

## MODULE - 3

Introduction to Statistics



Notes



318en07

7

# PRESENTATION OF DATA

In the previous lesson, you have learnt about the methods of organizing and condensing data in the form of arrays and frequency distributions. It is the first step towards analysis of data. Another step in this direction is presentation of data to highlight and compare significant statistical facts. Statistical data can be systematically organized and presented in the form of tables, graphs and charts. There are various types of graphs. In this lesson, you will learn about table, bar charts, pie diagram (or chart) and time series line graph.



## OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning and purpose of a table;
- distinguish between reference table and special purpose table;
- draw the format of a table;
- explain the meaning and construction of simple and multiple bar charts;
- explain the need and construction of component bar charts;
- explain the meaning of pie chart and steps in its construction;
- explain the meaning of a time series graph and steps in its construction; and
- construct histogram, frequency polygon and cummutative frequency curve (OGIVE).

## 7.1 TABLE

## (a) Meaning

A table is a systematic arrangement of related statistical data in columns and rows with some predetermined aim or purpose. Can you arrange the following information in tabular form?

“There are 50 Science, 50 Commerce and 50 Arts students in a college. The number of students from poor families is same for each course and their total is 30. Whereas science and commerce courses are equally popular in rich families, yet the number of rich arts students is twice as much. In all 40 students are from the rich families studying in the college. The majority of students are from middle class families and their number is 80.”

Let us arrange this information in tabular form. There are 150 students in all. A table leaves a more lasting impression on human mind than statements saying the same thing. As they say, a picture is worth 1000 words.

**Table 7.1: Distribution of students according to course and economic status**

	Science	Arts	Commerce	Total
Rich	10	20	10	40
Middle Class	30	20	30	80
Poor	10	10	10	30
Total	50	50	50	150

## (b) Purpose

The purpose of a table is to simplify presentation of related data and make comparisons easy. The reader can easily locate the desired information. For example, the purpose of table 7.2 might be to show the imports and exports of country 'A' vis-à-vis other countries B, C, D and E.

**Table 7.2: Imports and Exports of Country 'A' during 2002-05 (₹. Crores)**

	Country	Imports	Exports
1	B	70	73
2	C	72	80
3	D	74	85
4	E	85	80



Notes



Notes

From the table 7.2 on exports and imports, we can easily locate the country which has highest exports. The data given in rows is read from left to right. For example, row 1 shows that country A imports 70 from B and exports 73 to B. The data given in column B read from above to downwards. For example, column 2 shows that country A imports 70, 72, 74, 85 respectively from countries B,C,D and E.

(c) Types of Tables

Basically we have two types of tables (i) Reference or general purpose tables or (ii) special purpose or text tables. Let us discuss them one by one.

- (i) **Reference or general purpose tables:** These tables are in a way a store of information with an aim of presenting detailed statistical data. From these tables we can derive smaller tables. Generally, statistical tables presented by Government of India and its various statistical agencies and departments are reference or general purpose tables.
- (ii) **Special purpose or test tables:** These tables are smaller and can be obtained from reference tables. They aim to analyse a particular aspect so that we are able to bring out a specific point or answer a specific question.

(d) Parts of Table

Parts (or elements) of a table vary from table to table depending upon the nature of data and purpose of a table. However, some points are common to all (see format of table 7.3). They are:

**Table 7.3: (..... Title .....) (in ₹. Crores)**

Stub Head	Column Head 1		Column Head 2	
	Sub Column head	Sub column head	Sub column head	Sub column head
Stub Entries	Main Body of the Table (field)			

Footnote (.....)

Source of data (.....)

1. **Table Numbers:** If more than one table has been used or presented at one place, it is always better to give them numbers. It makes further reference to them easy. This number is always indicated in the top for example Table 7-1, Table 7-2 etc.
2. **Title:** Title is to the table what heading is to an essay. It appears at the top of a table and gives idea about what is contained in the main body of the table. The title should be brief and to the point. It is better if the title is presented in bold letters or capital letters. What is the title of Table 7-2?

3. **Head note (or prefatory note):** It is written below the title. It clarifies the contents of the table and unit of measurements like “in rupees crores” or “in lakh tons” or “in thousand bales of cotton” etc. It must be written in brackets on right side (top) of the table immediately below the title. For example, in table 7.2 the unit of measurement is rupees crores.
4. **Stub:** The stub consists of stub head and stub entries. Whereas stub describes the stub entries down below it, each stub entry labels a given data placed in its row. Both stub head and stub entries appear on the left hand column of the table. Further, stub entries describe the column heads.
5. **Main Body or Field:** It is the most important part of the table and contains the numerical information about which a hint is given in title. For example, if the title is “Exports and Imports of Country A during 1995-96, it clearly shows that the body of the table contains statistical/numerical information on value of exports and imports of country A with different countries.
6. **Footnote:** It is a qualifying statement placed at the bottom of a table. Its purpose is to explain omission or limitations of the data presented in main body of the table. For example, if the data for a year is not available then it is mentioned at the bottom of the table.
7. **Source of Data:** Last but not the least, it is essential to mention the source of data presented in the table. It helps the reader to check the original source of data himself and get more of it on the subject. This also makes the data presented in the table more reliable. It should mention information like title, edition, page number and source of publication etc.



