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Diagrammatic Presentation

One of the main functions of statistics is to simplify complex data. The classification and tabulation, discussed in previous chapters, are the devices of presenting the data in a neat, concise, systematic, intelligible and understandable manner. A large amount of information extending over a large number of columns often does not interest the public; and it is difficult for one to understand the significance of the data at a glance. Of course, percentages, ratios, averages, etc., reduce the complexity into a simple and single figure. Yet, the figures may not be interesting but confusing to many people. These have necessitated the statisticians to introduce methods of diagrams and graphs. Complicated data through a diagram or graph can easily be understood; at the same time appealing, and convincing to the eye and mind. They are nothing but points, lines, bars, squares, circles, pictures, maps, charts etc.

Classification refers to grouping of data into homogeneous class and categories. Tabulation is the process of presenting the classified data in tables. Classification and tabulation are applied in order to make the collected data understandable. Yet to many these figures may be uninteresting and even confusing. A better way of representing the data is by diagrams and graphs.

A diagram is a visual form for presentation of statistical data. Diagram refers to the various types of devices such as bars, circles, maps, pictorials, cartograms, etc. These devices can take many attractive forms. Strictly speaking, these are not graphic devices. Diagrams do not add any new meaning to the statistical facts, but they exhibit the results more clearly. An ordinary man can understand pictures and diagrams more easily than the figures. The use of diagrams is becoming more and more popular in the present time. Diagrams occupy an important place, because:

(1) **They are attractive and impressive.** Diagrams are attractive and create interest in the mind of the readers. They are more appealing to the eye. Even a layman can understand them very easily. Diagrams have greater attraction than mere figures.

(2) **They save time and labour.** Diagram saves much time and labour to understand it and enables one to draw meaningful inferences

from it. Human beings may not like to go through numerical data, but may go through a diagram or graph, because without strain one can understand it.

(3) **They have universal applicability.** Diagrammatic presentation of statistical data is followed universally. It is greatly used in almost all walks of life as a good guide in economics, business, social institutions, administration and other fields.

(4) **They make data simple.** Diagrams can be remembered easily, as they render comparison in an easy and possible way. They render the whole data readily intelligible. For example, the study of profit pattern of two firms with the help of figures may not be clear, but when the figures are put in the media of diagram, the trend can be very clear at once.

(5) **They make comparison easy.** Diagrams render comparison between two or more sets of data. In absolute figures comparison may not be clear, but diagrammatic presentation makes it easier and simpler.

(6) **They provide more information.** A diagram will reveal more information than the data in a table. Cold figures can speak in clear tones, if translated into diagrammatic language.

Diagram plays an important role in the modern advertising campaigns. The newspapers, journals, etc., are filled with diagrams.

Limitations of a Diagram

The presentation of a diagram, without a careful study, will be misleading. In brief, the following are the deficiencies or restricted uses:

1. Diagrams cannot be analysed further.
2. Diagrams show only approximate values.
3. The uses of certain diagrams are limited to the experts (e.g., multi-dimensional ones).
4. It exposes only limited facts. All details cannot be presented diagrammatically.
5. To draw a table is easy but construction of a diagram is not so easy.
6. It is a supplement to the tabular presentation but not an alternative to it.
7. Minute readings cannot be made. Small differences in large measurements cannot be studied. For example the difference between 9025 and 9000 shown in diagram, cannot be apparent.
8. If there is a wide gap between two different measurements, the diagram will not give a meaningful

look. For example, if and you compare the height of diagram, whatever the scale be adopted.

9. Diagrams are drawn when comparisons between two or more they are of little use.

10. Diagrams drawn on false lines are misleading.

Rules for Making a Diagram

Diagrammatic presentation of a statistical series is effective as photographic memory will last long in the mind of other form. The construction of a diagram is an art, which acquired through practice. However, the following rules may help in making them more effective:

1. **Heading.** Every diagram must have suitable title. The title, bold letters, conveys the main facts depicted by the diagram. If necessary, sub-headings can also be given. It must be brief, and explanatory and clear.

2. **Size.** The size of the diagram should neither be too big nor too small. It must match with the size of the paper. It should be in the middle of the paper.

3. **Length and Breadth.** An appropriate proportion should be maintained between length and breadth. Lutz has suggested that proportions of length and breadth should be 2:1 or 3:4, i.e., it is the diagram looks attractive. Care should be taken to ensure that the diagram does not wear ugly look.

