1 Graphs in Economics

Introduction

Economics explains and analyses various economic events occurring in the real world. An analysis of the statistics provided by the state, banks and international organizations is very purposefully done in economics. Lay persons do not get interested in discussions and analysis of events done by experts. But their attention is drawn when important aspects of certain events and matters pertaining to economic changes are presented by way of pictures; and this way certain information which must be conveyed to people, reaches them. Generally two types of pictures are used to depict such information and these are called : (1) Diagrams and (2) Graphs.

1.1 Meaning of a Diagram and a Graph

Statistics classifies diagrams and graphs as different types of pictures which are used for distinct purposes. In economics also, these are used for different purposes.

(1) Diagram : Diagram is a representation of observable data by way of a picture. Scales and measurements are used while drawing a diagram, though, thorough knowledge of statistics is not required to draw. A diagram is drawn for data which are presented in discrete frequency distribution. In other words, a diagram is drawn for self-explanatory data and lay persons do not require detailed knowledge of statistics in order to draw or understand a diagram. A diagram is used by advertising companies to draw attention, by the government to provide information and by social organization to spread awareness.

(2) Graph : A graph is also a representation of observable data by way of a picture. But a graph is drawn for statistical information which is not self-explanatory. A graph is drawn for data with continuous frequency distribution. In order to simplify such data, use of statistical tools is made. A graph is also drawn for other types of complex (unclear) statistical information. Thorough

knowledge of statistics is essential to draw and understand a graph. A graph can extend over one or more of the four quadrants obtained by the intersection of 'X' an 'Y' axes on a plane and it cannot be drawn without taking appropriate measurements.

A graph is generally drawn on a graph paper. Graphs are used more by researchers and educationists. Graphs are not used for conveying information to general public (lay persons).

Example of data with discrete (discontinuous) frequency distribution

Table 1.1

Price (In ₹)	Demand (in units) Frequency
1	100
2	80
5	70
7	20
10	10

Example of data with continuous frequency distribution

Table 1.2

Income Class	Number of People (Frequency)
10,000 - 20,000	500
20,000 - 30,000	300
30,000 - 40,000	100

Table 1.3

Classes of Marks	Number of Students (Frequency)
10 - 19	50
20 - 29	30
30 - 39	10

1.1.1 Importance of Diagrams and Graphs in Economics :

The importance of diagrams and graphs in economics can be stated as under :

(1) The study of the subject of economics which is perceived as difficult and complicated is made easier by way of diagrams and less confusing (clearer) by way of graphs.

(2) Trends of certain economic parameters over various years can be observed through a single diagram or graph.

(3) Changes occurring in various sectors of the economy can also be easily understood.

(4) A comparison can be easily drawn for the distribution of some economic parameters between groups/classes, regions, sectors as well as time periods.

(5) When many aspects of economics which are found apparently difficult are presented through a diagram/graph, the time and effort of the presenter in explaining and of the reader in understanding these aspects is saved.

(6) Certain difficult principles of economics are easy to understand with the help of diagrams and graphs. For example, the concepts of expansion and contraction of demand and supply, price elasticity of demand and supply etc. are made easier by way of pictures; and, the trends of macroeconomic parameters can be clarified by way of time - series graphs. For instance, the short-run and long-run irregular fluctuations in agriculture or the regular fluctuations in some industry are calculated by the method of time series and their trends are presented by way of time-series graphs.

1.1.2 Aspects to be Considered while Drawing a Diagram (Graph)

While making diagrams and graphs, the following aspects must be considered as the purpose of drawing pictures is to make an analysis simpler and more effective :

(1) Choice of type of Diagram or Graph and their Presentation : The right type of diagram or graph must be chosen to make a picture more effective. Certain data can be presented in a bar diagram as well as in a pie diagram. The user must make the right choice to make the picture more effective.

(2) Clarity: A picture must look neat and clear. Different colours or shades may be used to denote the various components of a picture.

(3) Scales and Measures : To make a picture look appropriate in size, scales must be taken in accordance with the data.

(4) Representation of axes : Both axes of a diagram or graph must be denoted/represented with appropriate details of what they represent.