Notes



### INTEXT QUESTION 7.1

1. State whether the following statements are true or false:
  - (a) Satisfactory collection of data must be followed by its good presentation.
  - (b) Tabulation is the only way of presenting data.
  - (c) Tables help in intelligent use of statistical data.
  - (d) The title of a table should be brief and to the point.
2. Fill in the blanks using suitable word given in the bracket.
  - (a) A ..... is a systematic arrangement of statistical data in columns and rows. (table, graph)
  - (b) Head note is written below the ..... of the table. (title, footnote)
  - (c) The ..... consists of stub head and stub entries. (stub, note)
  - (d) A foot-note is placed at the ..... of a table. (top, main body, bottom)

7.2 BAR CHARTS OR DIAGRAMS



Notes

Meaning

A bar can be defined as a thick ‘line’, often made thicker to draw attention of the reader. The height of this bar shows the quantity of the variable we want to present. It is also called one dimensional diagram because only height of the bar is important and its base or width is not taken into account. To make them look more beautiful, bars are either coloured or shaded in different ways.

Types of bar charts:

There are two types of bar charts (a) simple and (b) components.

(a) Simple bar charts

Simple bar charts can be (i) Single bar charts, and (ii) Multiple bar charts.

(i) **Single bar charts:** We can either have vertical bars (figure 7.1) or horizontal bars (figure 7.2). Normally vertical bars are often used. Let us now explain how a bar diagram can be prepared from given data in table 7.4.

Table 7.4: Number of cars registered in three States

States	No. of Cars
A	8,000
B	10,000
C	4,000

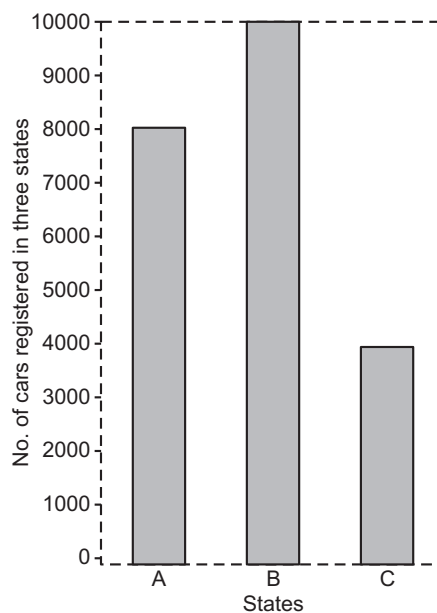


Fig. 7.1: Cars registered in states

In the case of vertical bars. States are represented on X axis and number of cars on the Y axis. As per the data given in table 7.4 each bar (rectangle with same base) is raised accordingly to the value of the variable (here the number of cars registered). For example, rectangle representing State A is raised upto 8,000, for State B upto 10,000 and for State C upto 4,000 (see Fig. 7.1).

In case we prefer to use horizontal bars, we represent States on Y-axis. Here the bars (rectangles) are drawn horizontally upto 8,000, 10,000 and 4,000 cars respectively for the three States A, B and C. (see figure 7.2).

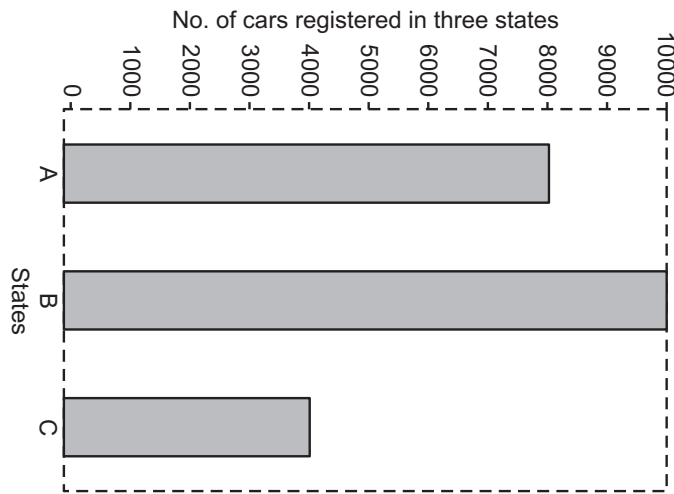


Fig. 7.2: Cars registered in states

(ii) **Multiple bar charts:** Sometimes it is desired to represent more than one interrelated series of data on a bar diagram. In such cases a simple bar diagram is not suitable. We have to use what is known as multiple bar diagram. Here the number of bars for each year of region or zone is equal to the number of variables (data) to be represented. For example, imports and exports will be represented by two bars; selling price, cost price and profits by three bars and so on. Normally we do not take more than three bars because it becomes complicated. The method of drawing bars is same as explained for simple bar diagrams. Two examples of multiple bar diagrams are presented below (figure-7.3 based on table 7.5 and figure 7.4 based on Table 7.6).