4. **Drawing.** Since impression is needed, it should be drawn neatly and accurately with the help of drawing instruments. Each diagram should also be numbered for ready reference.

5. **A proper scale.** A proper scale must be chosen for the diagram to look attractive and create a visual impact on the reader. It must suit the space available. Accuracy should not be sacrificed to attractiveness.

6. **Selection of Appropriate Diagram.** The most important point is the selection of proper diagram to present a set of figures. All types of diagrams are not suitable for all types of data. A wrong selection of the diagram will distort the true characteristics of the phenomenon to be presented and might lead to very wrong and misleading interpretations.

7. **Right method.** C.W. Lowe writes, "The important point, that must be borne in mind at all times, is that the pictorial presentation, chosen for any situation, must depict the true relationship and point out the proper conclusion. Use of an inappropriate chart may distort the facts and mislead the reader. Above all, the chart must be honest."

8. **Index.** When many items are shown in a diagram, through different colours, dottings, crossing, etc., an index must be given for identifying and understanding the diagram.

external

10. **Simplicity.** Diagram should be very simple. It must be so simple that even a lay man who does not have knowledge of mathematical or statistical background, can understand the diagram. If the data are very large draw more diagrams to represent the data.

Too much information presented in a diagram will be confusing. Therefore, it is suggested to draw several simple diagrams, which are more effective than a complex one.

Types of Diagram

There are various diagrammatic devices by which statistical data can be presented. We shall discuss a few of them, which are mostly used. The following are the common type of diagrams:

1. One-dimensional diagram (line and bar).
2. Two-dimensional diagram (rectangle, square, circle, etc.)
3. Three-dimensional diagram (cube, sphere, cylinder etc.)
4. Pictogram.
5. Cartogram.

1. **One-dimensional diagram.** In one-dimensional diagram, the length of the lines or bars is considered and the width of the bars is not taken into consideration. The term 'bar' means a thick wide line. The following are the main types:

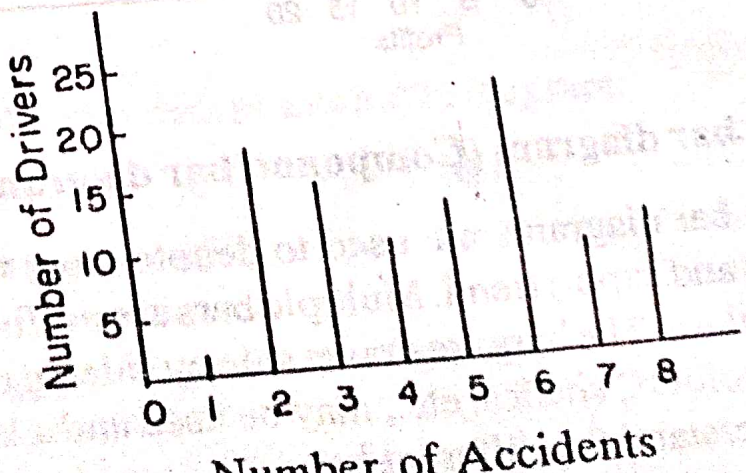
(A) Line diagram

This is the simplest of all the diagrams. On the basis of size of the figures, heights of bars or lines are drawn. The distance between lines is kept uniform. It makes comparison easy. This diagram is not attractive; hence it is less important.

Illustration 1

The following data show the number of accidents sustained by 100 drivers of a company in a particular year. Draw a suitable diagram.

Number of accidents	1	2	3	4	5	6	7	8
Number of drivers	2	18	15	10	13	22	9	11



(B) Simple bar diagram

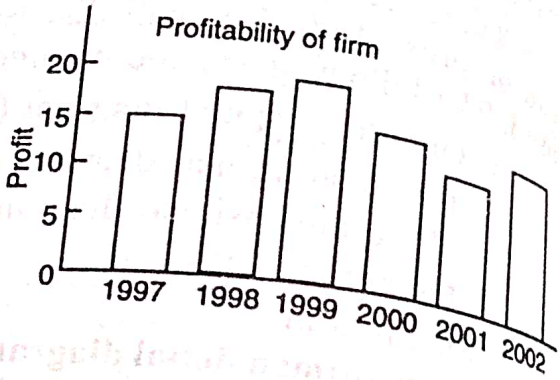
A simple bar diagram can be drawn either on horizontal or vertical base. Bars on horizontal base are more common. A bar diagram is simple to draw and easy to understand. In business and economics it is commonly used.