(5) Data Table and Source of Data : Diagrams and graphs must be accompanied by the data table from which they are created and by mentioning the source of data, the picture becomes more reliable and authentic.

(6) Method of Calculating the Data : When the picture is not drawn from self explanatory data but is drawn from data simplified with statistical formulae, it is appropriate to state the statistical method briefly.

1.2 Types of Diagrams

There are many types of commonly used diagrams like –

- Pictogram
- Scatter diagram
- Line diagram (based on time periods)
- Circle diagram
- Bar diagram
- Pie diagram

In this section, we shall understand about time-based line diagram, bar diagram and pie diagram.

1.2.1 Time-Based Line Diagram (Curve)

Pictures which show the shape or slope of a relationship in economics between two variables are often drawn. For example, a demand curve, a supply curve etc.

The independent variable is measured on 'X' axis and the dependent variable is measured on 'Y' axis.

Economics often uses line diagram representing time-based self explanatory trends of a variable. For example, size of population in different time periods, rate of inflation in various years, literacy rate in various years etc. Such diagrams can be termed as time-based line (curve) diagrams.

Example :

Table 1.4 Percentage Growth Rate of India's Population Since 1951

Decade	Decadal Growth Rate of Population in %
1951-61	21.64
1961-71	24.80
1971-81	24.66
1981-91	23.87
1991-2001	21.54
2001-2011	17.64

Source : Census of India

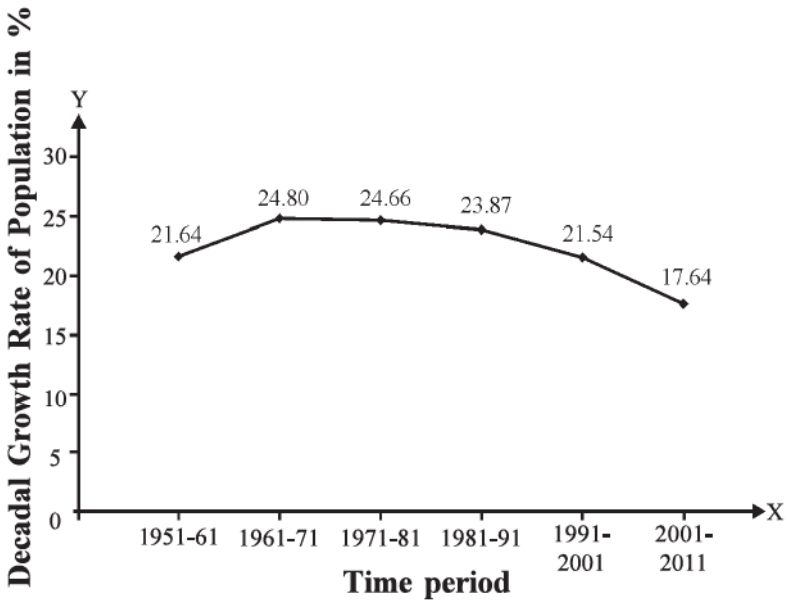

Figure 1.1 : Time-based Line Diagram (Curve)

1.2.2 Bar Diagram and Types of Bar Diagram

A bar diagram shows distribution of the value of a variable in various components. For example, literacy rate in a country in various years or literacy rate among females and males in a particular year.

- A vertical or horizontal bar is drawn for each value of the variable.
- A separate bar is drawn for each section or time-period and the height/length of the bar indicates the value for that section or time-period.

Thus, by comparing the height/length of the bars a comparison can be made of the values of each section.

Bar diagrams are generally of three types : (A) Simple bar diagram (B) Clustered bar diagram (C) Divided bar diagram

1.2.2.1 Meaning and Example of a Simple Bar Diagram : A simple bar diagram represents values of only one variable over a base, say various regions or years etc. It gives a visual effect of the difference in the value of the variable between regions, years and so on.