Table 7.5: Imports and Exports of Country 'X' during 2009 to 2013 (₹. Crores)

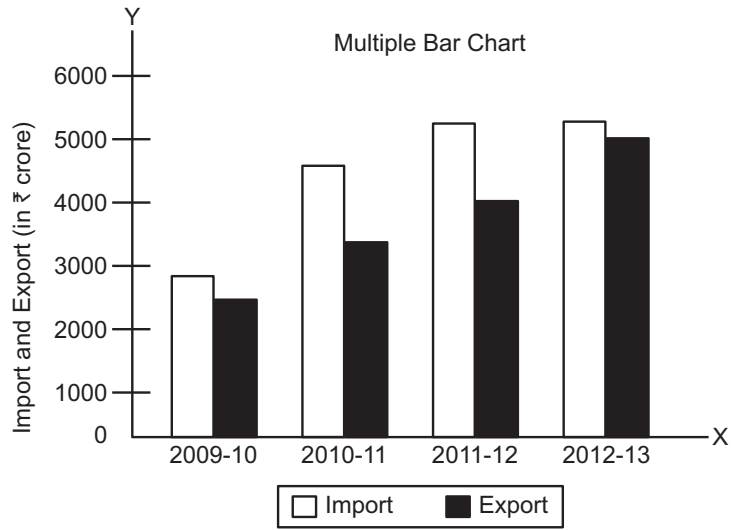
Year	Imports	Exports
2009-10	2955	2523
2010-11	4519	3329
2011-12	5265	4049
2012-13	5265	5143



Notes



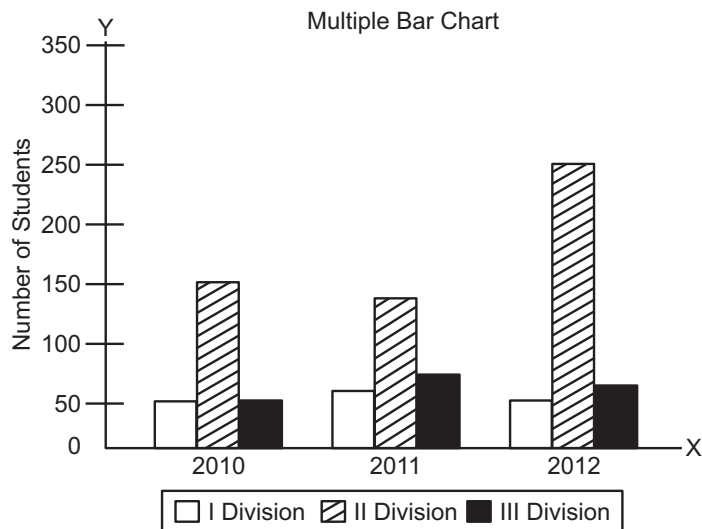
Notes



**Fig. 7.3:** Imports and Exports of country A during 2009-13 (in rupees Crores)

**Table 7.6: Result of Class XII during 2010-2012**

Year	First Division	Second Division	Third Division
2010	50	150	50
2011	60	140	70
2012	50	250	60



**Fig. 7.4:** Result of class XII during 2010-2012

**(b) Component Bar Chart**

A simple bar diagram explained above is used to present only one variable. But when a breakdown of total or a series of totals is to be represented, we have to use what is called sub-divided or component bar diagrams. Here we use sub-divided or component bar diagram as shown in Fig. 7.5. It is based on imaginary (or hypothetical) data shown in table 7.7.

