UNIT 14 DIAGRAMMATIC PRESENTATION OF DATA

Structure

14.1 INTRODUCTION

In Unit 13, we have discussed about the classification and tabulation of data. Though these methods are very helpful to make easy and systematic presentation of the data, even then people are least interested in tables. A group of large number of observations always makes misperception to the reader and he/she may understand it wrongly. If data are presented in the form of diagrams, it attracts the reader and he/she tries to understand it. Diagrammatic presentation helps in quick understanding of data. Confirmation of this can be found in the financial pages of news papers, journals, advertisement, etc. There are many methods of representing the numerical figures through diagrams but sometimes, it is very difficult to decide that which is the best diagram in a specific situation?

In this unit we will discuss one-dimensional, two dimensional and pie diagrams. Pictogram and Cartogram have been also discussed in this unit. Unit ends with a note on choice of a suitable diagram in a given situation.

Objectives

After studying this unit, you should be able to:

- become familiar with the diagrammatic presentation of data;
- draw suitable bar diagrams for given data;
- draw rectangle and square diagrams for the given data;
- draw pie diagram;
- draw pictograms and cartograms; and
- select an appropriate diagram to represent data.

14.2 DIAGRAMATIC PRESENTATION OF DATA

Before we discuss different types of diagrams, let us first see what are the significance and general rules for constructing the diagrams?

14.2.1 Significance of Diagrammatic Presentation of Data

Significance of the diagrams can be explained by the following points.

(i) Easy Understanding

A large number of observations become, easy to understand through diagrams. As the number of observations increases, their analysis tends to be more tedious, but through diagrams the presented data can be understood easily. It is saying also that a picture have explanation power of worth more than 10000 words.

(ii) Attractive Look

Diagrams look attractive to the eyes. The numbers are boring whereas the diagrams give pleasure to the eyes. Diagrams are more attractive and impressive than the numbers. That is why, the reader gives more attention to the diagrams rather than the numbers, while reading a newspaper or magazine. Therefore, the use of diagrams is increasing very fast in exhibitions, fairs, newspapers and common festivals day by day.

(iii) Greater Memorising Effect

Diagrams are long lasting than numbers. Numbers may not be remembered easily but diagrams have greater memorising effect, as the impressions created by them remains in mind for long time.

(iv) Comparison of Data

Through the diagrams, one can easily compare the data related to different areas and time. It is difficult to read and compare the numbers whereas diagrams can be compared easily by viewing the presented informations.

14.2.2 Components of Diagrams

The following components should be considered carefully while constructing diagrams:

(i) Title of the Diagram

Every diagram should have a suitable title. The title of the diagram should convey the main idea in as least words as possible, but it should not omit the necessary information. The title of the diagram may be preferably placed at the top of the diagram.

(ii) Size of the Diagram

Diagram should have a proper size. A proper proportion between the height and width of the diagram should be maintained. If either height or width is too short or too long in proportion, the diagram would give an odd impression. There are no fixed rules about the dimensions, but we may follow an important suggestion given by Lutz in the book entitled "Graphic Presentation" that the proportion between height and width should be 1:1.414. In this proportion diagram looks attractive.

(iii) Scale of the Diagram

Before constructing diagram, a proper scale should be identified. No hard and fast rules are to be followed about the scale. The concern data and the required size of diagram are the guiding factors. The diagram should neither become too big nor too small. Similar scale is necessary for comparison of diagrams. Scale should be mentioned clearly at the top of the diagram or below it.

(iv) Footnotes

To clarify certain points about the diagram, footnotes are to be used. Footnotes may be given at the bottom of the diagram.

(v) Index of Diagram

An Index should be given to illustrate different types of lines or different types of shades or colours, so that the reader can easily make out the meaning of the diagram.

(vi) Neat and Clean Diagram

A good diagram should be absolutely neat and clean. Too many information should not be given in one diagram otherwise reader may get confused.

(vii) Simple Diagram

A good diagram should be as simple as possible so that the reader can understand its meaning clearly, otherwise the complexity can omit its main theme.

In previous two subsections we have explained the significance and general rules for construction of diagrams. In next subsection we will just list the types of the diagrams. Then in subsequent sections we will discuss each type of diagrams in detail.

14.2.3 Types of Diagrams

In practice, various types of diagrams are in use and new ones are constantly being added. For the sake of application and simplicity several types of diagrams are categorised under the following heads:

(i) One Dimensional Diagrams or Bar Diagrams

(ii) Two Dimensional Diagrams

(iii) Pie Diagrams

(iv) Pictogram

(v) Cartogram

14.3 ONE DIMENSIONAL OR BAR DIAGRAMS

Bar diagrams are the most commonly used diagrams. Shape of a bar is like a rectangle filled with some colour (see Example 1). They are called one dimensional diagrams because only length of the bar matters and not the width. That is, width of each bar remains same in a diagram, but it may vary diagram to diagram depending on the space available and number of bars to be presented. For large number of observations lines may be drawn instead of bars to save space.

Following are the special merits of bar diagrams or one dimensional diagrams:

(i) They are easily understood even by those who are not chart minded.

(ii) They are the simplest and easiest in comparing two or more diagrams.

(iii) They are the only form that can be used effectively for comparing the large number of observations.

After looking the merits of bar diagrams, you will be keen to know how bar diagrams are constructed and how many types of bar diagrams are generally used. Coming two subsections will address the above two points/questions.

14.3.1 Types of Bar Diagrams

The following are the different types of bar diagrams:

(i) Simple Bar Diagram

(ii) Subdivided Bar Diagram

(iii) Multiple Bar Diagram

(iv) Percentage Bar Diagram

(v) Deviation Bar Diagram

(vi) Broken Bar Diagram

Let us discuss these types of bar diagrams one by one.

(i) Simple Bar Diagram

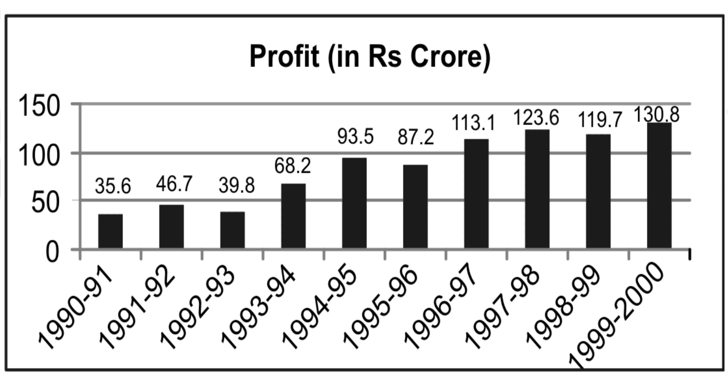
If someone has to represent the data based on one variable, then the simple bar diagram can be used. For example, the figures of productions, profits, sales, etc. for various years may be represented by the help of simple bar diagrams. From simple bar diagrams reader can easily see the variation in the characteristic under study with respect to time or some other given factor, because width of each bar is same and only lengths of the bars vary. In our representation we will take length of bars along vertical axis and other given factor along horizontal axis. They are very popular in practice. For example, while presenting the total turnover of a company for last five decades, one can only depicts the total turnover amount in the simple bar diagrams. Let us construct a simple bar diagram in the following example.

Example 1: The profit (in Rs crore) of a company from 1990-91 to 1999-2000 are given below:

Year	Profit (in Rs crore)	Year	Profit (in Rs crore)
1990-91	35.6	1995-96	87.2
1991-92	46.7	1996-97	113.1
1992-93	39.8	1997-98	123.6
1993-94	68.2	1998-99	119.7
1994-95	93.5	99-2000	130.8

Represent this data by a simple bar diagram.

Solution: The simple bar diagram of the above data is given below:



(ii) Subdivided Bar Diagram

If various components of a variable are to be represented in a single diagram then subdivided bar diagrams are made in this situation. For example, a number of members of teaching staff in various departments of an institute may be represented by a subdivided bar diagram. Each bar is divided into the number of components in this diagram. First of all the cumulative or total amount is calculated from the amounts of components. Then bar is divided with respect to the magnitude of the components. The length of the bar is equal to the total of the amounts of the components.