Illustration 2

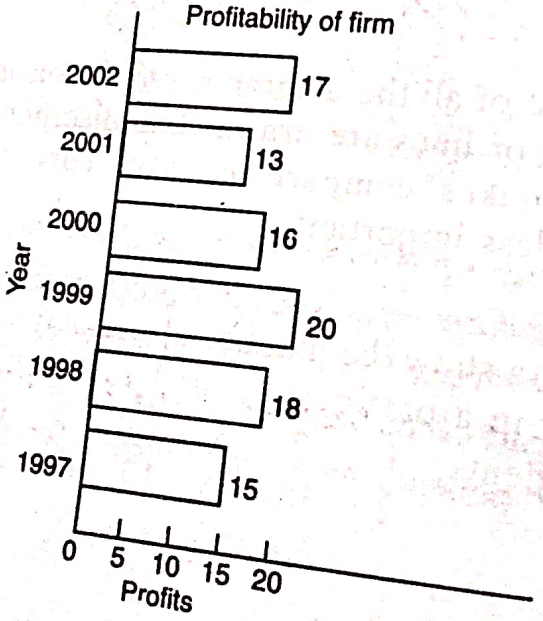
Draw a suitable bar diagram showing the following data.

Year	Profits ('000)
1997	15,000
1998	18,000
1999	20,000
2000	16,000
2001	13,000
2002	17,000

(A) Vertical bar diagram



(B) Horizontal bar diagram



(C) Multiple bar diagram (Compound bar diagram)

Multiple bar diagrams are used to denote more than one phenomenon, e.g., for import and export trend. Multiple bars are useful for direct comparison between two values. The bars are drawn side by side. In order to distinguish the bars, different colours, shades, etc., may be used and a key index to this effect be given to understand the different bar.

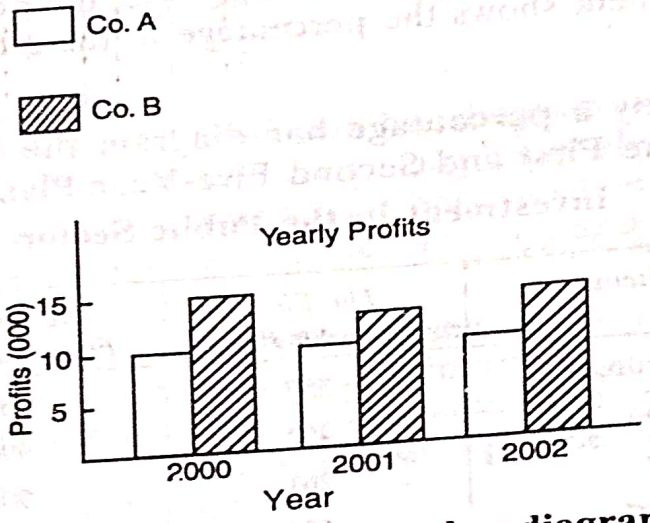
Illustration : 3

The data below gives the yearly profits of two companies *A*, and *B* :

Year	Profits	
	A	B
2000	10,000	15,000
2001	8,000	13,000
2002	13,000	14,000

Represent the data by means of a multiple bar diagram.

Solution :



***(D)* Sub-divided bar diagram (Component bar diagram)**

The bar is subdivided into various parts in proportion to the values given in the data and may be drawn on absolute figures. or percentages. Each component occupies a part of the bar proportional to its share in the total. To distinguish different components from one another, different colours or shades may be given.

Illustration 4

Represent the following data in a suitable diagram.

Districts	A	B	C
Population — Male	1,000	1,200	1,300
Population — Female	500	800	900
	1,500	2,000	2,200

90

Solution :

(E) *Percentage subdivided bar diagram*

The above-mentioned diagrams have been used to represent absolute value. But comparison is made on a relative basis. The various components are expressed as percentage to the total. For dividing the bars these percentages are cumulated. In this case, the bars are all of equal height. Each segment shows the percentage to the total.