Example : Bi-Monthly Sale of Chocolate boxes in a Shop

Table 1.5

Months	Sale in units
Jan-Feb	35
March-April	60
May-June	65
July-Aug	40
Sept-Oct	50
Nov-Dec	30

Source : Hypothetical Example

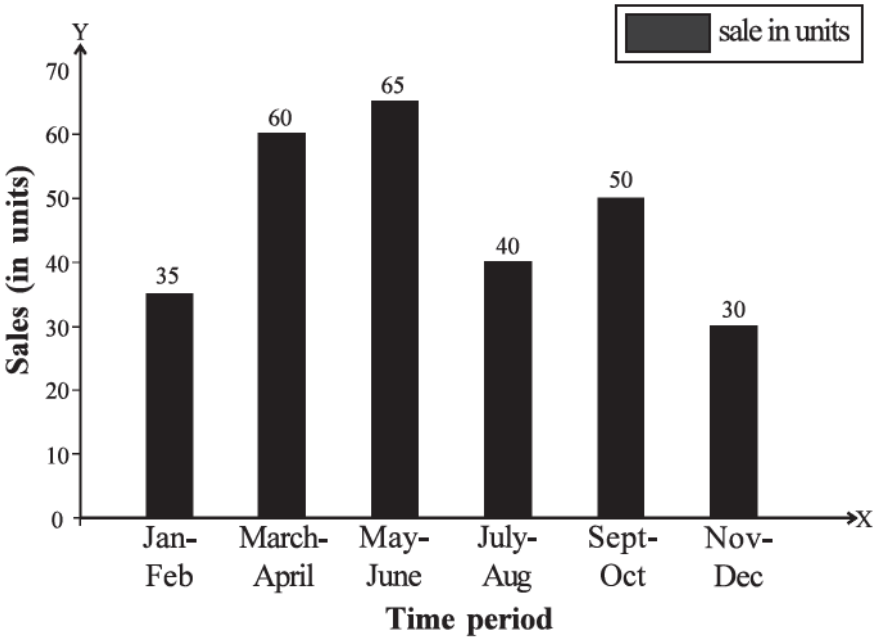

Figure 1.2 : Simple Bar Diagram

1.2.2.2 Clustered Bar Diagram : In this type of a graph, values of a common variable and over a common base are given for more than one section of related parameters. Hence, we get a cluster of bars for the same variable over various base-values.

For example, if the base is time period, the variable is literacy level and its values are expressed for two categories namely, females and males then for one time period, two bars showing literacy level for females and males respectively are drawn in a cluster.

To create proper visual effect and help comparison, each bar is coloured differently and value which it represents are indicated on it.

Example : Bi-Monthly Sale of Chocolate Boxes of Different Sizes in a Shop

Table 1.6 Number of Chocolates Sold

	Sales (in units)		
	Small size	Medium size	Large size
Jan-Feb	30	15	25
March-April	40	25	50
May-June	50	25	35
July-Aug	25	15	10
Sept-Oct	40	20	25
Nov-Dec	60	40	20