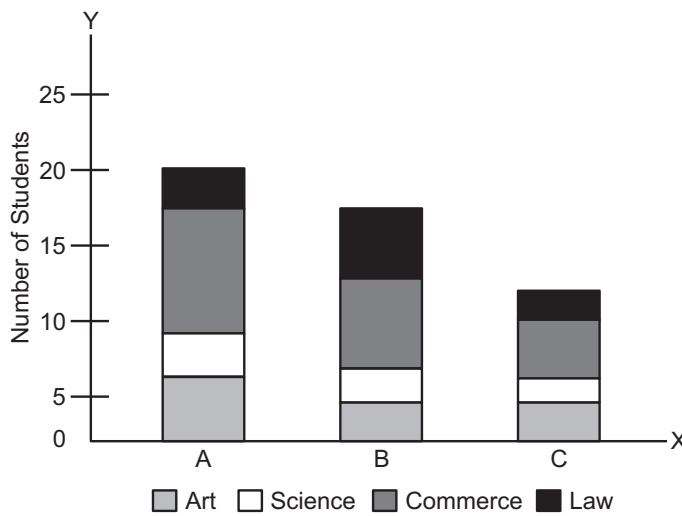


Notes

**Table 7.7: No. of students appearing in examination**

Stream	University A	University B	University C
Art	8,000	6,000	3,000
Science	4,000	2,000	1,000
Commerce	7,000	5,000	4,000
Law	1,000	2,000	2,000
Total	20,000	15,000	10,000

Number of Students appearing in Examinations in Various Universities



**Fig. 7.5: Steps in the construction of a component bar diagram**

- Step 1.** The order of various components in different bars should be same so as to facilitate comparison.
- Step 2.** The number of components in a bar, in no case should exceed 10.
- Step 3.** Index or key showing various components must be shown through different shades or colours





Notes

### 7.3 PIE DIAGRAM

#### Meaning

It is also known as angular diagram. Pie diagrams are more popularly used for presenting percentage breakdown of data. For example, students of a particular college may be put in three categories-Science students, Commerce students and Arts students. Or exports of India may be classified as to USA, Europe, Middle-East countries, Africa etc. The pie diagram can be effectively used to show these categories or breakdowns. A pie diagram therefore, is a circle subdivided into component sectors to present the proportion of different constituent parts to the total. As such a pie diagram is shown in percentage terms.

#### Steps in the construction of pie diagram

- Step 1.** Find the value of each category or component or group as percentage of total of all categories or components or groups.
- Step 2.** Calculate degree of the angle formed by each category or component or group by the formula given below.

Degree for a particular category/component/group

$$= \frac{\text{Value of the group}}{\text{Total of all groups}} \times 360^\circ$$

- Step 3.** Take a circle of a suitable size and draw radius.
- Step 4.** Now draw angles calculated in step 2 with the help of a protractor.
- Step 5.** Shade or colour different segments suitably or make the distinctions between different categories or components or groups.
- Step 6.** For each category or component or group put the percentage in the pie diagram as shown in figure 7.6.

Let us now take an imaginary example to illustrate the construction of a pie-diagram.

**Example:** From the monthly budget of an industrial worker of Mumbai Industrial Area, it was found that the family spent ₹. 360 on food, ₹. 108 on clothing, ₹. 90 on housing, ₹. 24 on comforts, ₹. 12 on education and entertainment and ₹. 6 on miscellaneous items. Construct a pie-diagram.

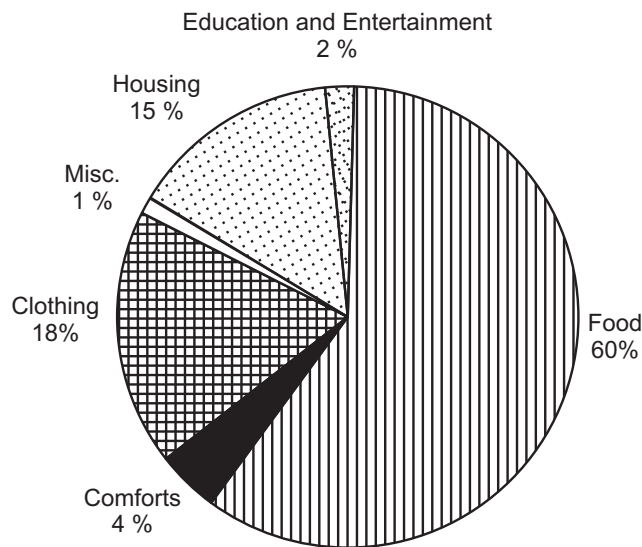
**Solution:** We arrange the data in tabular form given below and complete all the steps mentioned above.