Illustration : 5

Represent by a percentage bar diagram the following data on investment for the First and Second Five-Year Plans :

Investment in the Public Sector

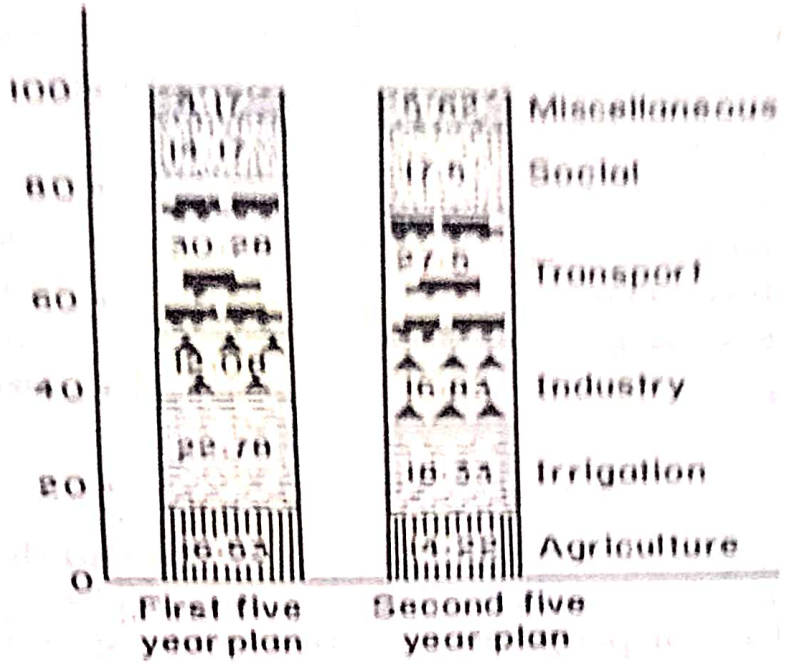
Items	The First Five-year Plan	The Second Five-year Plan
Agriculture	357	768
Irrigation	492	990
Industry	261	909
Transport	654	1485
Social services	306	945
Miscellaneous	90	300

(B.A. Eco. Kerala)

Solution :

Percentage Bar

Item	First Five Year Plan		Second Five Year Plan	
	Investment	Percentage	Investment	Percentage
Agriculture	357	16.33	76	14.22
Irrigation	492	22.78	990	18.33
Industry	261	12.08	909	16.83
Transport	654	30.28	1485	27.50
Social services	306	14.16	945	17.50
Miscellaneous	90	4.17	300	5.62
	2160	100	5400	100



(F) Other Bar Diagrams

(*a*) **Deviation bars.** Deviation bar diagram is used to depict the net deviations in different values *i.e.,* surplus or deficit, profit or loss, net import or export, etc., which have both positive or negative values. Positive values are shown above the base line and negative below the base line.

(*b*) **Broken bars.** In certain cases we may come across data which contain very wide variations in values—very small or very large. In order to provide adequate and reasonable shape to the smaller bars, the larger bars may be broken at the top. The value of each bar is written at the top of the bar.

2. **Two-dimensional diagram** (Area or Surface diagram). In one-dimensional diagram, only length is taken into account. In two-dimensional diagram, the area of the diagram represents the data, *i.e.,* the length and breadth are considered. The important types are :

A. **Rectangles.** Rectangles are used when two or more magnitudes with different components have to be compared. The area of the rectangles are kept in proportion to the values. It may be of two types : (*i*) Percentage sub-divided rectangular diagram. In such a diagram the width of rectangles is kept according to the proportion of the values, the various components of the values are converted into percentage and rectangles divided according to them. (*ii*) Subdivided rectangle. Such diagrams are used to show some related phenomena. *e.g.*, cost per unit, quantity of production, etc.