Source : Hypothetical Example

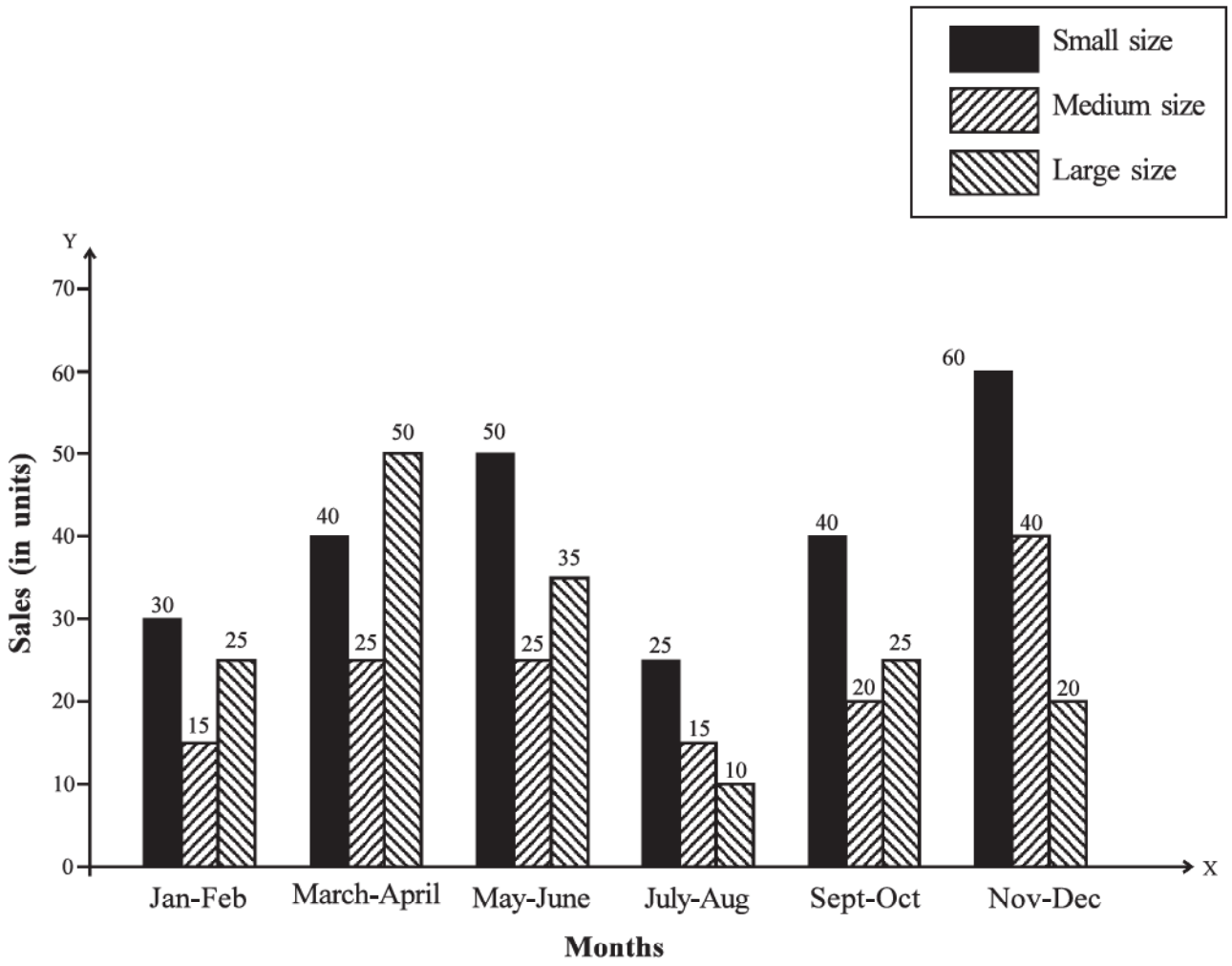

Figure 1.3 : Clustered bar diagram

1.2.2.3 Divided Bar Diagram : In such a diagram, every single value of the variable has sub categories. Hence, we get divisions in all the bars which represent a common variable and common base values.

To create proper visual effect and help comparison, each division of the bar is coloured differently and values which it represents are indicated.

Example : Bi-Monthly Sale of Chocolate Boxes by a Sales Person in Rural and Urban Areas in a Region :

Table 1.7 Number of Chocolates sold in Rural and Urban areas

Sector	Sales (In units)					
	Jan-Feb	March-April	May-June	July-Aug	Sept-Oct	Nov-Dec
Rural	30	35	40	20	35	40
Urban	40	80	70	30	50	80
All India	70	115	110	50	85	120