**Table 7.8: Monthly Family Budget of an Industrial Worker of Bombay**

Items	Expenditure	Percentage	Degree = $\frac{\text{Value of item}}{\text{Total value}} \times 360^\circ$
Food	360	$\frac{360}{600} \times 100 = 60$	$\frac{60}{100} \times 360^\circ = 216.0^\circ$
Clothing	108	$\frac{108}{600} \times 100 = 18$	$\frac{108}{100} \times 360^\circ = 64.8^\circ$
Housing	60	$\frac{90}{600} \times 100 = 15$	$\frac{15}{100} \times 360^\circ = 54.0^\circ$
Comforts	24	$\frac{24}{600} \times 100 = 4$	$\frac{4}{100} \times 360^\circ = 14.4^\circ$
Education and Entertainment	12	$\frac{12}{600} \times 100 = 2$	$\frac{2}{100} \times 360^\circ = 7.2^\circ$
Misc.	6	$\frac{6}{600} \times 100 = 1$	$\frac{1}{100} \times 360^\circ = 3.6^\circ$
<b>Total</b>	<b>600</b>	<b>100</b>	<b>360°</b>



Notes



**Fig. 7.6: Monthly Budget of Industrial Worker in Mumbai**



Notes



**INTEXT QUESTIONS 7.2**

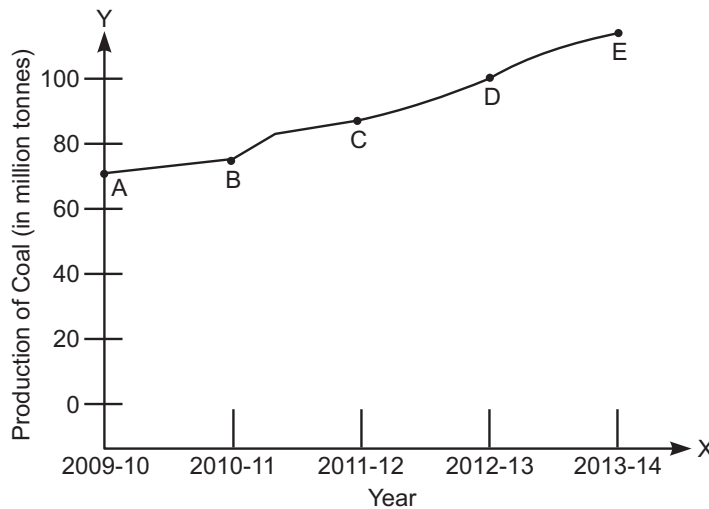
1. State whether the following statements are true or false:
  - (a) The width of a one-dimensionl bar diagram is important.
  - (b) In bar diagram, height of bars shows the value of the variable.
  - (c) We an have vertical as well as horizontal bars to present some data having one variable.
  - (d) When a break down of data is to be represented we use multiple bar diagram.
  
2. Fill in the blanks with suitable word out of those given in the brackets:
  - (a) A pie chart is also called ..... diagram.  
(a bar, an angular, a multiple bar)
  
  - (b)  $\frac{\text{Value of the group}}{\text{Total of all groups}} \times 360^\circ = \dots\dots\dots$   
(area, radius, degree for a groups).

**7.4 TIME SERIES LINE GRAPH**

Statistical data can also be presented in the form of line graphs. A line graph records the relationship between two variables. If one of the two variables is time in days, weeks, months or years we get a time series line graph. For example, let us draw a line graph on the basis of the following data on production of coal in country ‘X’ from 2009-10 to 2013-14.

**Table 7.9: Production of Coal (Million Tons)**

Year	Production (Million Tons)
2009-10	77.22
2010-11	78.17
2011-12	88.42
2012-13	99.80
2013-14	103.50



**Fig. 7.7:** Production of coal in country X 2009-14 (in Million Tons)

The above graph is a time series line graph. Time is represented on the X axis and production on the Y axis. Time and production are two variables in this graph. It is production which changes with time. In other words as time passes production is affected and it increases or decreases or may remain constant. Since production changes with time, it is said to be dependent on time. Production is, therefore, treated as a dependent variable. Time is not influenced by production and therefore taken as an independent variable.

Point A on the line graph (also called curve) shows that production of crude oil in country 'X' in the year 2009-10 was 77.22 million tones. Similarly points B, C and D show production levels in the subsequent years. The upward rising curve from left to right indicates that production of coal oil in Country 'X' is constantly rising since 2009-10.

It is possible to show two or more comparable dependent variables on a time series line graph. In that case each dependent variable will be recorded on a separate curve. For example, take the following data on exports and import of country 'X'.

**Table 7.10: Exports and Imports of Country 'X'**

Year	Imports (in ₹ 100 crores)	Exports (in ₹ 100 crores)
2009-10	15	35
2010-11	85	100
2011-12	90	70
2012-13	130	120
2013-14	170	180