Illustration : 6

Draw a two-dimensional diagram to represent the following data:

Item of expenditure	Expenditure in Rupees	
	Family A	Family B
1. Food	200	300
2. Clothing	48	75
3. Education	32	40
4. House Rent	40	75
5. Miscellaneous	80	110
	400	600

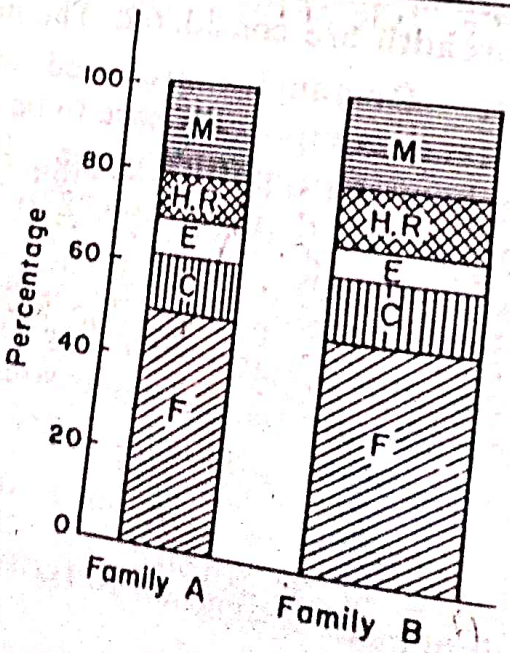
(B.Com. Gujarat)

Solution :

The total expenditure will be taken as 100 and the expenditure on each item will be expressed in percentage. The width of the two rectangles will be in proportion to the total expenditure of the two families ; *i.e.* 400 : 600 or 2 : 3. The height of each rectangle will be the same as it represents 100 per cent.

Solution :

Items of expenditure	Monthly Expenditure					
	Family A (Rs. 400)			Family B (Rs. 600)		
	Rs.	%	Cumulative %	Rs.	%	Cumulative %
1. Food	200	50	50	300	50	50
2. Clothing	48	12	62	75	12.5	62.5
3. Education	32	8	70	40	6.67	69.17
4. House Rent	40	10	80	75	12.5	81.67
5. Miscellaneous	80	20	100	110	18.33	100
	400	100		600	100	



(B) Square diagram

While preparing squares, we have to bear in mind that the ratio is to be maintained according to the areas of the squares. To draw a square diagram, the square root is taken of the values of the various items to be shown in the diagram : Then suitable scale may be adopted to draw it.

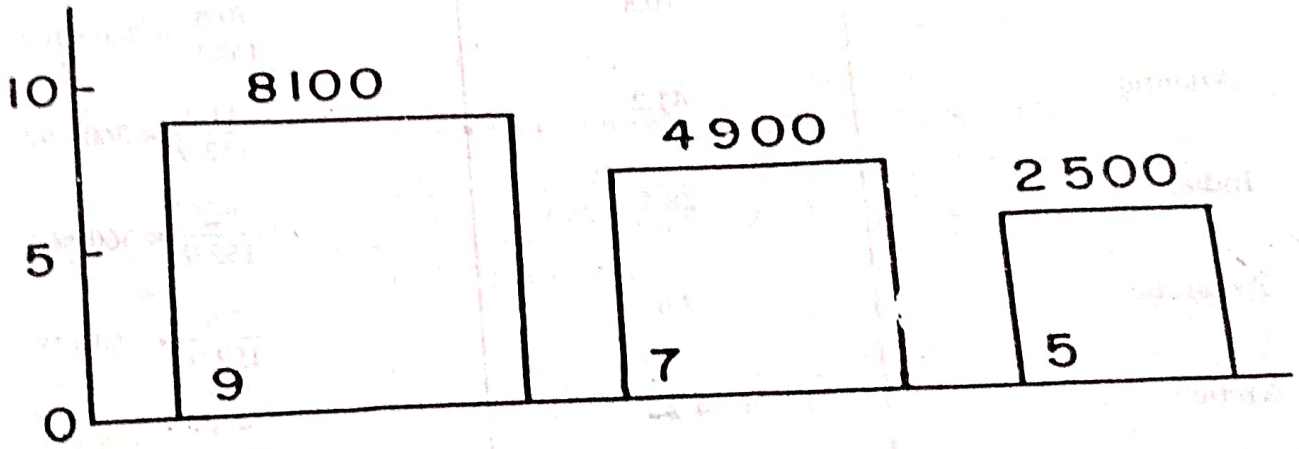
Illustration : 7

Draw a square diagram to represent the following data :

8100 4900 2500

Solution :

First we have to find out the square root of the figures; they are 90, 70 and 50. Further, these roots are divided by 10 ; thus we get 9, 7 and 5.



(C) Circle

Circle diagrams are alternative to square diagram. Steps are similar to the above. The side of the square will become the radius of the circle.