A bar is represented in the order of magnitude from the largest component at the base of the bar to the smallest at the end of the bar, but the order of various components in each bar is kept in the same order. Different shades or colours are used to distinguish between different components. To explain such differences, the index should be used in the bar diagram.

Subdivided bar diagrams can be represented vertically or horizontally. If the number of components are more than 10 or 12, the subdivided bar diagrams are not used because in that case, the diagram would be over loaded with information and cannot easily be compared and understood. Let us see how subdivided bar diagram is constructed with the help of the following example:

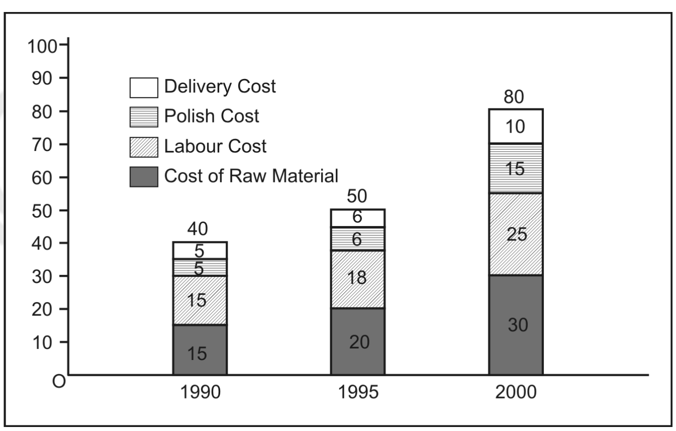
Example 2: Represent the following data by subdivided bar diagram:

Category	Cost per chair (in Rs) year wise		
	1990	1995	2000
Cost of Raw Material	15	20	30
Labour Cost	15	18	25
Polish	5	6	15
Delivery	5	6	10
Total	40	50	80

Solution: First of all we calculate the cumulative cost on the basis of the given amounts:

Category	1990		1995		2000	
	Cost (in Rs)	Cumulative Cost (in Rs)	Cost (in Rs)	Cumulative Cost (in Rs)	Cost (in Rs)	Cumulative Cost (in Rs)
Cost of RM	15	15	20	20	30	30
L Cost	15	30	18	38	25	55
Polish cost	5	35	6	44	15	70
Delivery	5	40	6	50	10	80
Total	40		50		80	

On the basis of above table required subdivided bar diagram is given below:



(iii) Multiple Bar Diagram

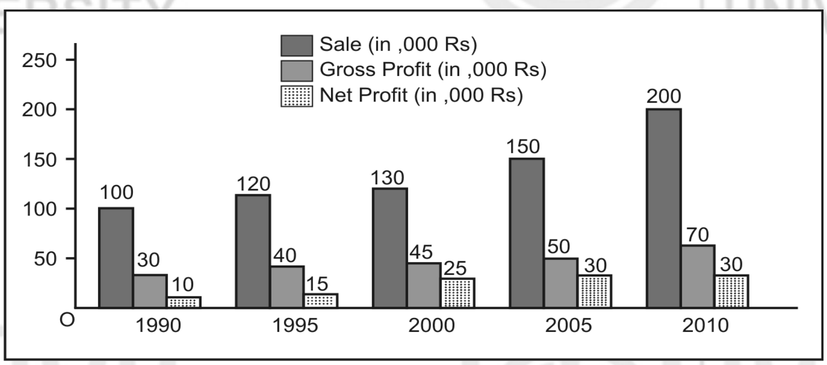
In multiple bar diagram, we construct two or more than two bars together. The multiple bars are constructed for either the different components of the total or for the magnitudes of the variables. All the bars of one group of data are made together so that the comparison of the bars of different groups can be done properly. The height of the bars will be magnitude of the component to be presented as similar as we do in simple bar diagram. In this diagram the space between the vertical axis and the first bar of the first group of bars is left but no space is left between the bars of the same group. There must also be left the space between the bars of the two different groups of bars.

In multiple bar diagrams two or more groups of interrelated data are presented. The technique of drawing such type of diagrams is the same as that of simple bar diagram. The only difference is that since more than one components are represented in each group, so different shades, colours, dots or crossing are used to distinguish between the bars of the same group, and same symbols are used for the corresponding components of the other groups. The multiple bar diagrams are very useful in situations of either the number of relative components are large or the change in the values of the components of one variable is important. Following example will illustrate how a multiple bar diagram is drawn for given data.

Example 3: Draw the multiple bar diagram for the following data.

Year	Sale (in ,000 Rs)	Gross profit (in '000 Rs)	Net profit (in, '000 Rs)
1990	100	30	10
1995	120	40	15
2000	130	45	25
2005	150	50	30
2010	200	70	30

Solution: Multiple bar diagram for the above data is given below.



(iv) Percentage Bar Diagram

Subdivided bar diagram drawn on the basis of the percentage of the total is known as percentage bar diagram. When such diagrams are drawn, the length of all the bars is kept equal to 100 and segments are formed in these bars to represent the components on the basis of percentage of the aggregate. First of all the total of the given variable is assumed equal to 100. Then the percentage is calculated for each and every component of the variable. After then the cumulative percentage are calculated for every component. Finally the bars are subdivided into the cumulative percentage and presented like subdivided bar diagram. Let us explain the procedure with the help of the example given below.

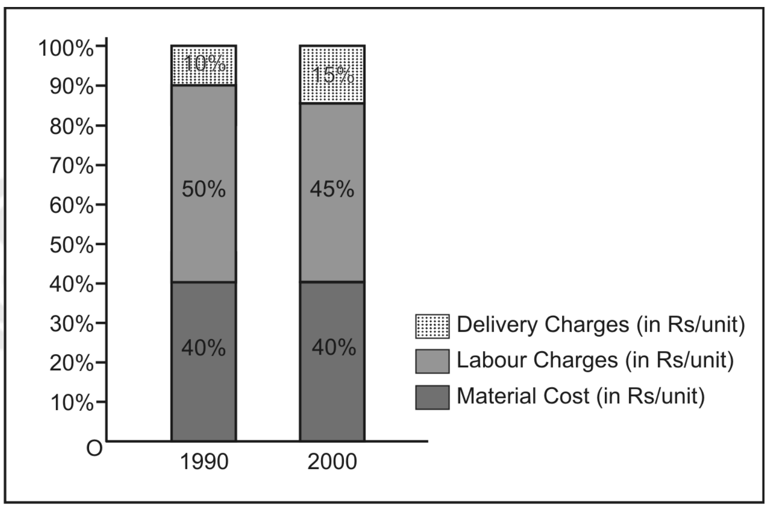
Example 4: Draw a percentage bar diagram for the following data:

Category	Cost Per Unit (1990)	Cost Per Unit (2000)
Material	20	32
Labour	25	36
Delivery	5	12
Total	50	80

Solution: First of all percentage and cumulative percentage are obtained for both the years in various category.