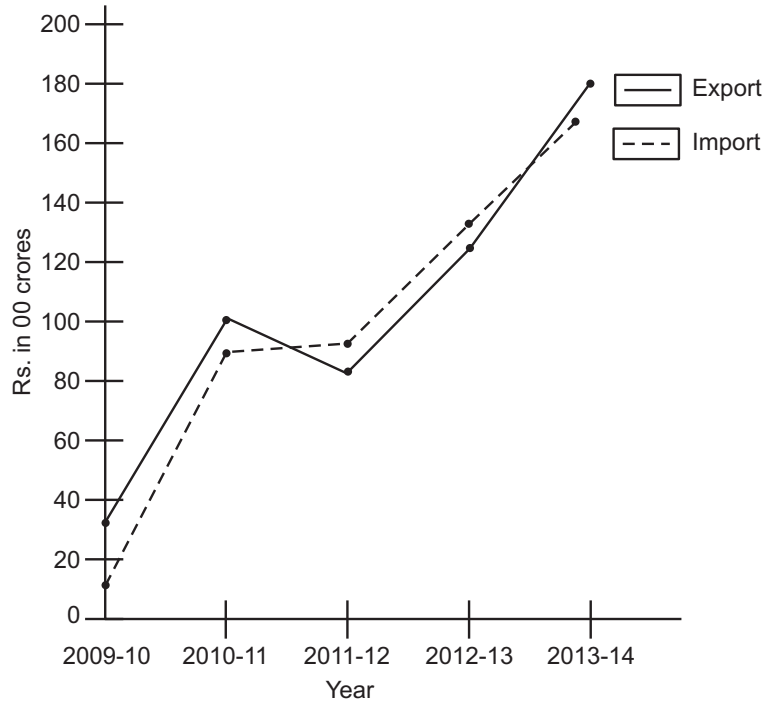


Notes



**Notes**

The time series line graph prepared on the basis of above data is given below (see figure 7.8)



**Fig. 7.8:** Exports and Imports of Country X in 2009-14 (in rupees' 00 crores)

In the above graph imports are shown in broken line and exports otherwise. Such a presentation is very useful to make comparison between two dependent variables.



**INTEXT QUESTIONS 7.3**

Fill in the blanks:

- (a) A ..... graph shows the relationship between two variables.
- (b) If one of the variable on line graph is ..... it is called time series line graph.
- (c) In a time series line graph ..... is an independent variable.
- (d) In a time series line graph ..... variable is represented on the Y-axis.

**7.5 HISTOGRAM**

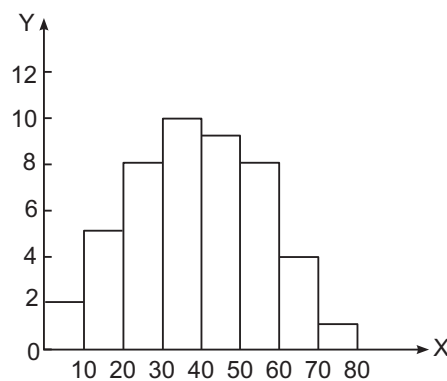
Histogram is a joining rectangular diagram of a continuous series in which each rectangle represents the class interval with frequency. It is a two dimensional diagram and also called a frequency histogram.

**(i) Histogram of equal class intervals:****Example:** Presents the following data in a histogram:

Marks	Frequency
0-10	2
10-20	5
20-30	8
30-40	11
40-50	10
50-60	9
60-70	4
70-80	1

**Notes****Method of Construction of Histogram**

- (i) Take marks on x-axis.
- (ii) Take frequencies on y-axis.
- (iii) Get rectangle joining each other representing each class with frequency.
- (iv) Label both the axis.

**Fig. 7.9:** Histogram of equal class intervals.**(ii) Histogram of unequal class intervals****Example:** Represent the following data by mean of histogram:

## MODULE - 3

Introduction to Statistics



Notes

Presentation of Data

Marks	No. of students(F)
10-15	6
15-20	19
20-25	28
25-30	15
30-40	12
40-60	12
60-80	8

### Method of Construction of Histogram

- Since the last intervals are unequal, frequencies must be adjusted.
- Take the class which has the lowest class interval.
- Do not adjust the frequencies of the lowest class.
- Frequencies of other classes are adjusted with this lowest class intervals.
- Adjusted frequencies will decide the heights of each rectangle of histogram but widths will be according to class limits.
- The frequencies of minimum class intervals on which the frequencies of other classes are adjusted will not be changed.
- Both axis should be clearly labelled.

