights of 8 players = 520 kg

When one player of weight 72 kg leaves, then the total weight of remaining 7 players

= 520 kg – 72 kg

= 448 kg

$$\therefore \text{ The average weight of remaining 7 players} = \frac{\text{Total weight of remaining 7 players}}{7}$$

$$= \frac{448}{7} = 64\text{ years}$$

Hence, the average weight of remaining 7 players is 64 years.

Question 5: The average monthly salary of 10 employees in an office is ₹50000 per month. One employee earning ₹60000 per month resigns and a new employee having salary ₹40000 per month joins. Find the new average salary of 10 employees.

Solution: Initially, the average monthly salary of 10 employees is ₹50000.

$$\therefore \quad ₹50000 = \frac{\text{Total salary of 10 employees}}{10}$$

$\Rightarrow$ Total salary of 10 employees = ₹500000 per month

$\therefore$ Total salary after removing 1 employee having salary ₹60000 per month

= (₹500000 – ₹60000) per month

= ₹440000 per month

So, the total salary after adding 1 employee having salary ₹40000 per month

= (₹440000 + ₹40000) per month

= ₹480000 per month

$$\therefore \text{ New average salary} = \frac{₹480000}{10} \text{ per month}$$

= ₹48000 per month

Hence, the new average salary of 10 employees is ₹48000 per month.

Test Your Understanding 2

Q.1. The number of factors of 36 is

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.2. The irreducible factorised form of $15x^3y^2z$ is _____ .

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.3. How many common factors of $12q^2$ and $6q^2$?

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.4. A perfect square number can never have the digit _____ at the units place.

(*a*) 9 (*b*) 8 (*c*) 1 (*d*) 4

Mean of two numbers

We have learnt that mean of a set of observations or a data lies between highest and lowest value in the data. Obviously, the mean of two observations or any two numbers will lie between two numbers.

For Example: (*i*) Mean of 4 and 6 = $\frac{4+6}{2} = 5$

$\therefore$ 5 is greater than 4 but less than 6 .

(*ii*) Mean of 210 and 216 = $\frac{210+216}{2} = 213$

$\therefore$ 213 is greater than 210 but less than 216.

In general, for any two numbers a and b, their mean is $\left(\frac{a+b}{2}\right)$ and by considering a is the smaller of the two, we write the inequality as below:

$$a < \left(\frac{a+b}{2}\right) < b$$

Using this idea, we can find as many fractional numbers between any two fractional numbers, as we like. Let us understand with the help of an example.

Example 1: The three fractional numbers between $\frac{3}{5}$ and $\frac{4}{5}$ are obtained as below.

Explanation: We know that, the mean of two numbers lies between them.

$$\therefore \text{First number} = \text{Mean of } \frac{3}{5} \text{ and } \frac{4}{5} = \frac{\frac{3}{5}+\frac{4}{5}}{2} = \frac{\frac{3+4}{5}}{2} = \frac{\frac{7}{5}}{2} = \frac{7}{10}$$

$$\Rightarrow \frac{3}{5} < \frac{7}{10} < \frac{4}{5} \qquad \ldots(i)$$

Second number can be mean of $\frac{3}{5}$ and $\frac{7}{10}$

$\therefore$ Second number $= \dfrac{\dfrac{3}{5}+\dfrac{7}{10}}{2} = \dfrac{\dfrac{6+7}{10}}{2} = \dfrac{\dfrac{13}{10}}{2} = \dfrac{13}{20}$

$\Rightarrow \dfrac{3}{5} < \dfrac{13}{20} < \dfrac{7}{10}$ ...(*ii*)

From (*i*) and (*ii*), we write as: $\dfrac{3}{5} < \dfrac{13}{20} < \dfrac{7}{10} < \dfrac{4}{5}$ ...(*iii*)

Now, the third number can be mean of $\dfrac{13}{20}$ and $\dfrac{7}{10}$

$\therefore$ Third number $= \dfrac{\dfrac{13}{20}+\dfrac{7}{10}}{2} = \dfrac{\left(\dfrac{13+14}{20}\right)}{2} = \dfrac{27}{40}$

$\Rightarrow \dfrac{13}{20} < \dfrac{27}{40} < \dfrac{7}{10}$ ...(*iv*)

From (*iii*) and (*iv*), we can write as:

$\dfrac{3}{5} < \dfrac{13}{20} < \dfrac{27}{40} < \dfrac{7}{10} < \dfrac{4}{5}$

Clearly, the fractional numbers between two fractional numbers are not unique. If we choose to take mean of different fractions, we will get different numbers.

Following the above procedure, we can find as many fractional numbers as we like between any two fractional numbers.

Test Your Understanding 3

Q.1. The number of factors of 36 is

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.2. The irreducible factorised form of $15x^3y^2z$ is _____ .

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.3. How many common factors of $12q^2$ and $6q^2$?

