36

REPRESENTATION OF STATISTICAL DIAGRAMS

36.1 INTRODUCTION

In our daily life we come across different types of information through newspaper, television, computers and conversation. Some of this information is quantitative that is it can be measured like the length of a piece of cloth; while others are quantitative which cannot be measured but can be described like the colour of the cloth. Statistic is concerned mainly with information that is quantitative. In this lesson we will study about statistical data and its representation through various types of diagrams and maps.

36.2 OBJECTIVES

After studying this lesson, you will be able to:

- distinguish between statistical information (statistical table) and diagram;
- recognise various types of diagrams such as a line, bar, pie and star diagram and a dot map;
- construct line, bar, pie and star diagrams;
- select a suitable diagram for the given data;
- explain merits and demerits of each diagram.

36.3 WHAT IS DATA

Let us take a poor man from the United States of America (USA) and a rich man from India. If the income of the Indian is higher than the income of the poorman of the USA, can we say that India is richer than the USA? Certainly not. Why? Because comparison is between two specific persons from the USA and India, which do not represent their countries so far as their individual income is concerned. For any such comparison we have to see the income of larger population in the USA as well as in India. For this we will have to collect information about the annual income of individuals, agricultural production, industrial production, unemployment rates, total population of different areas etc. All such information will be numerical and will relate to a large number of individuals or areas. Numerical information related to the measurement of groups or masses is termed as data, (singular is datum). When numerical information is related to an individual or event, it is not data.

In geography, statistical data play a very important role. The data gives us numerical information about geographical facts. We arrange them, analyse them, draw valid conclusions from them.

(a) Source of Data

There are two sources from where data can be obtained. These are:

1) Primary source and

2) Secondary source.

1) Primary source of data is the field investigation and collection of specific information by the scholar from the field itself. It is a lengthy process requiring a lot of time, money and manpower.

2) Secondary source of data are the published reports and tables prepared by various public agencies for general use. For the user the data from secondary sources are thus less expensive, time saving and do not require large manpower for its collection. Secondary data, however, is very general. It does not give all the details, which a user may need.

(b) Variables

- Values of certain characteristics like price, quantity, age, weight, time etc. changes when we move from one individual to another. Such characteristics are known as variables.On the basis of the nature of the values of the variables, the data can be classified into two categories; (1) Continuous variables and (2) Discontinuous variables.

1) Continuous variables are those units of measurement which can be broken down into definite gradation such as temperature, height, weight etc. For example, temperature of an area could be 35° C or 35.03° C or any other value. Similarly height of an individual, amount of rainfall etc are also continuous variables.

2) Discontinuous variables are those which are measured in single unit. For example number of schools in a town could be 10, 15, 18 etc. It cannot be 13.2 or 14.7 etc. Similarly number of tube wells, number of shops in an area etc could be discontinuous variables.

REPRESENTATION OF DATA THROUGH DIAGRAMS

The data collected through primary source or through secondary source, is in its raw form. It does not give a clear picture about itself. Some values are very large, some are low and some are in between low and high. These are all scattered values lying here and there. The data becomes clear once it is organised and put in to some systematic form of a table. Statistical tables are very handy and represent the data in a systematic and manageable form. Numerical representation of data, however, requires of smaller and larger values. A direct-mental comparison of such values is also possible if these are represented through diagrams.

WHY DO WE REPRESENT DATA THROUGH DIAGRAM?

The below mentioned points reveals the advantages of diagrams over the raw data. The advantages are as followes:

(i) The diagram creates greater interest in the subject matter which has been represented by it.

(ii) It clarifies and simplifies the subject matter.

(iii) They help in making quick and accurate comparision of data.

(iv) They bring out hidden fact and relationship and can stimulate as well aid to analytical thinking.

(v) It is more illustrative and attractive than the statistical inforamtion.

These are following important diagrams through which various types of statistical data can be represented:

(1) Line graph

(2) Bar diagram

(3) Pie diagram

(4) Star Diagram

36.4 A LINE GRAPH

There are certain variables whose values fluctuate with time, like temperature of an area or rainfall etc. There are some other variables which increase or decrease with time like population, agricultural and individual production and prices of various commodities. The data for all such variables is collected and tabulated with reference to time. If we plot such data on a graph paper in such a way that time is plotted on x-axis and values of the variables are plotted on y-axis and join the points by straight lines what we get is known as a line-graph.

Example

Average monthly maximum temperature of an area(x°c) is given below for 12 months. Plot the data by a line graph.

Month	Jan	Feb	Mar	Apr	May	June	July	August	Sep	Oct	Nov	Dec
x°c	24.5	26.6	32.2	38.1	42.5	44.3	40.4	33.4	30.2	29.7	29.2	25

In order to plot the given data, the most suitable diagram would be a line graph since the values of the temperature are given against time. Plotting months on the x-axis and temperature on the y-axis we get 12 points. If we join these points by straight lines as given in figure 36.1, we get the required line graph.