Category	Cost Per Unit (1990)			Cost Per Unit (2000)		
	Cost	% Cost	Cumulative % Cost	Cost	% Cost	Cumulative % Cost
Material	20	40	40	32	40	40
Labour	25	50	90	36	45	85
Delivery	5	10	100	12	15	100
Total	50	100		80	100	

On the basis of above table required percentage bar diagram is given below



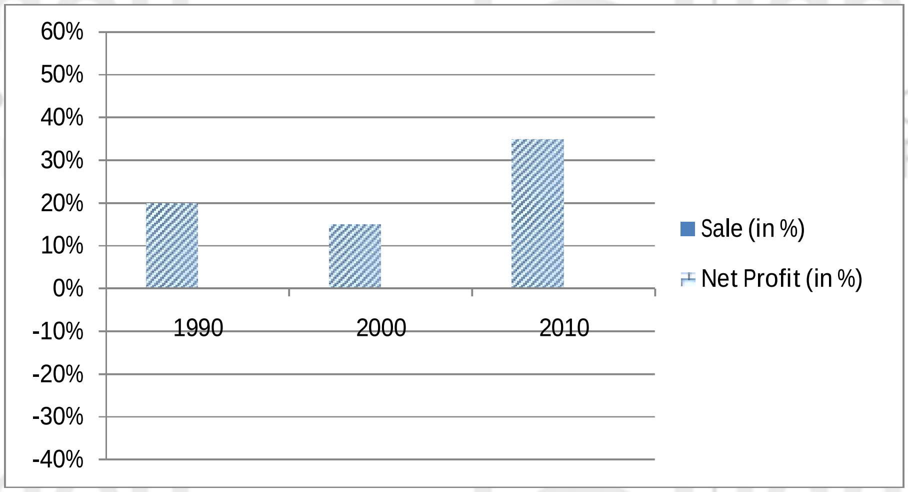
(v) Deviation Bar Diagram

For representing net quantities excess or deficit, i.e. net profit, net loss, net exports, net imports, etc., the deviation bar diagrams are used. Through this kind of bars we can represent both positive and negative values. The values which are positive can be drawn above the base line and negative values can be drawn below it. The following example would explain this type of diagram:

Example 5: Draw a deviation diagram for the following data:

Year	Sale	Net profits
1990	20%	35%
2000	15%	50%
2010	35%	–30%

Solution: Deviation diagram for the given data is shown on the next page:



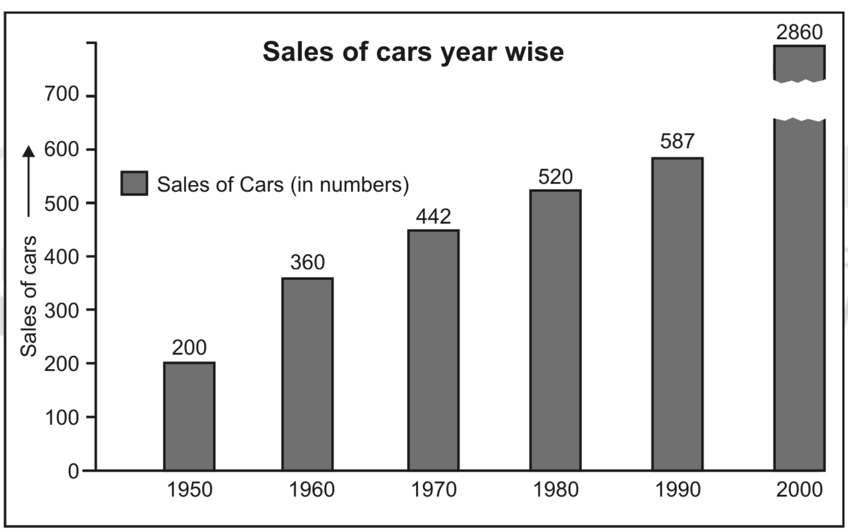
(vi) Broken Bar Diagram

If large variation exists in the values of certain type of data, i.e. some values are very small and some are very large, then in order to gain space for the smaller bars of the data, the large bar(s) may be presented as broken bars. These bars are similar to the other bars but the form of presentation is different because of having much variation from others. Let us illustrate the idea of broken bar diagram with the help of the following example:

Example 6: Represent the following data by a suitable bar diagram.

Year	Sale of cars
1950	200
1960	360
1970	442
1980	520
1990	587
2000	2860

Solution: The sale of the cars in year 2000 is almost 14 times that of in year 1950. In order to gain space for the sale figure in the year 1950, we have to use broken bar to represent the sale of cars for year 2000. Subdivided bar diagram for the given data is shown below.



14.3.1 Principles of Construction of Bar Diagrams

(i) The width of each bar must be uniform in a diagram.

(ii) The gap between two bars should be uniform throughout the diagram.

(iii) Bars may be either horizontal or vertical. The vertical bars should be preferred because they give a better look than horizontal bars and also facilitate comparison. We will use vertical bars in our presentation.

(iv) The respective figures should also be written at the top of bars so that the reader may able to know the precise value without looking at the scale.

Now, you can try the following exercises:

E1) Represent the following data by a suitable diagram:

Years:	2005	2006	2007	2008	2009	2010
Enrollment of the students:	280	294	302	270	325	406

E2) Represent the following data by a suitable bar diagram:

Year:	2007-08	2008-09	2009-10
Gross Income:	440	480	520
Gross Expenditure:	410	440	490
Net Income:	160	180	175
Tax:	180	165	190

E3) Represent the following information by a suitable diagram:

Class	Average marks in Mathematics	Average Marks in Statistics	Average Marks in Physics
A	58	70	65
B	62	68	72

E4) Draw a suitable diagram for given expenditure data of two families.

Item	**Family A**	**Family B**
Food	300	350
Clothing	250	200
Education	280	300
Others	220	200

E5) Draw a suitable diagram to represent the following information:

Item	**Company A**	**Company B**
Selling Price	9500	8000
Raw Material	5500	6500
Direct Wages	3500	4000
Rent of Office	1500	1500

14.4 TWO DIMENSIONAL DIAGRAMS

In one dimensional diagrams only length of the bar is important and comparison of bars are done on the basis of their lengths only, while in two dimensional diagrams both length and width of the bars are considered, i.e. in two dimensional diagrams given numerical figures are represented by areas of the bars. So, two dimensional diagrams are also known as “Area Diagrams.” The following are the types of two dimensional diagrams:

(i) Rectangles

(ii) Squares

(iii) Circles

Let us discuss these one by one:

(i) Rectangles Diagram

In rectangles diagram given numerical figures are represented by areas of the rectangles. We know that area of a rectangle = (length)$\times$(breadth). So, rectangles diagram is drawn by taking one of the two variables as lengths and another variable as breadths of the rectangles along two axes. To understand this diagram, go through to the following illustration.

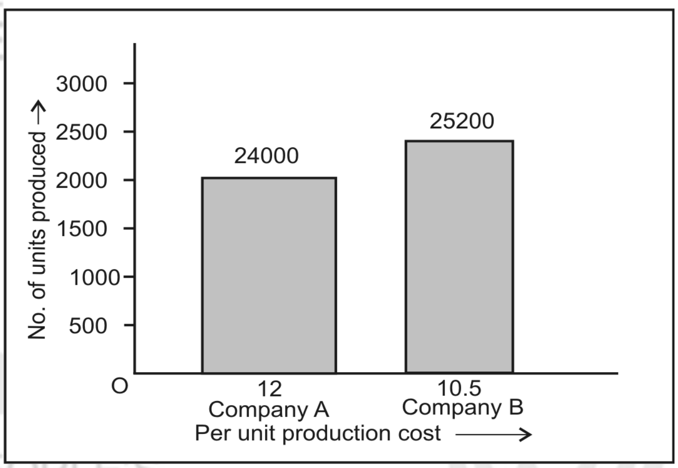
Example 7: Two companies A and B produce the same item. Company A produced 2000 units in January 2011 and in the same month company B produced 2400 units. The production cost per unit for company A and company B was Rs 12 and Rs 10.5 respectively. Represent these facts by using rectangles diagram.

Solution: The rectangles for both companies are to be drawn on the following basis:

Company A
Length = 2000 (total produced units)
Breadth = 12 (per unit production cost)
Area = $2000 \times 12 = 24000$

Company B
Length = 2400 (total produced units)
Breadth = 10.5 (per unit production cost)
Area = $2400 \times 10.5 = 25200$

Therefore, the length and width of rectangles of these companies will be in proportion of $2000 : 2400$ and $12 : 10.5$ respectively. Now, the areas calculated for both companies on the basis of their length and breadth given above, represent the total cost of the two companies. These rectangles are represented below.