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.4. A perfect square number can never have the digit _____ at the units place.

(*a*) 9 (*b*) 8 (*c*) 1 (*d*) 4

MODE

The mode of a set of observations or a data is the observation that occurs most often. We may also define mode as the observation having greatest frequency.

For Example: consider the data given below:

15, 19, 17, 15, 20, 18, 19, 17, 18, 20, 17

For finding the mode of the data, we rearrange it such that the same value are put together, as below.

15, 15, 17, 17, 17, 18, 18, 19, 19, 20, 20

We can see that the mode of this data is 17 because it occurs more frequently than other observations.

Mode of Large Data

If the number of observations is large, putting the same observations together and counting them is not easy. In such cases we tabulate the data. We put tally marks corresponding to each observation and find the frequencies of all observations.

Let us take an example.

Example: The shoe sizes of 40 students in a class are:

6, 7, 8, 6, 7, 7, 8, 9, 7, 6, 6, 8, 9, 7, 8, 7, 7, 8, 7, 6, 9, 7, 8, 9, 7, 6, 8, 9, 8, 7, 7, 8, 9, 6, 6, 7, 8, 7, 9, 7

The mode of above data can be obtained using below explanation.

Explanation: Here, the number of observations is large and therefore, we tabulate the data as below.

Shoe Size	Tally Marks	Frequency
6	𝍸 | | |	8
7	𝍸 𝍸 𝍸	15
8	𝍸 𝍸	10
9	𝍸 | |	7

So, the observation with highest frequency is 7 (15 times). Thus, the mode of the data is 7.

Hence, the modal shoe size of the students of class is 7.

Question 1: Librarian of a school records the number of books borrowed by 40 students of a class in a month as below.

2, 3, 2, 4, 3, 3, 2, 5, 3, 2, 4, 3, 5, 2, 4, 2, 3, 3, 5, 4, 3, 2, 4, 2, 5, 3, 3, 4, 2, 5, 3, 2, 4, 3, 2, 5, 3, 4, 3, 2

Find the mode of the data.

Solution: We need to tabulate the data first as below.

Book Borrowed	Tally Marks	Frequency
2	𝍸 𝍸 | |	12
3	𝍸 𝍸 | | | |	14
4	𝍸 | | |	8
5	𝍸 |	6

So, the mode of the data is 3 as it has highest frequency (14 times).

Hence, the mode of the data is 14.

Question 2: Number of smartphones sold by a shop on each day of April 2024 is as follows:

12, 15, 10, 14, 12, 18, 12, 15, 14, 10, 15, 12, 14, 10, 12, 18, 14, 15, 10, 12, 15, 10, 18, 12, 14, 15, 12, 18, 10, 12.

Find the mode of the above data.

Solution: Let us tabulate the given data as shown below.

Number of Smartphones Sold	Tally Marks	Frequency
10	𝍸 I	6
12	𝍸 IIII	9
14	𝍸	5
15	𝍸 I	6
18	IIII	4

So, the mode of the data is 12 as it occurs most number of times.

Hence, the mode of the given data is 12.

Test Your Understanding 4

Q.1. The number of factors of 36 is

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.2. The irreducible factorised form of $15x^3y^2z$ is _____ .

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.3. How many common factors of $12q^2$ and $6q^2$?

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.4. A perfect square number can never have the digit _____ at the units place.

(*a*) 9 (*b*) 8 (*c*) 1 (*d*) 4

MEDIAN

Median is the middle value of a set of observations or a data. Half of the values in data are smaller than the median and half are larges.

How to find median of a data?

Consider a data consisting of n values. The following steps are used.

Step 1: Arrange the data in ascending or descending order.

Step 2: **Case 1:** If n is odd, then the median = $\left(\frac{n+1}{2}\right)^{th}$ observation.

Case 2: If n is even, then the median = Mean of $\left(\frac{n}{2}\right)^{th}$ and $\left(\frac{n}{2}+1\right)^{th}$ observations

$$= \frac{\left(\frac{n}{2}\right)^{th} \text{ observation} + \left(\frac{n}{2}+1\right)^{th} \text{ observation}}{2}$$

NOTE

(*i*) If the number of observations in the data is odd, then the median is the middle observation. In this case, median is one of the observations.

(*ii*) If the number of observations in the data is even, then the median is the mean of two middle observations. In this case, median may not be one of the observations.

Question 1: The heights (in cm) of 11 students in school football team are given below.

142, 148, 150, 145, 155, 140, 152, 147, 149, 153, 144

Find the median height.

Solution: First, we need to arrange the data in ascending or descending order. Let us arrange the data in ascending order.