Source : Hypothetical Example

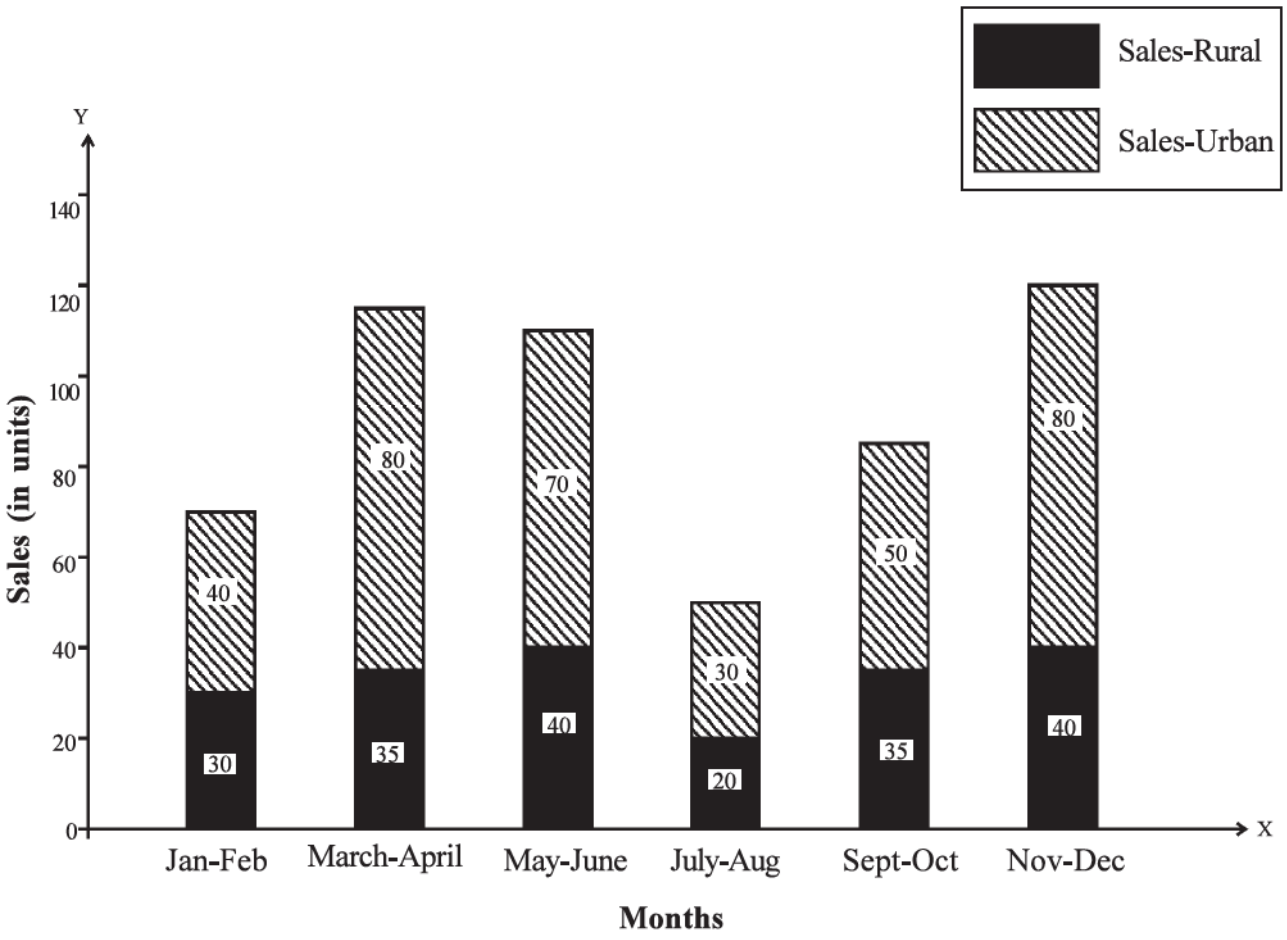

Figure 1.4 : Divided bar diagram

1.2.2.4 Aspects to be Considered while Drawing a Bar Diagram :

(i) The width of the bars does not represent any data and hence all bars should be of equal width.

(ii) The length of the respective bars should be proportional to the value of the variable which they represent.

(iii) The distance between all bars should be equal and that should also be maintained between the first bar and the origin.

(iv) All bars rest on the same line called the base which usually coincides with the 'X' axis.

In today's times with the help of computer technology, horizontal bars are also drawn instead of vertical bars.

(v) All vertical bars should be arranged from left to right in order of the data series. Therefore, the bar representing the first data in the series is drawn first near the point of origin.