(ii) Squares Diagram

When variation between given numerical figures is high then choice of squares diagram is more suitable instead of rectangles diagram. Like rectangles diagram here given numerical figures are represented by areas of squares. We know that area of a square = $(\text{side})\times(\text{side}) = (\text{side})^2$. So, we take

$(\text{side})^2$ = given numerical figure $\Rightarrow$ side of square = $\sqrt{\text{given numerical figure}}$

Remember that the base line would be same for all squares.

In other words, we follow the following steps for the construction of the square diagram:

Step 1 Take the given numerical observations/figures as areas of the corresponding squares.

Step 2 Take square roots of the given numerical observations/figures as sides of the corresponding squares.

Step 3 Construct the corresponding squares like rectangle diagrams.

Let us discuss the method of drawing the square diagram with the help of the following example:

Example 8: Represent the following data of the number of schools in a city A from 1970-80 to 2000-10 in a square diagram.

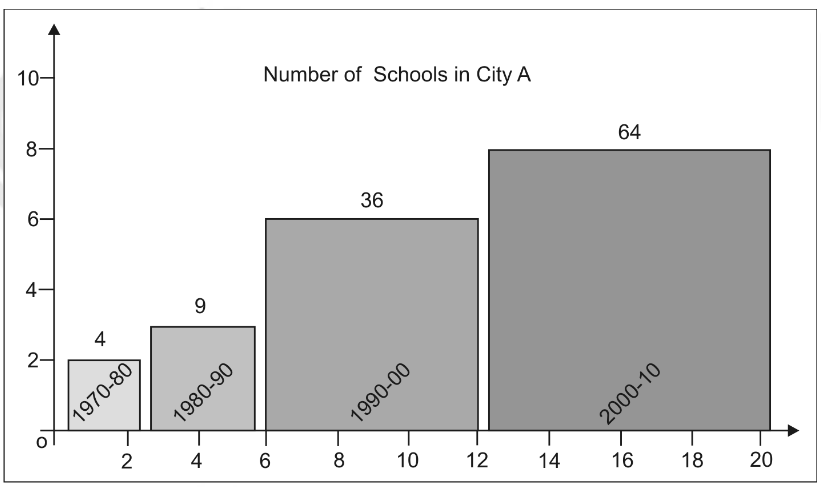
Years	1970-80	1980-90	1990-2000	2000-10
Number of schools in city A	4	9	36	64

Solution:

Step 1 Areas of the corresponding squares = 4, 9, 36, 64

Step 2 Sides of the corresponding squares = $\sqrt{4}, \sqrt{9}, \sqrt{36}, \sqrt{64}$ = 2, 3, 6, 8

Step 3 Square diagram for the given data is shown below.



Remark 1: If in some cases given observations are large and so their square roots, then we can adjust the scale in usual way.

For example, suppose the given observations are 256, 1600, 5184, 9216, then sides of the squares will be

$\sqrt{256}, \sqrt{1600}, \sqrt{5184}, \sqrt{9216}$ = 16, 40, 72, 96.

Here we can adjust the scale by taking 16 units = 1 unit, after this, sides of the squares reduces to 1, 2.5, 4.5, 6. Now using sides of the squares as 1, 2.5, 4.5, 6, we can construct the square diagram as done in above example, provided we have to mention in the right top most corner the scale used (i.e. 16 units = 1 unit along both axes).

(iii) Circles Diagram

Another form of preparing the two dimensional diagram is circle diagram. As in square diagram we took given numerical figures/observations as the areas of the corresponding squares. Similarly, here we take given numerical figures/observations as areas of the corresponding circles. But as we know that

Area (A) of a circle = πr^2, where r is radius of the circle

$\Rightarrow A \; \alpha \; r^2$, read as A is proportional to r^2 $\left[\begin{array}{l}\because \text{ if } y = ax, \text{where a is} \\ \text{constant, then we say that} \\ \text{y is proportional to x.}\end{array}\right]$

$\Rightarrow \pi r^2 \; \alpha$ Given numerical figures/observations

$\Rightarrow r^2 \; \alpha$ Given numerical figures/observations as π is constant

$\Rightarrow r \; \alpha$ Square roots of the given numerical figures/observations

Therefore, we follow the following steps for the construction of the circle diagram:

Step 1 Take the given numerical observations/figures as areas of the corresponding circles.

Step 2 Take squares of the radii (r^2) of the corresponding circles proportional to the given numerical figures/observations as sides of the corresponding squares.

Step 3 Take radii (r) of the corresponding circles proportional to the square roots of the given numerical figures/observations.

Step 4 Construct the corresponding circles like rectangles/squares diagrams.

Circles diagram is the simplest of the two dimensional diagrams used for illustrating the totals having large differences in them like squares diagram. But circles diagram looks more attractive than squares diagram and therefore use of circle diagram is more popular compare to squares diagram. There are as many circles drawn as the totals for representation.

Let us discuss the method of drawing the square diagram with the help of the following example:

Example 9: Draw a circles diagram for the data given in Example 8.

Solution: Using the data of Example 8 for drawing a circles diagram, we have

Step 1 Areas of the corresponding circles ($\pi r_1^2, \pi r_2^2, \pi r_3^2, \pi r_4^2$) = 4, 9, 36, 64

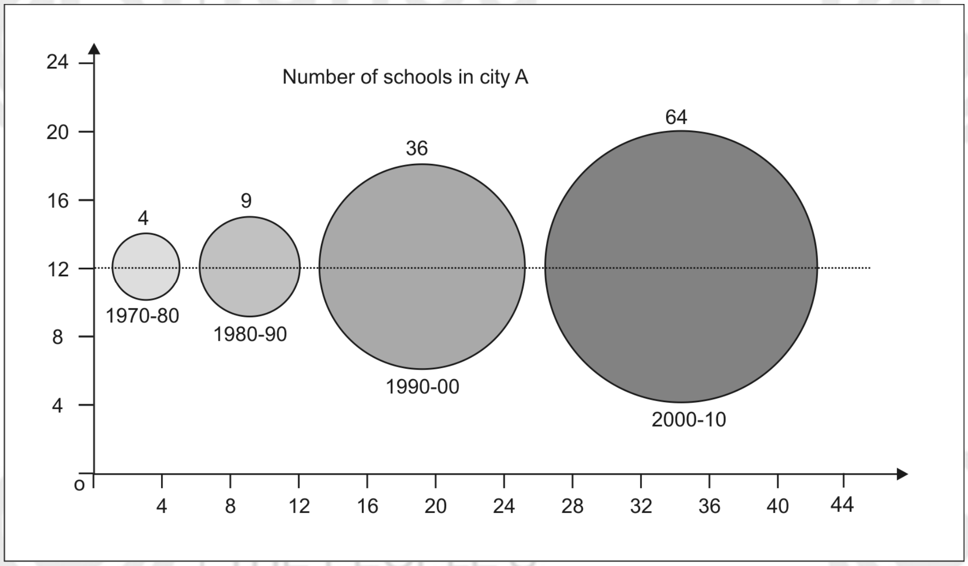
Step 2 Square of radii of corresponding circles are proportional to 4, 9, 36, 64

i.e. $r_1^2, r_2^2, r_3^2, r_4^2 \; \alpha \; 4, 9, 36, 64$

Step 3 Radii of corresponding circles are proportional to $\sqrt{4}, \sqrt{9}, \sqrt{36}, \sqrt{64}$

i.e. $r_1, r_2, r_3, r_4 \; \alpha \; \sqrt{4}, \sqrt{9}, \sqrt{36}, \sqrt{64}$ = 2, 3, 6, 8

Step 4 Circles diagram for the given data is shown on the next page. Radii of the circles lie on the dotted line.



Remark 2: Here also we can follow similar approach as discussed in Remark1.

Now, you can try the following exercises.