140, 142, 144, 145, 147, 148, 149, 150, 152, 153, 155

Here, the number of observations in the data, $n = 11$, which is odd.

$$\text{Median (when } n \text{ is odd)} = \left(\frac{n+1}{2}\right)^{th} \text{ observation}$$

$$\therefore \quad \text{Median height} = \left(\frac{11+1}{2}\right)^{th} \text{ observation}$$

$$= 6^{th} \text{ observation}$$

$$= 148$$

Hence, the median height is 148 cm.

Question 2: The marks obtained (out of 100) by 12 students are 78, 85, 90, 80, 75, 62, 88, 92, 100, 84, 77, 89

Find the median marks.

Solution: Arranging the given data in ascending order, we get

62, 75, 77, 78, 80, 84, 85, 88, 89, 90, 92, 100

(84, 85 → two middle values)

Here, number of observations, $n = 12$, which is even.

We know that, if n is even, then median is the mean of two middle observations *i.e.*

mean of $\left(\frac{n}{2}\right)^{th}$ observation and $\left(\frac{n}{2}+1\right)^{th}$ observation

$$\therefore \quad \text{Median marks} = \frac{\left(\frac{n}{2}\right)^{th} \text{ observation} + \left(\frac{n}{2}+1\right)^{th} \text{ observation}}{2}$$

Now, $\frac{n}{2} = \frac{12}{2} = 6$ and $\frac{n}{2}+1 = 6+1 = 7$ $[\because n = 12]$

So, $$\text{Median marks} = \frac{6^{th} \text{ observation} + 7^{th} \text{ observation}}{2}$$

$$= \frac{84 + 85}{2} = \frac{169}{2}$$

$$= 84.5$$

Hence, the median marks is 84.5.

Question 3: Weights of 8 students (in kg) arranged in ascending order are 45, 48, 49, 51, x, 54, 55, 55

If median weight is 52 kg, what is the value of x.

Solution: The given data is

$$45, 48, 49, \underbrace{51, x,}_{\text{two middle values}} 54, 55, 55$$

Here, number of observations, $n = 8$, which is even.

$\therefore$ Median is the mean of two middle observations.

$$\Rightarrow \quad \text{Median} = \frac{4^{th} \text{ observation} + 5^{th} \text{ observation}}{2}$$

$$\Rightarrow \quad 52 = \frac{51 + x}{2}$$

$$\Rightarrow \quad 104 = 51 + x$$

$$\Rightarrow \quad x = 104 - 51$$

$$\Rightarrow \quad x = 53$$

Hence, the value of x is 53.

Test Your Understanding 5

Q.1. The number of factors of 36 is

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.2. The irreducible factorised form of $15x^3y^2z$ is _____ .

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.3. How many common factors of $12q^2$ and $6q^2$?

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.4. A perfect square number can never have the digit _____ at the units place.

(*a*) 9 (*b*) 8 (*c*) 1 (*d*) 4

BAR GRAPH (OR BAR CHART)

A bar graph (or bar chart) is a way of representing data visually using rectangular bars having height or length proportional to the values they represent. The bars can be plotted vertically or horizontally. Bar graphs are well-suited for comparing different in groups or categories of data.

How to Plot a Bar Graph?

Let us understand the steps involved in plotting a bar graph with the help of an example.

Example: 100 students of a school are asked to name their favourite sport. The collected data is as below.

Favourite Sport	Tennis	Football	Cricket	Hockey	Basketball
Number of Students	10	16	43	12	19

Steps to plot the bar graph are given below.

Step 1: Draw the horizontal axis (x-axis) and vertical axis (y-axis) on a graph paper.

Step 2: Identify independent category and dependent category. In this example, 'different sports' is independent category and 'number of students' is dependent category.

Step 3: For a vertical bar graph, take independent category along x-axis and dependent, category along y-axis. For a horizontal bar graph, do the opposite.

Here, we are plotting a vertical bar graph. Therefore, 'different sports' (independent category) is taken along x-axis and 'number of students' (dependent category) is taken along y-axis.

Step 4: Write the names of different sports along the x-axis leaving equal space between them. (Refer graph below)