1.2.3 Pie Diagram :

Division of a circle in degrees represents a pie diagram. If an entire circle is considered as universal set of an entire data and the different components of this data are represented by dividing the circle in degrees proportional to the data then a pie diagram is obtained.

Pie diagram is drawn for the similar type of data for which a bar diagram can be drawn.

Since an entire circle represents 360°, the entire data represents 360° and sections/divisions of the data are represented by dividing the circle in degrees proportional to each data section.

In other words, a diagram which is drawn by representing sub-divisions of an entire data by proportionate degrees in a circle is called a pie diagram.

Formula for obtaining proportional degree for a component of data :

$$\text{degree} = \frac{\text{component value}}{\text{total value}} \times 360$$

Example : Percentage of Pocket Money Spent by a Student on Various Items

Table 1.8

Item	Percentage of Money Spent	Calculation of Degrees
Books	20	(20 × 360) ÷ 100 = 72°
Stationery	5	(5 × 360) ÷ 100 = 18°
Phone, Computer, other devices etc.	30	(30 × 360) ÷ 100 = 108°
Food	30	(30 × 360) ÷ 100 = 108°
Clothes	15	(15 × 360) ÷ 100 = 54°
Total	**100**	**(100 × 360) ÷ 100 = 360°**

Source : Hypothetical Example

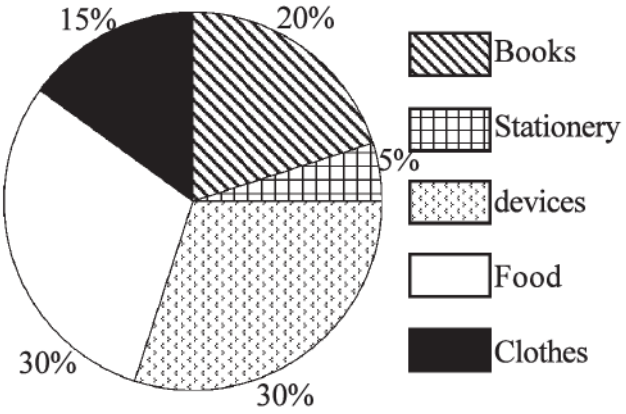

Figure 1.5 : Pie Diagram

1.2.3.1 Aspects to be Considered while Drawing a Pie Diagram :

(i) 360 degrees make a circle.

(ii) Degrees for sub divisions are calculated in proportion to the value of the variable for that division and the sum total of the degrees of all such sub divisions must be 360°.

(iii) If relevant data is to be compared across regions or time periods then two pie graphs can be drawn side by side. For a data set with a smaller total value, a circle with smaller dimensions is drawn and for a data set with larger total value, a circle with bigger dimensions is drawn.

1.3 Types of Graphs

Use of graphs is also frequently made in Economics. Statistics classifies graphs as under :

(1) Time-series graphs

(2) Graphs for continuous frequency distribution

- Histogram
- Frequency polygon
- Frequency curve
- Cumulative frequency polygon

(3) Logarithmic graphs

1.3.1 Time Series Graphs

In a trade cycle or in cycles of economic activities, short term and long term regular or irregular (erratic) changes are observed. The trends of such changes are obtained with the help of statistical tools; and when graphs are drawn taking these changes as variable and time period as base then such graphs are called time series graphs.

Since the syllabus does not include other types of graphs, they are not discussed here.

1.4 Use of Technology in the Study of Economics

We are living in an age of digital technology and we use this technology in our daily lives. We use digital technology to stay connected with friends and relatives, to watch movies, to listen to music, to navigate our way while driving on unknown roads, to order purchase goods, to pay our bills, to buy tickets and for many more purposes.

This technology is also used for education.

Economics is an art and science which evolves every day as the behaviour of human beings, society and state changes with time. Hence people in ordinary business of life as well as experts have to update themselves by the day and technology helps to cope up.

Different types of digital tools frequently used in the study of economics are explained below :

1.4.1 Computer Technology

A student of economics is aware of the word computer. We may have used a computer frequently in our school and some of us might also be having a computer at home. Oh! Today even smart phones perform several functions of a computer. We can use various programmes of a computer technology in our study. Like,

(i) Presentations : Complicated economic information/data and difficult theories of economics can be made easy by expressing in a power point presentation.