E6) Draw a suitable diagram to represent the following data:

	Rate per item	Sale of item
Company P	20	400
Company Q	30	600

E7) Draw a squares diagram for the data given below:

Year	1980	1990	2000	2010
Number of colonies in city A	16	25	65	150

E 8) Draw a circle diagram for the data given in E 7)

14.5 PIE DIAGRAMS

Pie diagram/chart is used when the requirement of the situation is to know the relationship between whole of a thing and its parts, i.e. pie chart provides us the information that how the entire thing is divided up into different parts. For example, if the total monthly expenditure of a family is Rs 1000, out of which Rs 250 on food, Rs 200 on education, Rs 100 on rent, Rs 150 on transport, and Rs 300 on miscellaneous items are spent. Then this gives us the information that 25%, 20%, 10%, 15% and 30% of the total expenditure of the family are spent on food, education, rent, transport and miscellaneous items respectively. Here we note that if money spent on food (say) increased from 25% to 30% then percentages of other head(s) must shrink so that total remains 100%. Similarly, if money spent on any one of the heads decreased then percentages of other head(s) must spread so that total remains 100%. That is why pie chart gives relationship between whole and its parts.

Steps used for constructing a pie chart.

Step 1 Find the total of different parts.

Step 2 Find the sector angles (in degrees) of each part keeping in mind that total angle around the centre of a circle is of 360^0.

Step 3 Find the percentage of each part taking the total obtained in step 1 as 100 percent.

Step 4 Draw a circle and divide it into sectors, where each sector (or area of the sector) of the circle with corresponding angles obtained in step 2 will represent the size of corresponding parts. Diagram thus obtained is nothing but pie chart fitted to the given data.

Let us explain the procedure with the help of the following example:

Example 10: A company is started by the four persons A, B, C and D and they distribute the profit or loss between them in proportion of $4:3:2:1$. In year 2010 company earned a profit of Rs 14400. Represent the shares of their profits in a pie chart.

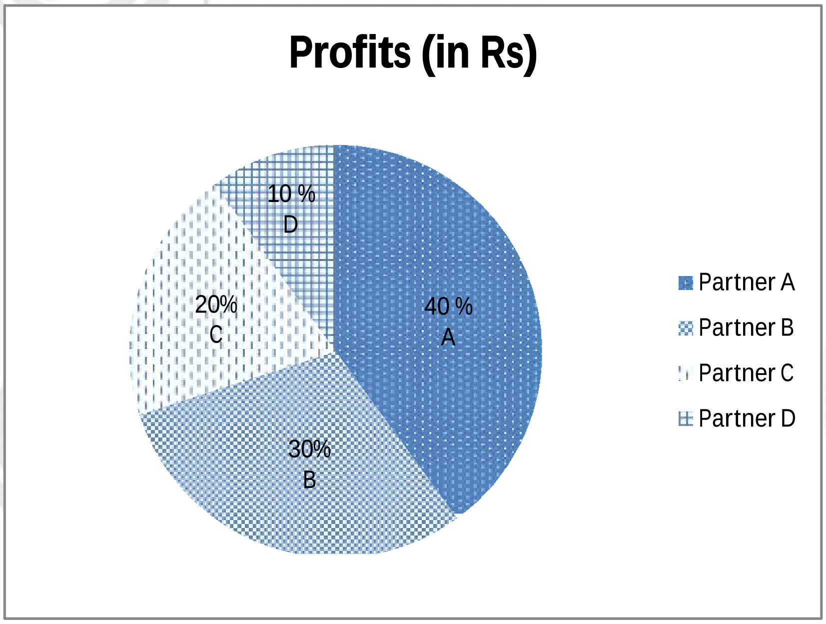
Solution: Given ratio is $4:3:2:1$

$\therefore$ sum of ratios = 4 + 3 + 2 + 1 = 10

Calculation of Degrees and Percentages

Partners	Profits (in Rs)	Sector Angles (in degree)	Percentages
A	$14400\times\frac{4}{10}=5760$	$\frac{5760}{14400}\times 360=144$ or $\frac{4}{10}\times 360=144$	$\frac{5760}{14400}\times 100=40$
B	$14400\times\frac{3}{10}=4320$	$\frac{4320}{14400}\times 360=108$ or $\frac{3}{10}\times 360=108$	$\frac{4320}{14400}\times 100=30$
C	$14400\times\frac{2}{10}=2880$	$\frac{2880}{14400}\times 360=72$ or $\frac{2}{10}\times 360=72$	$\frac{2880}{14400}\times 100=20$
D	$14400\times\frac{1}{10}=1440$	$\frac{1440}{14400}\times 360=36$ or $\frac{1}{10}\times 360=36$	$\frac{1440}{14400}\times 100=10$
Total	14400	360	100

Solution: On the basis of above calculation, pie chart which shows the shares of profit of the four partners is shown on the next page:



Note:

(i) In drawing the components on the pie diagram it is advised to follow some logical arrangements, pattern or sequence. For example, according to size, with largest on top and others in sequence running clock wise.

(ii) Pie chart is used only when

(a) total of the parts make a meaningful whole. For example, total of the expenditures of a family on different items make a meaningful whole, but if in a city there are 100 doctors, 40 engineers, 50 milkmen, 80 businessmen then total of these do not make a meaningful whole so pie chart should not be used here.

(b) observations in different parts are mutually exclusive. For example in the situation discussed in part (a) a businessman may also be an engineer so the observations in different parts are not mutually exclusive.

(c) observations of the different parts are observed at the same time.

We have discussed the method of drawing pie diagram, in this section. Let us discuss some limitations of the pie diagram.

Limitation of Pie Diagram

The following are the limitations of the pie diagram/chart:

(i) For accurate reading and interpretation, particularly when data are divided into a large number of components or the difference among the values of components is very small, the pie diagram is less effective than the bar diagrams.

(ii) Attractiveness of a pie chart suffers if the number of parts of the whole is more than 7 or 8. That is, pie chart should be avoided if number of parts of the whole is more than 7 or 8.

(iii) In terms of comparison, the pie diagram appears inferior to simple bar diagram or divided bar diagram.

(iv) Pie chart is used only when total of the parts make a meaningful whole.

(v) Pie chart should not be used if observations of the different parts are not mutually exclusive.

(vi) Pie chart should not be used if observations of the different parts are observed at different time.

Now, you can try the following exercises.

E9) Represent the following data of utilization of 100 paise of income by XYZ company in year 2009-10.

Item/Head	Money spent (in paise)
Manufacturing Expenses	42
Salaries of employees	14
Selling and distribution Expenses	8
Interest Charges	6
Advertisement Expenses	15
Excise duty of sales	5
Taxation	10

E10) Draw a pie diagram to represent the expenditure of Rs 100 over different budget heads as given below of a family

Item	Expenditure (in Rs.)
Food	25
Clothing	15
Education	20
Transport	10
Outing	10
Miscellaneous	5
Saving	15

14.6 PICTOGRAM

Pictograms, also known as picture grams, are very frequently used in representing statistical data. Pictograms are drawn with the help of pictures. These diagrams indicate towards the nature of the represented facts. Pictograms are attractive and easy to comprehend and as such this method is particularly useful in presenting statistics to the layman.

The picture which is used as symbols to represent the units or values of any variable or commodity selected carefully. The picture symbol must be self explanatory in nature. For example, if the increase in number of Airlines Company is to be shown over a period of time then the appropriate symbol would be an aeroplane.

The pictograms have the following merits:

(i) The magnitudes of the variables may be known by counting the pictures.