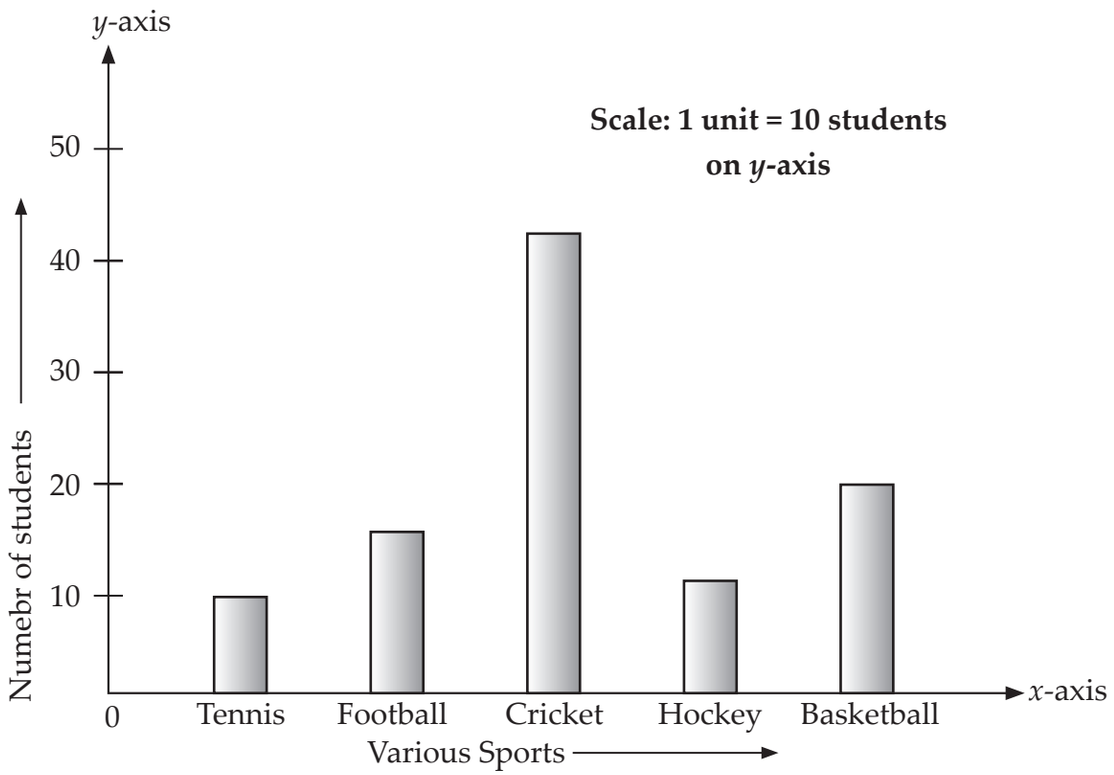
Step 5: Choose a suitable scale along the y-axis.

Case 1: If numbers to be shown are in single digits (units), then we may represent one observation by one unit length.

Case 2: If the numbers to be shown are in tens or hundreds, one unit length may represent 10 or 100 observations.

Here, the numbers are in tens. So, we choose a scale where 1 unit length represents 10 observations *i.e.* 10 students. We start the scale at 0. Since the greatest value in the given data is 43, we end the scale at 50. Scale should at a value greater than greatest value in the data.

Step 6: Now, make rectangular bars of equal width and having equal gap among them corresponding to each sport. The height of bars should be according to frequency *i.e.* number of students and chosen scale. So, the bar graph is ready as shown below.



Question 1: The monthly electricity consumption (in kWh) of a household for first five months of an year are given in tabular form as below.

Month	January	February	March	April	May
Consumption	220	180	160	260	325

Draw a bar graph representing the above data.

Solution: **Steps for plotting the bar graph as shown below:**

Step 1: Draw the horizontal axis (x-axis) and vertical axis (y-axis) on a graph paper.

Step 2: Here, 'Months' is independent category and 'Units consumed' is dependent category.

Step 3: Label x-axis as 'Months' and y-axis as 'Units consumed'.

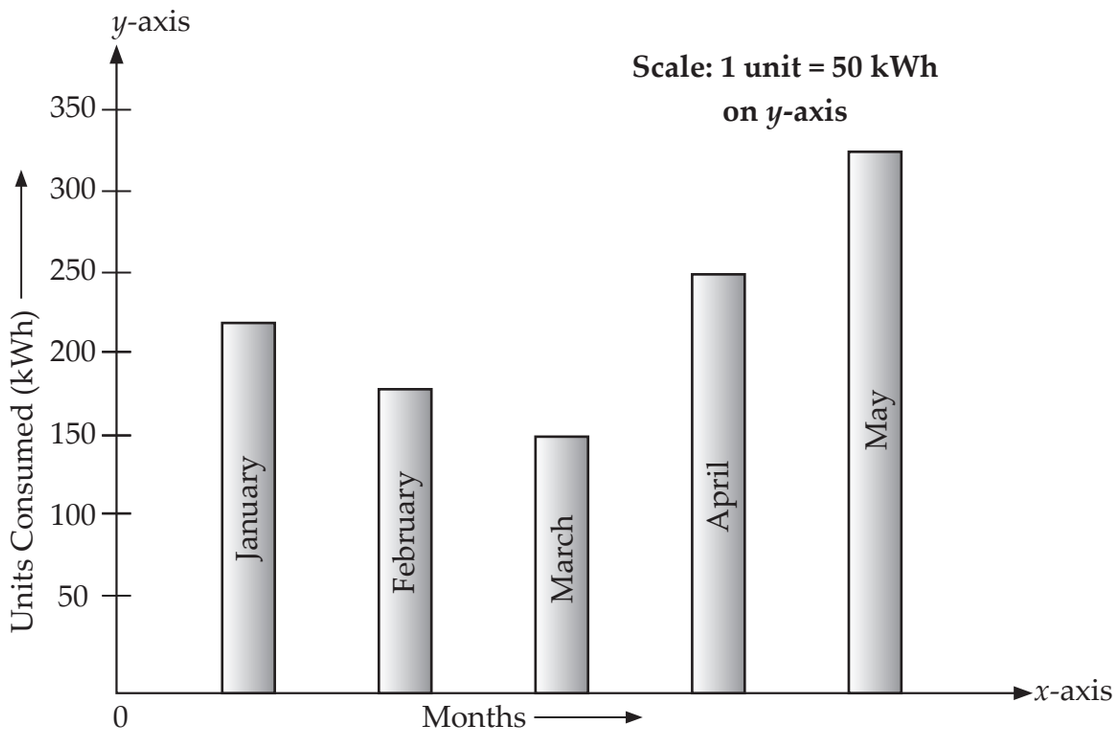
Step 4: Choose a suitable scale.