For example, the entire topic of budget can be highlighted in 3 slides. One can give the meaning and two accounts in a budget and their meaning. Another can show the example of the contents of a budget and how it is presented. The third slide can give the trends of budget in our country or can give the actual budget of a government for a recent year.

(ii) Excel Work Sheets : Economics deals with lots of data. Researchers sometimes deal with data in thousands of observations. For instance, if we do a survey on number of items produced by small scale industries in India, we may get thousands of observations. Such data must be entered in an excel sheet and this sheet can process the data for any formula at only one click. For example, it can give us sum total, averages, correlations and much more. Excel sheets are almost an important tool for processing data in economics. We can also obtain various figures for the data in an excel sheet.

(iii) Diagrams and Graphs : There are several programmes in a computer which help us to draw diagrams and graphs which we frequently use in economics.

There are simple drawing tools in a word file which can be used to draw simple free hand figures like a simple downward sloping or upward sloping demand or supply curve. Excel sheet plots almost all types of diagrams and graphs for the data which we enter in the work sheet. We must only know the formula for doing so and give the relevant command.

(iv) Storage Tools : We use plenty of study material in economics. Such material becomes useful in higher studies in economics or for research. We need space and carefulness to preserve such material in the form of physical note books or books. There is a fear of losing such material owing to moisture, pests etc. But we can preserve all such material in a computer. Besides, it can be carried anywhere by transferring it in a hard disc or pen drive. By transferring it in e-mail, drop-box, google drive, digi-locker etc. we can access this material and read it in any part of the world. Thus, study materials can be preserved with the help of computer technology.

(v) Other Tools : Statistical programmes like SPSS, SHAZAM, E-views, SAS etc. are developed to do almost all types of data processing for lakhs of observations in minutes by entering the right formulae. Research institutes buy such programmes. These are very expensive. However, certain software like Gretl, PSPP, R etc. can be obtained free of cost through the internet.

Now-a-days all these functions of a computer are also available on smart phones and tablets.

Caution in Using Computer Technology :

Computer is an aid in studying and it is not a study material by itself. It helps to make the process of studying easier and faster but it does not replace the process of studying. If we do not use the right commands in a computer, we may end up losing our material. We may also end up getting incorrect graphs and data processing if we do not know the correct formulae and commands.

1.4.2 Internet Technology :

Internet is another facility created by digital technology, which all of us have used from time to time. The use of internet in economics can be summarized in the following chart.

Purpose	Manner in which Internet Helps
(1) Tutorials	Some educational websites put power point presentations and study material along with work sheets on the open access link. We can view such presentations as tutorials.
(2) Active Learning	Some videos of lectures by experts are put on open access sites by some educational institutions; some institutions create live lectures available to students. We can register on these sites and we can listen to a lecture on the net like we do in our class room. e.g. lectures by experts are available in economics and other subjects
(3) Reading Material	Numerous books are available online free of cost for reading. Some good research articles, copies of journals etc. are also available for reading. Some articles, books and journals can be accessed by paying some annual fees on those websites. These materials are called e-books, e-journals, etc.

Purpose	Manner in which Internet Helps
(4) Information	By merely searching, we can get information on universities offering degrees in economics, or any other information about any subject.
(5) Miscellaneous	We can get quotes by economists, names of reference books etc. also on internet by using the search engine.
(6) Data	Economics uses a lot of secondary data. For instance, we use data on budget of a government, banking, agricultural production, value of exports and imports, poverty, employment, industrial production and many others. These data can be accessed from authentic websites. For example, authentic site for data on banking in India is the official website of Reserve Bank of India, for exports and imports is the website of Ministry of Commerce and Industries of Government of India, Budget related information from Ministry of Finance, Government of India and so on. Some Organizations and agencies functioning at national and international levels also collect publish as well as put data on websites. For example, CSO, NSSO, WHO, UNO, CMIE, ILO, IMF, World Bank and so on. (By authentic data is meant data which is published by recognized research institutes after doing comprehensive research.)