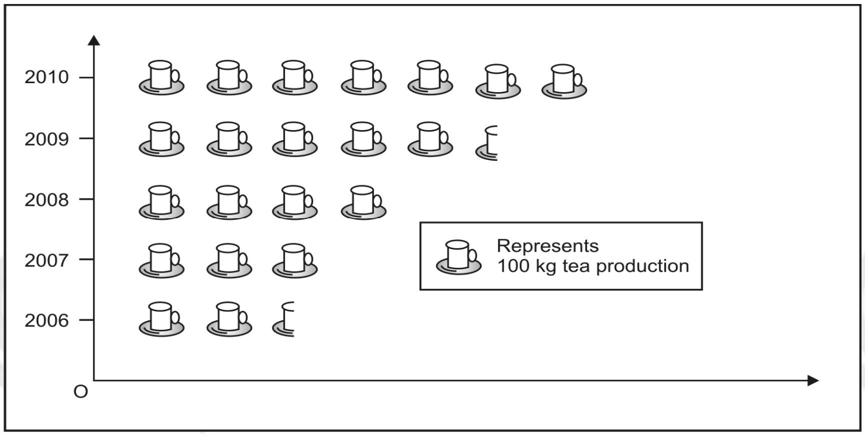
(ii) An illiterate person can also get the information.

(iii) The facts represented in a pictorial form can be remembered longer.

Example 11: Draw a pictogram for the data of production of tea (in hundred kg) in a particular area of Assam from year 2006 to 2010.

Year	2006	2007	2008	2009	2010
Production of Tea (in 100 kg.)	2.5	3.0	4.0	5.5	7.0

Solution: Pictogram for the production of tea in a particular area of Assam from year 2006 to 2010 is shown below:



Now, you can try the following exercise.

E 11) Draw a pictogram for production of mangoes in a particular area of Maharashtra from 2006 to 2010.

Year	2006	2007	2008	2009	2010
Production of Mangoes (in tons)	5.0	4.5	6.0	3.5	5.5

14.7 CARTOGRAM

Representation of the numerical facts with the help of a map is known as cartogram. By representing the facts by maps, the impact of the results on different geographical area may be shown and to be compared also. Maps are helpful in comparative study of various districts of a state or different states of a country. For example, the production of wheat in different geographical areas can also be represented by cartogram. The quantities on the map can be shown in many ways, such as through shads or colours or by dots or by placing pictograms in each geographical area or by the appropriate numerical figure in each geographical area.

Let us take an example to get a look of the cartogram.

Example 11: Density per square kilometer in different states and union territories in India according 2011 census data is given below.

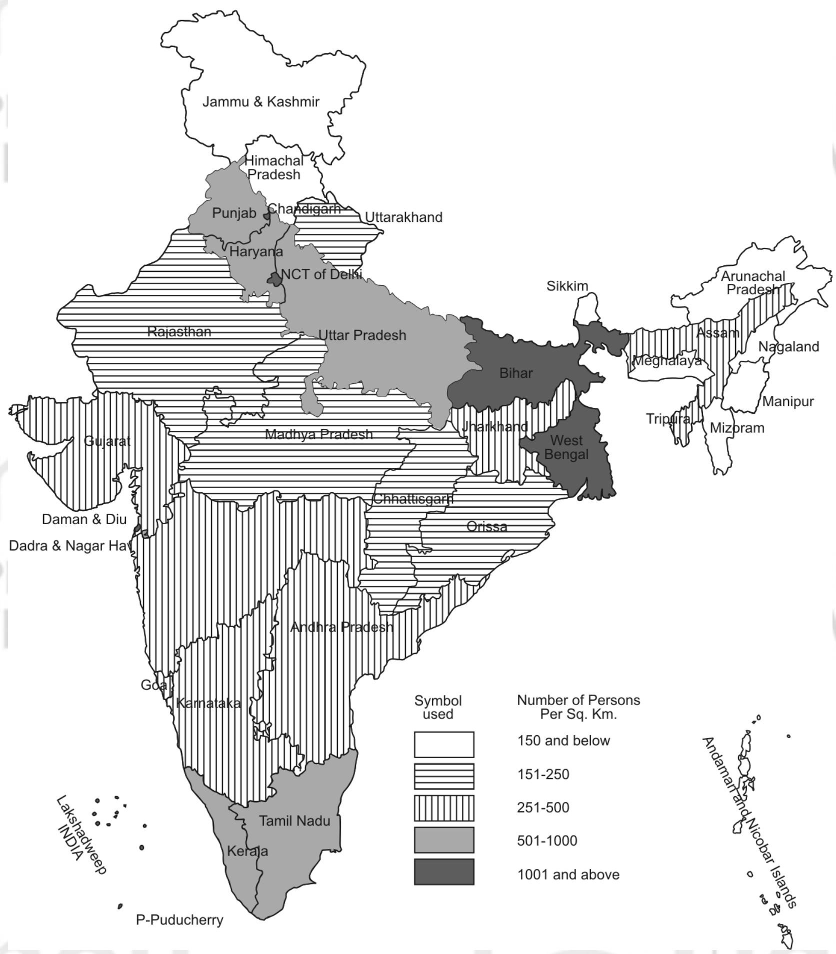
State/Union Territory	Density (per sq. km.	State/Union Territory	Density (per sq. km.	State/Union Territory	Density (per sq. km.
Andhra P	308	Kerala	859	Tripura	350
Arunachal P	17	Madya P	236	Uttarakhand	189
Assam	397	Maharashtra	365	Uttar P	828

Bihar	1102	Manipur	122	West Bengal	1029
Chhattisgarh	189	Meghalaya	132	Andaman and N I	46
Goa	394	Mizoram	52	Chandigarh	9252
Gujarat	308	Nagaland	119	Dadar and N H	698
Haryana	573	Orissa	269	Daman and Diu	2169
Himachal P	123	Punjab	550	Delhi	11297
J and K	124	Rajasthan	201	Lakshadeep	2013
Jharkhand	414	Sikkim	86	Pondicherry	2598
Karnataka	319	Tamil Nadu	555		

Represent the above data with the help of cartogram.

Solution: Cartogram for the above data is given below:

Density of Population, 2011



14.8 CHOICE OF A SUITABLE DIAGRAM

In Secs. 14.3 to 14.7 we have studies many types of diagrams, so a reasonable question may arise in your mind is that how we come to know that which is the suitable diagram in a given situation? To answer this question absolutely is not an easy job because there are situations in which more than one diagram may be used, secondly this is not a complete list of the diagrams. Even though there are some suggestions which may help you to select an appropriate diagram in a given situation.

The choice would primarily depend upon two factors, namely:

(i) The Nature of the Data: The nature of data would depend whether to use one dimensional, two dimensional or three dimensional diagrams and if it is one dimensional, whether it is simple, sub-divided, multiple or some other type. A cubic diagram would be preferred to a bar if the magnitudes of the figures are very wide apart.

(ii) The Type of People for whom the Diagram is to be made: For drawing attention of an undedicated mass pictogram or cartograms are more effective.

Some more points which may address the question raised are given below:

- Simple bar diagrams should be used when changes in totals are required to be represented.
- Sub-divided bar diagrams are more useful when changes in totals as well as in components figures (absolute ones) are required to be represented.
- Multiple bar diagrams should be used where changes in the absolute values of the component figures are to be emphasised and the overall total is of no importance.
- The multiple and sub- divided bar diagrams are used for not more than four or five components. For more than five components, pie diagrams will be the best choice.
- Percentage bar diagrams are better choices when changes in the relative size of component figures are to be displayed.
- Pictograms and cartograms are very elementary forms of visual presentation.
- The pictogram is admirably suited to the publications of articles in newspapers and magazines or in reports.
- Cartograms or statistical maps are particularly effective in bringing out the geographical pattern that may be handelled in the data.