Here, highest data value is 325, so we end the scale at 350. Scale starts at 0.

1 unit length on y-axis = 50 units (kWh)

Step 5: Make 5 bars of equal width with equal gap having their heights equal to individual data values according to scale chosen.

Step 6: Label each bar by the name of the month.



Question 2: Height (in metres) from the mean sea level (MSL) of five cities in north India are given below:

Name of the city	Delhi	Chandigarh	Lucknow	Jaipur	Jammu
Height from MSL (in m)	216	320	123	430	327

Draw a bar graph for above data.

Solution: **Steps for plotting the bar graph as shown below:**

Step 1: Draw the horizontal axis (x-axis) and the vertical axis (y-axis) on a graph paper.

Step 2: Here, 'Name of the city' is independent category and 'Height from MSL' is dependent category.

Step 3: Label x-axis as 'Name of the city' and y-axis as 'Height from MSL'.

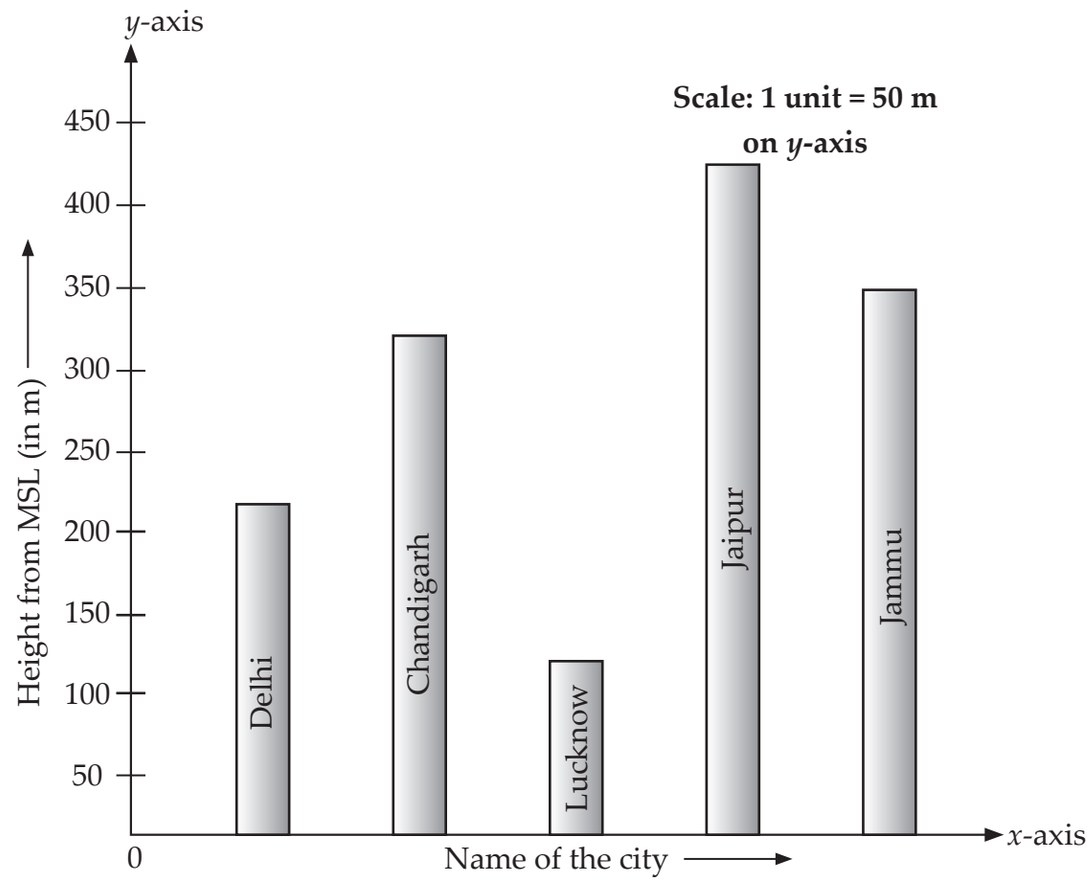
Step 4: Choose a suitable scale.