The adjusted frequencies are:-

Marks	Frequency	Adjusted	Adjusted Frequency
10-15	6	–	6
15-20	19	–	19
20-25	28	–	28
25-30	15	–	15
30-40	12	$\frac{5 \times 12}{10}$	6
40-60	12	$\frac{5 \times 12}{20}$	3
60-80	8	$\frac{5 \times 8}{20}$	2

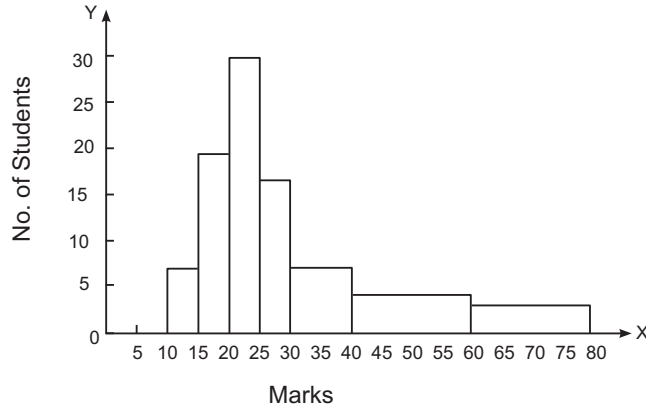


Fig. 7.10: Histogram of unequal class intervals



Notes

## 7.6 FREQUENCY POLYGON

Polygon is a diagrammatic presentation of data which is constructed by joining the midpoints of the tops of rectangles in a diagram. However, a polygon can be drawn even without constructing a histogram.

**Example:** Construct a frequency polygon from the data given below

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Students	5	10	15	20	12	8	5

### Method:

- (i) Draw a suitable histogram keeping in view all the basic principles.
- (ii) Get the mid-points of the upper horizontal side of each rectangle.
- (iii) join these mid-points of the adjacent rectangle of the histogram by straight lines.
- (iv) Both axes should be clearly labelled.





Notes

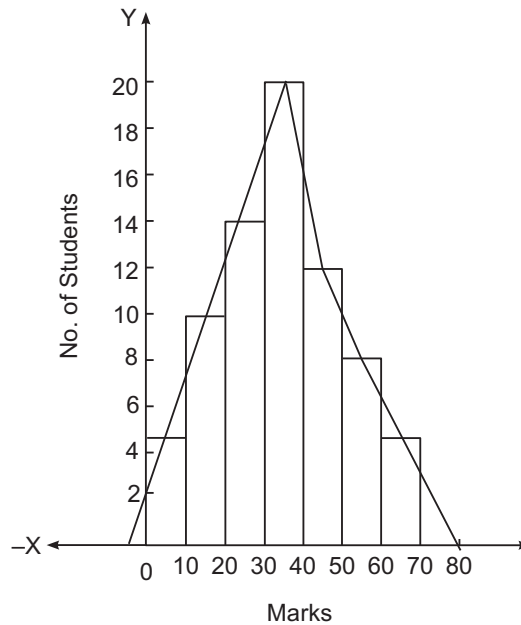


Fig. 7.11: Frequency polygon

### 7.7 CUMULATIVE FREQUENCY CURVE (OGIVE)

Cumulative frequency curve or ogive is the curve which is constructed by plotting cumulative frequency data on the graph paper in the form of a smooth curve.

A cumulative frequency curve or ogive may be constructed in two ways

- (a) Less than, method
- (b) More than method

**Example:** Present the following data in the form of less than ogive and more than ogive

Marks	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
No. of students	4	6	10	25	22	18	5	

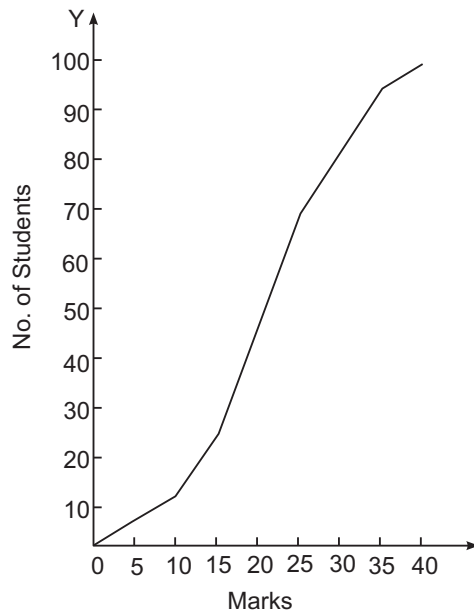
#### Method

- (i) Get the cumulative frequencies of the given frequencies either by 'less than' method or by 'more than' method;
- (ii) Take 'marks' (variable under study on x-axis.
- (iii) Take calculated cumulative frequencies on y-axis.

- (iv) Plot the various points and join them to get a curve i.e. ogive.
- (v) Both the axes should be clearly labelled.