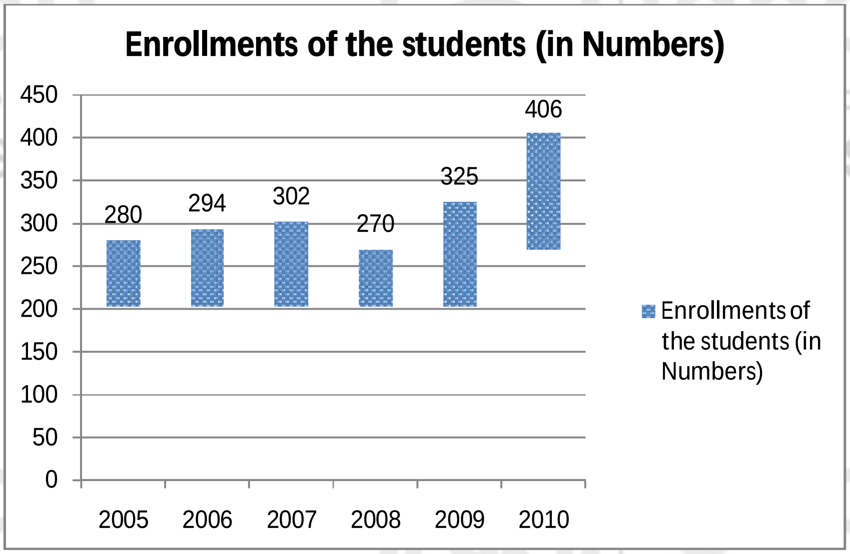
14.9 SUMMARY

This unit covered the diagrammatic presentation of the data. In this unit, we have discussed:

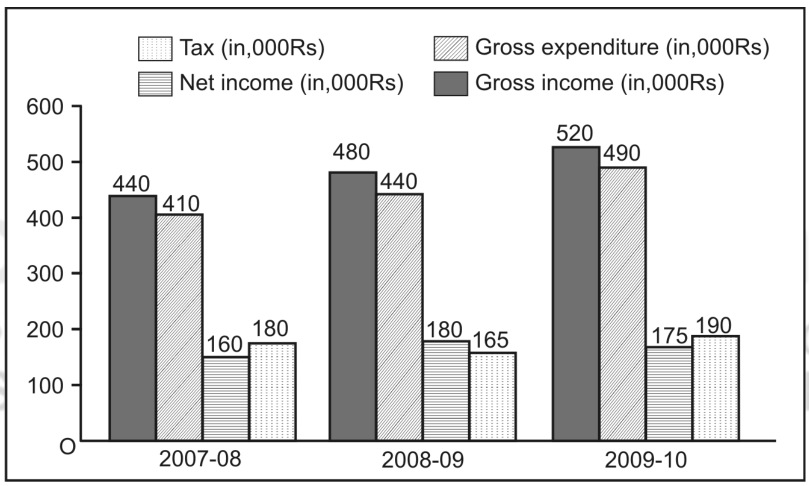
1) One dimensional diagrammatic presentation of the data.
2) How to draw different types of bar diagrams.
3) How to draw two dimensional diagrams to represent the given data.
4) How to draw Pie diagram.
5) How to draw Pictograms and Cartograms for the pictorial representations.
6) The selection of an appropriate diagram to represent the data of a given situation.

14.10 SOLUTIONS/ANSWERS

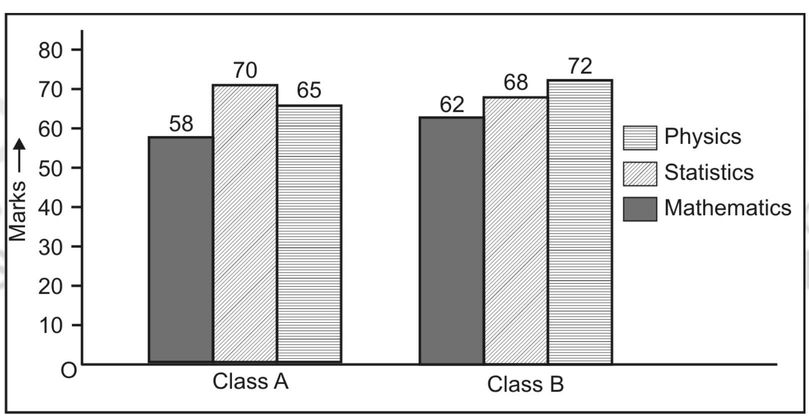
E1) The suitable diagram in this case is simple bar diagram which is shown on the next page:



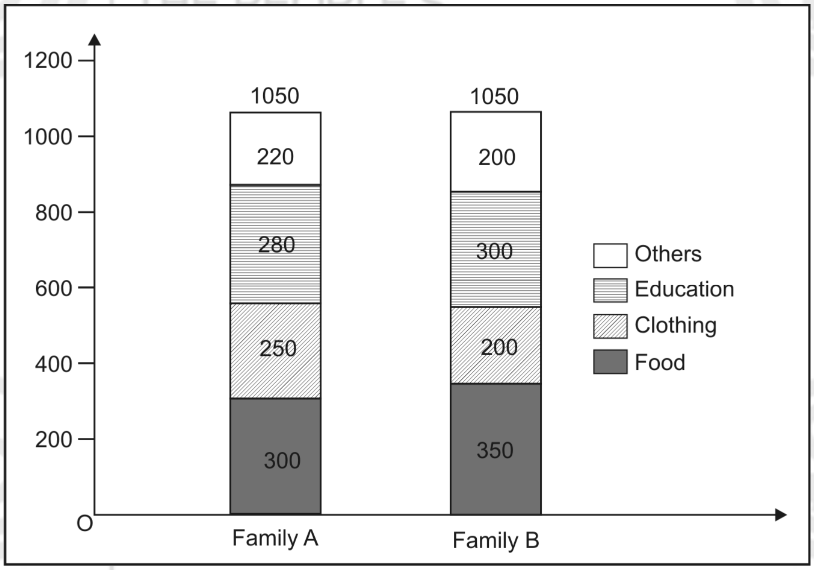
E2) The suitable diagram in this case is multiple bar diagram which is shown as follows:



E3) The suitable diagram in this case is multiple bar diagram which is shown as follows:



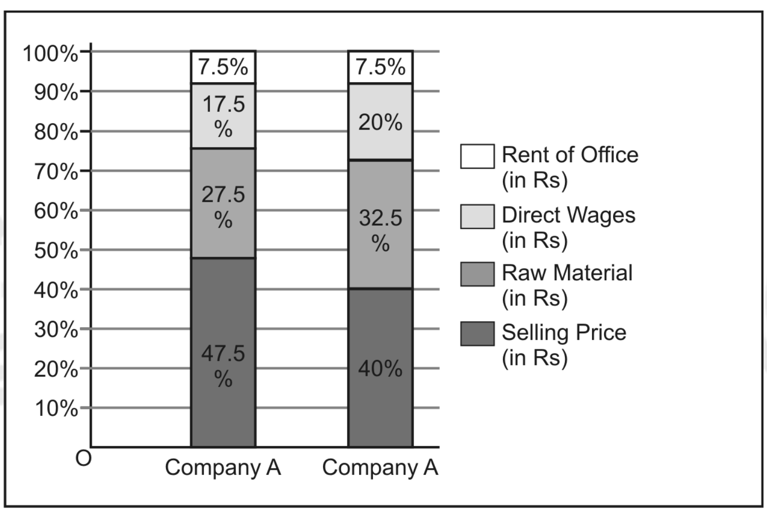
E4) The suitable diagram in this case is subdivided bar diagram which is shown as follows:



E5) The suitable diagram in this case is percentage bar diagram. So first of all we have to calculate percentage and cumulative percentage for both the companies in various categories as given below:

Category	Company A			Company B		
	Cost	% Cost	Cumulative % Cost	Cost	% Cost	Cumulative % Cost
Selling price	9500	47.5	47.5	8000	40	40
RM	5500	27.5	75	6500	32.5	72.5
DW	3500	17.5	92.5	4000	20	92.5
ROO	1500	7.5	100	1500	7.5	100
Total	20000	100		20000	100	

On the basis of the above calculation subdivided bar diagram is given below:



E6) The suitable diagram in this case is rectangles diagram. The rectangles for both companies are to be drawn on the following basis.