Start scale at 0. The greatest value in the data is 430, so we end the scale at 450.

1 unit length on y-axis = 50 m

Step 5: Make 5 bars of equal width with equal gap having their heights equal to individual data values according to scale chosen.

Step 6: Label each bar by the name of the city.



Question 3: Number of internet users (in millions) in five countries are as below:

Country	India	China	USA	Brazil	Indonesia
Internet Users (in millions)	850	1050	310	190	220

Draw a bar graph representing above data.

Solution: **Steps for plotting the bar graph as shown below:**

Step 1: Draw the horizontal axis (x-axis) and the vertical axis (y-axis) on a graph paper.

Step 2: Here, 'Name of the country' is independent category and 'Internet users' is dependent category.

Step 3: Label x-axis as 'Name of the country' and y-axis as 'Internet users'.

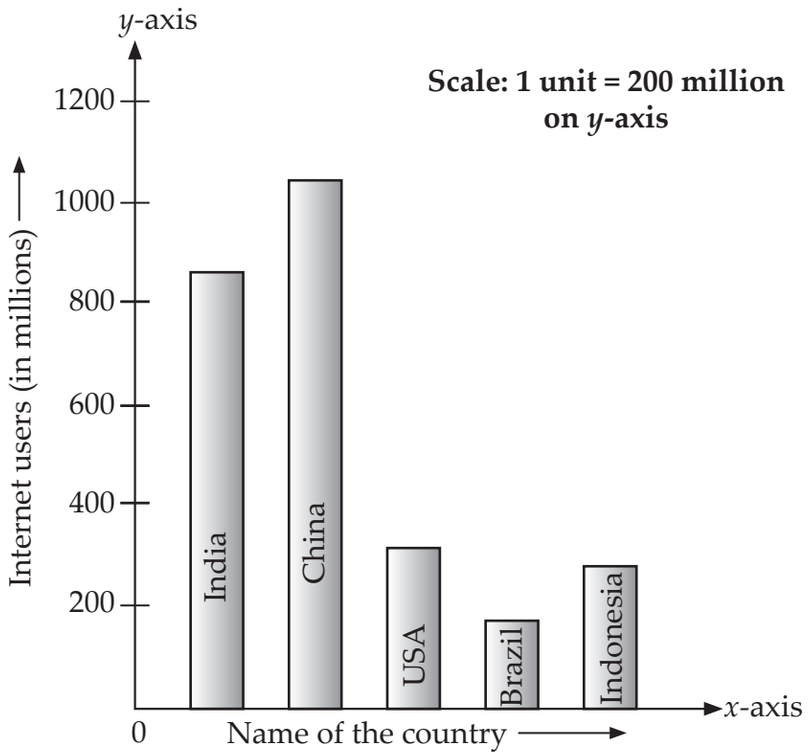
Step 4: Choose a suitable scale.

Start scale at 0. The greatest value (in millions) is 1050, so we end the scale at 1200.

1 unit length on y-axis = 200 million

Step 5: Make 5 bars of equal width with equal gap having their heights equal to individual data values according to scale chosen.

Step 6: Label each bar by the name of the country.



Test Your Understanding 6

Q.1. The number of factors of 36 is

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.2. The irreducible factorised form of $15x^3y^2z$ is _____.

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

DOUBLE BAR GRAPH

Double bar graphs are plotted to represent two sets of data on the same graph. They are used to show differences and similarities between two data groups. Bars corresponding to two data groups are drawn in different colours.

Let us learn how to plot a double bar graph with the help of an example. Marks scored by a student in four subjects in two terms are as below:

Subject	Term I	Term II
Maths	75	85
Science	80	75
Social Science	70	60
English	85	90