**Cumulative frequency Distributive**

Marks	Cumulative Frequencies	Marks	Cumulative Frequencies
less than 5	4	More than 0	100
less than 10	$4 + 6 = 10$	More than 5	$100 - 4 = 96$
less than 15	$10 + 10 = 20$	More than 10	$96 - 6 = 90$
less than 20	$20 + 10 = 30$	More than 15	$90 - 10 = 80$
less than 25	$30 + 25 = 55$	More than 20	$80 - 10 = 70$
less than 30	$55 + 22 = 77$	More than 25	$70 - 25 = 45$
less than 35	$77 + 18 = 95$	More than 30	$45 - 22 = 23$
less than 40	$95 + 5 = 100$	More than 35	$23 - 18 = 5$
		More than 40	$5 - 5 = 0$



**Fig. 7.12:** 'Less than' ogive



Notes



Notes

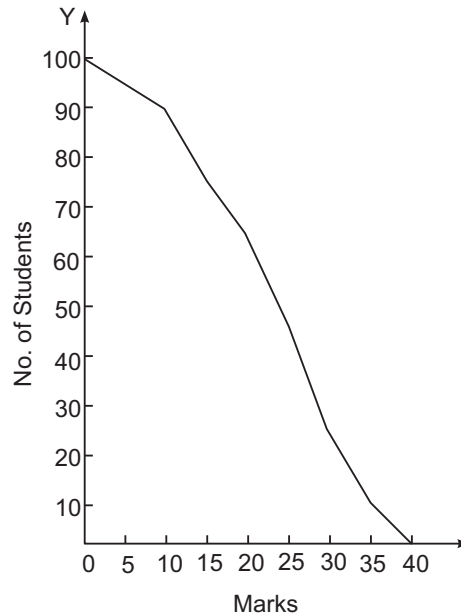


Fig. 7.13: 'More than' ogive



**WHAT YOU HAVE LEARNT**

- After data have been collected, they must now be arranged and presented in some useful form.
- A good presentation highlights the data and brings out important points for necessary comparison.
- Tables, frequency arrays, frequency distribution, time series line graphs etc., are some important ways in which data are presented.
- A table is a systematic presentation of data in rows and columns
- Each table has some essential constituent parts like table number, title, head note, caption, stubs, main body, foot note and source of information.
- A graph is also an important way of presenting data-such as time series line graphs, bar charts, pie diagram etc.
- A bar diagram is defined as a thick line made thicker to draw attention of the viewer.
- Its height is important as it shows the value of the variable.
  - A bar diagram can be drawn either vertically or horizontally.
  - When a breakdown of a total or a series of totals is to be shown, we use what is known as sub-divided or component bar diagram.
  - A pie diagram is also an important and effective way of presenting data. It is a circle sub-divided into components to present the proportion of different constituent parts of the total.

- When an economic variable is presented along with time, it is called a time series line graph.



**TERMINAL EXERCISE**

1. What is a statistical table? List its various parts.
2. What is the purpose of preparing a table? In this context distinguish between reference table and text table.
3. What is a bar chart? Explain briefly its various types.
4. What is the difference between simple bar diagram, sub-divided or component bar diagram and multiple bar diagram?
5. Explain the meaning and uses of a pie diagram. Prepare a pie diagram of family expenditure from the following data:

S.No.	Items	Expenditure (₹.)
1.	Food	480
2.	Clothing	300
3.	Education and Entertainment	330
4.	Rent	450
5.	Miscellaneous	240
	Total Expenditure	1800

6. Explain the meaning of time series line graph with the help of an example.
7. Draw a time series line graph on the basis of following data:

**Annual Profits of A Firm**

Year	Profit (₹. In thousand)
2009	60
2010	72
2011	75
2012	65
2013	80
2014	95



Notes

## MODULE - 3

### Introduction to Statistics



#### Notes

### Presentation of Data

8. Make a blank table (format) showing the distribution of students of 12<sup>th</sup> class according to:
- (a) Subject group i.e. Science, Arts and Commerce
  - (b) Sex i.e. boys and girls.
9. The following table gives selling price and cost price of a good 'X' for five years.

Year	2009	2010	2011	2012	2013
Selling Prices 'X'	105	110	120	90	160
Cost Price 'X'	100	80	120	120	140

Plot the above information on a graph paper in the form of line graph. What type of graph do you get?

10. Draw histogram, frequencies polygon, 'less than' ogive and 'more than' ogive from the data given below:

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	3	10	14	10	3



### ANSWERS TO INTEXT QUESTIONS

#### 7.1

1. (a) True (b) False (c) True (d) True  
(a) table (b) title (c) stub (d) bottom

#### 7.2

1. (a) False (b) True (c) True (d) False  
2. (a) an angular (b) degree for a component

#### 7.3

- (a) line (b) time (c) time (d) dependent

**Guidelines to Activities**1. **Hint:**

Subject group	Number of Students		Total
	Boys	Girls	
Science			
Arts			
Commerce			
Total			

- (a) Fill up yourself, the title, footnote, etc. i.e. parts of a table.
  - (b) Fill up the main body of the table with imaginary figures.
2. (a) Measure year of X axis and selling price (S.P.) as well as cost price (C.P.) on Y axis to get a time series line graph.

**Notes**