Caution in Using Internet for Education

Like computer, internet is also only a tool. It cannot replace books and teachers or our own thinking and reasoning. A lot of substandard material, irrelevant information, misleading information, plagiarised articles are found on internet. We must avoid using those. Readers must have the wisdom of identifying the authentic material on internet. Only authentic websites must be referred to otherwise we may end up getting misled.

1.4.3 Data CDs (Compact Discs) :

Some authorities and agencies like laboratories, research centres, government agencies, etc. involved in collection and publication of information and data pertaining to macroeconomic indicators put huge data content in compact discs and sell those for researchers and educational institutions. Such CDs are used by educational institutions, research institutes, etc. for their studies. Some such data CDs frequently used in economics are :

- CD of National Income Accounts of India
- CD of Census of India
- CD of Annual Survey of Industries in India
- CD of NSSO (National Sample Survey Organization)
- CD of data pertaining to any Ministry in India which are provided by the statistical department of respective Ministries.
- Some agencies like CMIE (Centre for Monitoring Indian Economy), also create data soft ware which can be purchased only by research institutes and corporations as these are very expensive.

Difficulty in Using Data CDs :

Since the data CDs and software contain a huge size of data, these become complicated to use. There are several sheets in a CD, and one must have the knowledge regarding searching the relevant data sheet and get the relevant data.

Exercise

1. Choose the correct option for the following questions :

(1) For which type of distribution a diagram is drawn ?

(a) Continuous (b) Discrete/Discontinuous

(c) Skewed (d) Ideal

(2) For which type of distribution a graph is drawn ?

(a) Continuous (b) Discrete/Discontinous

(c) Skewed (d) Ideal

(3) Which of the following diagrams are drawn for similar data ?

(a) Simple bar diagram and clustered bar diagram

(b) Bar diagram and pie diagram

(c) Clustered bar diagram and time-series graph

(d) Pie diagram and time-series graph

(4) Which of the following statements is true for internet in the present times ?

(a) It is a tool for studying.

(b) Fulfils the role of a teacher in the process of studying.

(c) Is a close substitute for schools.

(d) Is only a tool for entertainment for youth.

(5) Who/Which type of organization presents data CDs pertaining to economic information ?

(a) Private publishers

(b) Schools

(c) Laboratories, research centres, government etc.

(d) Individuals

2. Answer the following questions in one line :

(1) What is meant by a diagram ?

(2) What is meant by a graph ?

(3) What is meant by a bar diagram ?

(4) What is meant by a pie diagram ?

(5) What is a data CD ?

3. Answer the following questions in brief :

(1) What is meant by a diagram and for what purpose it is drawn ?

(2) What is meant by a graph and for what purpose it is drawn ?

(3) State the importance of diagrams and graphs in economics.

(4) How is computer technology useful in the process of learning ?

(5) Write a note on data CD.

4. Give answers to the point for the following questions :

(1) State the important aspects to be considered while drawing a diagram and a graph.

(2) State the important aspects to be considered while drawing a bar diagram.

(3) Give the difference between diagrams and graphs.

(4) Explain the usefulness of internet technology in the process of learning.

(5) Give the caution areas in using computer and internet technologies for studying.

(6) What is the importance of diagrams and graphs in context of presenting information about economics for lay persons and for experts.

5. Answer the following questions in detail :

(1) Explain the types of diagrams in detail.

(2) Give an understanding of the usefulness of technology in the study of economics.

Glossary

Diagram	:	Representation of the relationship between variables in a picture is called a diagram.
Graph	:	It is a picture drawn for complex information which is simplified with the help of statistical tools or for information expressed in continuous frequency which is made presentable with the help of statistical tools.
Bar Diagram	:	When a data set is distributed among various sections and for each section a bar is drawn on a common base, such that the height of the bar is proportional to the value of the variable for the respective section then such a diagram is called a bar diagram.
Pie Diagram	:	A diagram which is drawn by representing sub-divisions of an entire data by proportionate degrees in a circle, is called a pie diagram.