Company P

Length = 400 (items sold)

Breadth = 20 (rate per item)

Area = $400 \times 20 = 8000$

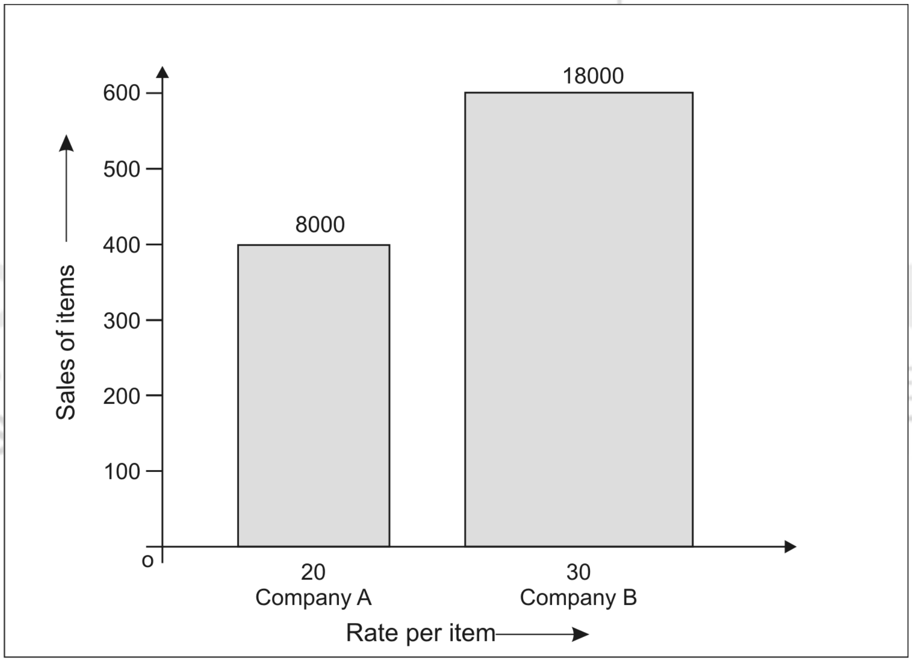
Company Q

Length = 600 (items sold)

Breadth = 30 (rate per item)

Area = 600×30 = 18000

Therefore, the length and breadth of the two rectangles will be in proportion of $400:600$ and $20:30$ respectively. Now, the areas calculated for both companies on the bases of their length and breadth given above, represent the total cost of the companies. These rectangles are represented below.



E7) Step 1 Areas of the corresponding squares = 16, 25, 65, 150

Step 2 Sides of the corresponding squares = $\sqrt{16}, \sqrt{25}, \sqrt{65}, \sqrt{150}$

$= 4, 5, 8.06, 12.25$

Here we can adjust the scale (as discussed in Remark 1).

Let us take 4 units = 1 unit, then we have

Sides of the corresponding squares = 1, 1.25, 2.02, 3.06

Step 3 Square diagram for the given data is shown on the next page:

E 8) Following the similar steps as in Example 9 we have

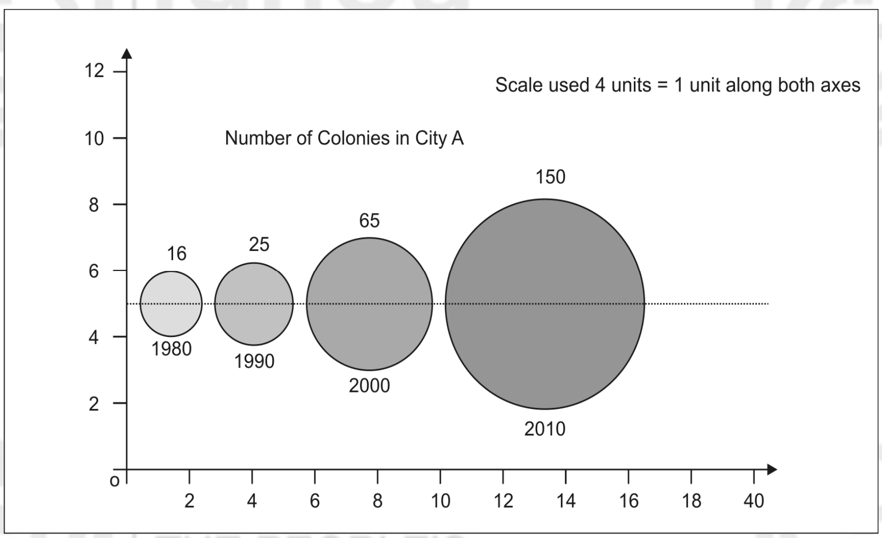
$$r_1, r_2, r_3, r_4 \;\alpha\; \sqrt{16}, \sqrt{25}, \sqrt{65}, \sqrt{150} = 4, 5, 8.06, 12.25.$$

Here we can adjust the scale (as discussed in Remark 1).

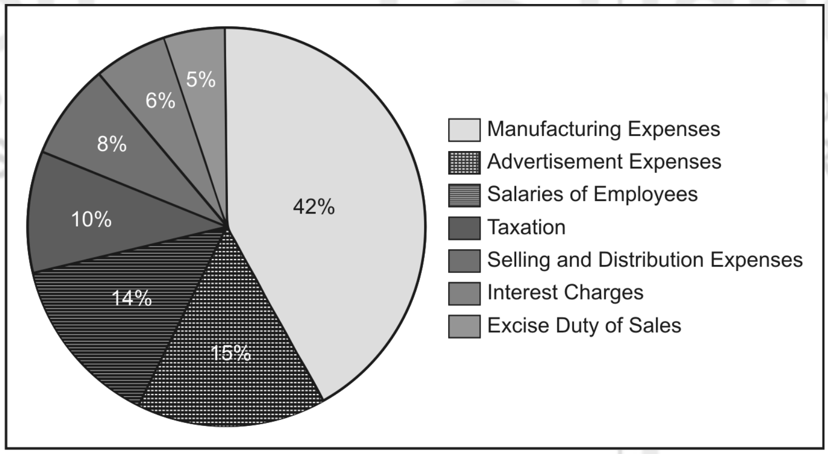
Let us take 4 units = 1 unit, then we have

$r_1, r_2, r_3, r_4 \;\alpha\;$ 1, 1.25, 2.02, 3.06.

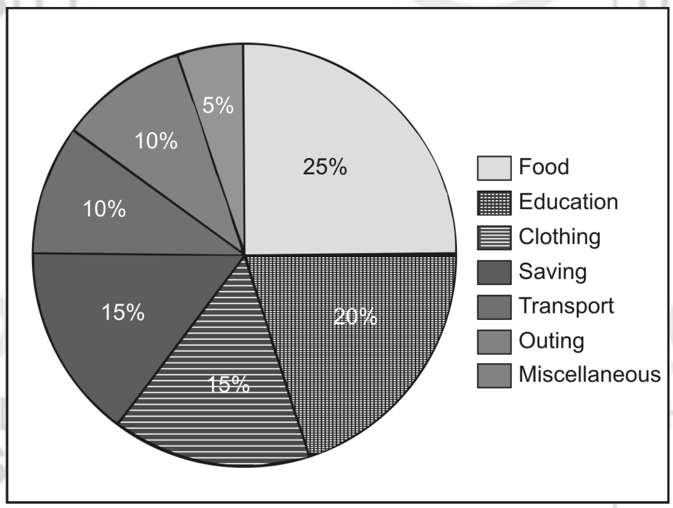
Circle diagram for the given data is shown below:



E9) The suitable diagram in this case is pie diagram. Calculation of degrees and percentages (as we did in Example 10) is an exercise for you. On the basis of calculation, pie chart which shows the utilization of 100 paise of income by XYZ company in year 2009-2010 is shown on the next page:



E10) The suitable diagram in this case is pie diagram. Calculation of degrees and percentages (as we did in Example 10) is an exercise for you. On the basis of calculation, pie chart which shows the expenditure of a family on different items is shown below:



E 11) We locate the production of mangoes through the picture of mango for the different years according to different magnitude of the data (taking 1 mango = 1 tons mangoes)