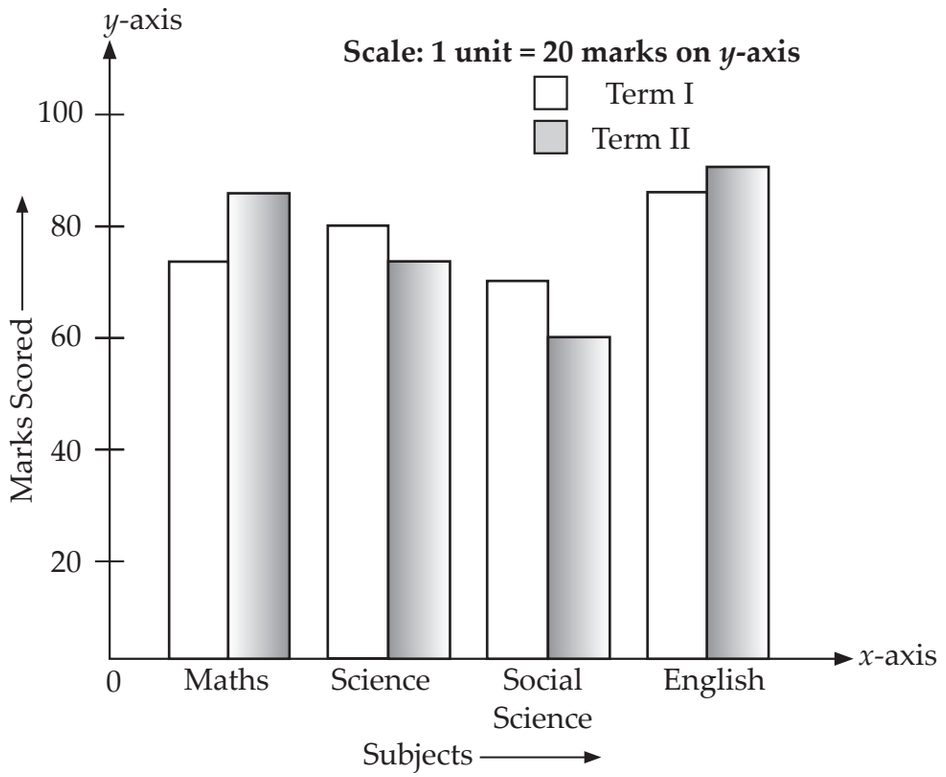
For plotting a double bar graph to represent above data, we follow steps given below.

Step 1: Label x-axis as 'Subjects' (independent category) and y-axis as 'Mark scored' (dependent category).

Step 2: **Scale:** 1 unit length on y-axis = 20 marks.

Step 3: Decide colours of bars. Here, we choose white for terms I and gray for term II.

Step 4: Draw the bars having heights equal to data values according to the scale chosen. There should be no gap between two bars representing two terms for a given subject. Double bar graph is ready as shown below.



Question 1: Production of wheat and rice (in lakh tonnes) in five states of india in a particular year is given below.

State	Wheat (lakh tonnes)	Rice (lakh tonnes)
Punjab	170	120
Haryana	130	80
Uttar Pradesh	280	160
Bihar	90	140
West Bengal	40	150

Draw a double bar graph for comparison of wheat and rice production in these five states.

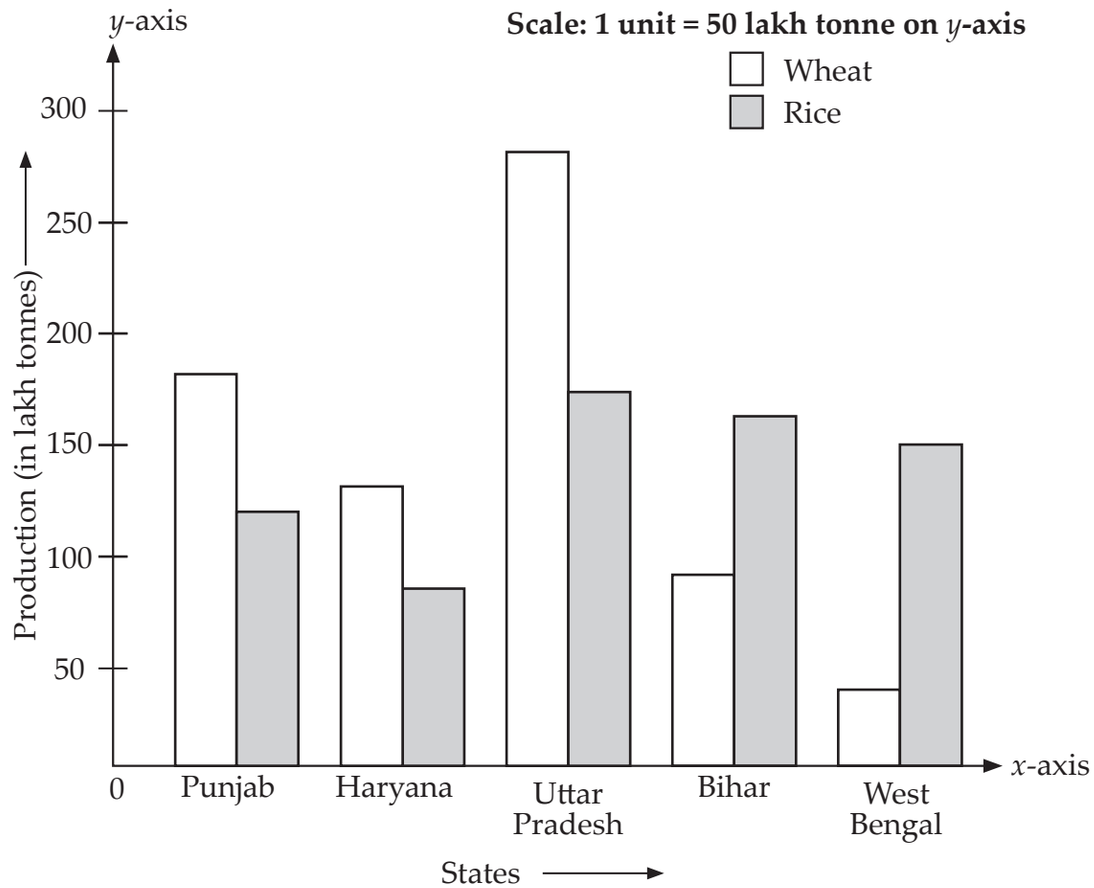
Solution:

Step 1: Label x-axis as 'States' which is (independent category) and y-axis as 'Production (in lakh tonnes)' which is dependent category.

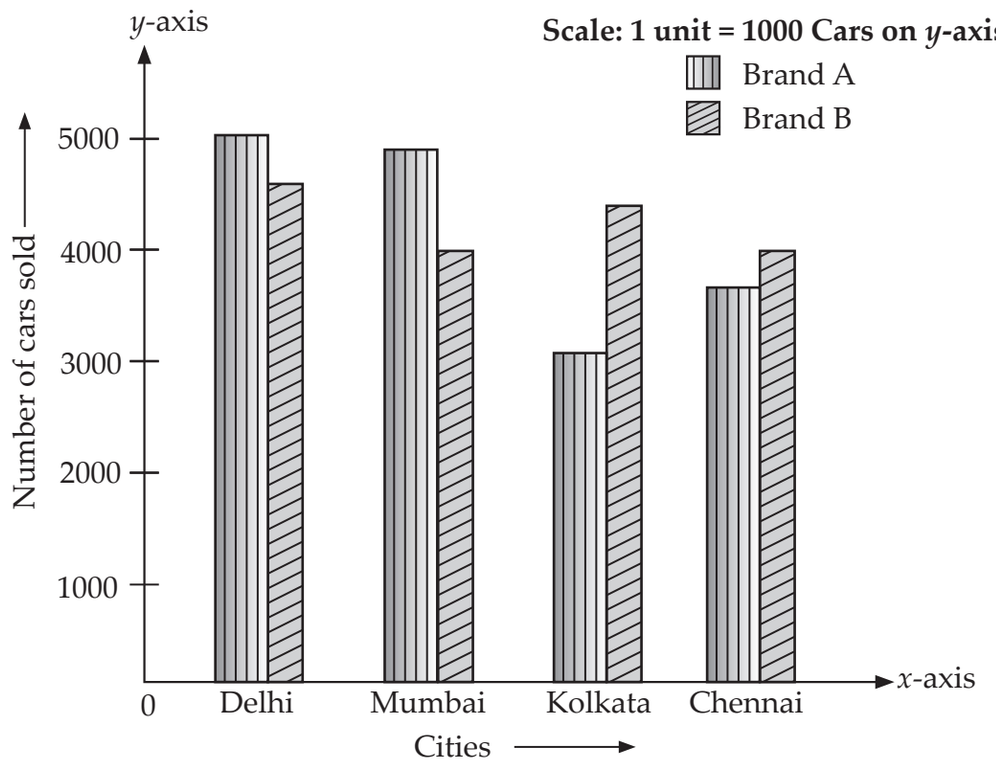
Step 2: **Scale:** 1 unit of length on y-axis = 50 lakh tonnes

Step 3: We choose white for bars corresponding to wheat and gray for bars corresponding to rice.

Step 4: Draw the bars having heights equal to data values according to the chosen scale. There should be no gap between two bars representing wheat and rice production for a particular state.



Question 2: Study the double bar graph given below and answer the following questions. The graph shows number of cars sold in one month by two competing brands A and B in four major cities of india.



(*i*) In which city brand A sold least number of cars?

(*ii*) In which city brand B sold maximum number of cars?

(*iii*) In which city difference between cars sold by two brands is maximum?

(*iv*) In which cities brand B has performed better?

(*v*) In which city both brands together have sold most cars?

Solution: (*i*) Brand A sold least number of cars in Kolkata.

(*ii*) Brand B sold maximum number of cars in Delhi.

(*iii*) The difference between cars sold by two brands is maximum in Kolkata.

(*iv*) Brand B has performed better in Kolkata and Chennai.

(*v*) Both brands together have sold most cars in Delhi.

Test Your Understanding 7

Q.1. The number of factors of 36 is

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.2. The irreducible factorised form of $15x^3y^2z$ is _____ .

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8

Q.3. How many common factors of $12q^2$ and $6q^2$?

(*a*) 7 (*b*) 10 (*c*) 9 (*d*) 8