(D) Angular or pie diagram

The pie diagram ranks high in understanding. Just as we divide a bar or a rectangle to show its components, a circle can also be divided into sectors. As there are 360 degrees at the centre, proportionate sectors are cut taking the whole data equal to 360 degrees. This will be clear from the following illustration.

Illustration : 8

The following table shows the area in millions of square kilometres of the oceans of the world :

Ocean	Area (million sq. km.)
Pacific	70.8
Atlantic	41.2
Indian	28.5
Antarctic	7.6
Arctic	4.8

Draw a pie diagram to represent the data. (B. Com. Bombay)

Solution :

Calculation for pie diagram

Ocean	Area	Degrees
Pacific	70.8	$\frac{70.8}{152.9} \times 360 = 167$
Atlantic	41.2	$\frac{41.2}{152.9} \times 360 = 97$
Indian	28.5	$\frac{28.5}{152.9} \times 360 = 67$
Antarctic	7.6	$\frac{7.6}{152.9} \times 360 = 18$
Arctic	4.8	$\frac{4.8}{152.9} \times 360 = 11$
	152.9	360°

PIE DIAGRAM SHOWING THE AREA OF OCEANS OF THE WORLD

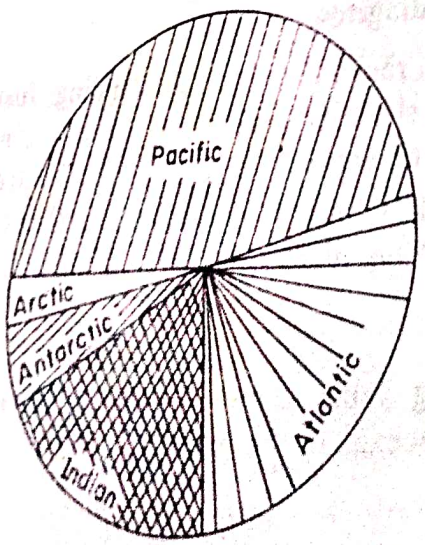


Illustration : 9

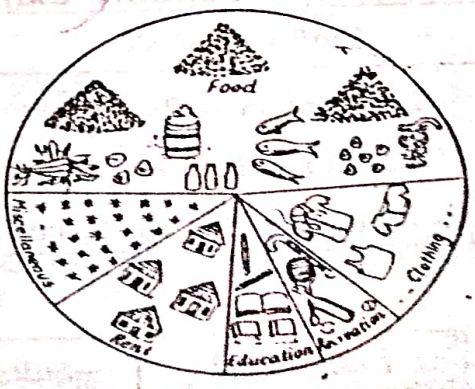
Represent the following data by a pie diagram.

Items	*Expenditure (in Rs.)*	*Items*	*Expenditure (in Rs.)*
Food	87	Education	13
Clothing	24	Rent	25
Recreation	11	Miscellaneous	20

(B.A.M.K. University)

Solution :

Items	*Expenditure*	*Angle of the circle*
Food	87	$\frac{87}{180} \times 360 = 174$
Clothing	24	$\frac{24}{180} \times 360 = 48$
Recreation	11	$\frac{11}{180} \times 360 = 22$
Education	13	$\frac{13}{180} \times 360 = 26$
Rent	25	$\frac{25}{180} \times 360 = 50$
Miscellaneous	20	$\frac{20}{180} \times 360 = 40$
	180	360



Pie Diagram

3. Three-dimensional diagram. The square, circle, rectangle, etc., may fail to represent the data if the quantities to be represented are awfully diverse. In such cases three-dimensional diagrams are

drawn. They are called so because length, height and width or depth are considered ; and these comprise of cubes, spheres, prisms, cylinders, blocks, etc. Of all these cubes are the easiest to draw as the side of the cube can easily be found out by taking the cube root of the data.

4. Pictogram and cartogram. Pictogram is a device of representing statistical data in pictures. These are very useful in attracting the attention. They are easily understood. For the purpose of propaganda, the pictorial presentations of facts are quite popular and find place in exhibitions. They are extensively used by government organisations as well as by private institutions.

In cartograms, statistical facts are presented through maps accompanied by various types of diagrammatic representation. It presents the numerical facts in a pictorial form in a geographical or spatial distribution. Cartograms are simple and are easy to understand. They are generally used when the regional or geographic comparisons are to be made.