We observe from the table that the monthly average of maximum temperature is least in the month of January and it rises marginally in February. In March and April it increases rapidly and reaches maximum of 44.3° in June. It remains quite hot in July also. From August onward the temperature starts declining again (see fig. 36.1)

This conclusion, about the temporal variations or changes in temperature does not require any elaborate description in the presence of the line graph. Anybody looking at the line-graph given in figure 36.1 can quickly make out the picture of this cyclic variations in the temperature of the area.

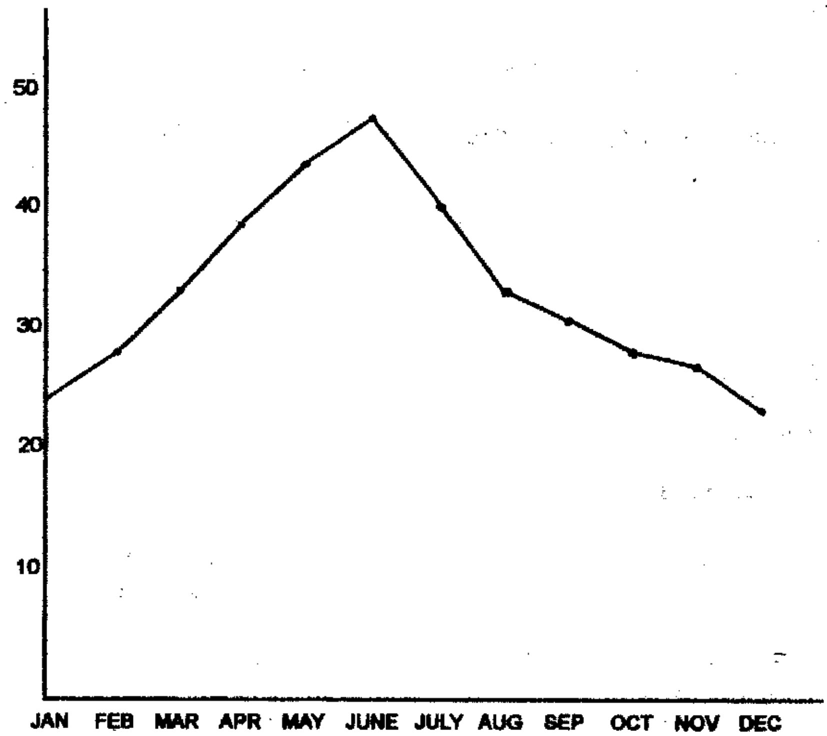

Fig. 36.1 A Line Graph

Rules for making line-graph

1) Time which is an independent variable is plotted on x-axis and temperature, rainfall, production or any other variable which is varying over time is plotted on y-axis.

2) All such points obtained by plotting the values on x-axis and y-axis should be jointed with the help of straight lines.

3) Since units of both x-axis and y-axis are different, separate scales should be chosen for these. For x-axis, the time unit-could be hours, days, months, years or any other unit of time. For y-axis the unit-could be °c, cm, tonnes or any other unit.

4) Normally vertical scale should start with zero so that the absolute magnitude of the values are represented. However, if most of the variations start after some fixed value, that value may start from origin of y-axis, for example take the values 12050, 12020, 12180, 12200, 12140, 12040, 12120……etc. As among these values variations are found after 12000, we can take 12000 as the starting value on the y-axis.

5) In a line graph time variable in most of the cases is at fixed intervals. It could be hours, days, months or years etc. Although this rule is not a must, but is generally observed for the sake of clarity.

Merits of a line graph

1) It shows the past as well as the present trends in the variations of a phenomenon.

2) With the help of it the intermediate values can be estimated (interpolated) as well as future values can also be predicted (extrapolated).

Demerits of a line graph

1) In comparison to mathematical relationship between time and the values of a variable, the relationship shown through line graph is only approximate.

2) It occupies more space as compared to a mathematical relationship.

A Compound line graph

Some times more than one variable can also be plotted on a line graph to compare their relative changes. For example, we can plot export and import figures on one graph for several years. It will give the changes in export in relation to imports. The difference between the two, will also give trade deficit. Similarly we can plot birth rates and death rates of a country for several years. The difference between the two in this case will give natural growth rate of the population. We may also plot the production of various agricultural crops to see as to which crop is maintaining upward trend and which is going downward. We can also plot the monthly maximum and minimum temperature on the same graph. Difference between the two will give monthly range of temperature.

Example

Line graph showing temporal variations in more than one variable is known as compound line graph.

The estimated Crude Birth Rate (CBR) and Crude Death Rate (CDR) of India are given below for the following years. Plot the data on a line graph.

Year	1921	1931	1941	1951	1961	1971	1981	1991
CBR (per 1000)	49	47	45	43	44	42	37	30
CDR (per 1000)	49	37	33	31	26	20	15	10

The data is plotted on the graph given in figure 36.2. There are two types of lines representing two different types of population data as indicated in the table. The compound line graph of crude birth rates and crude death rates shows a decline in both during 1921-1991. However, the graph shows a steep fall in crude death rate in relation to crude birth rate. This increasing gap is also highlighted on the graph by the shaded area between CBR and CDR.

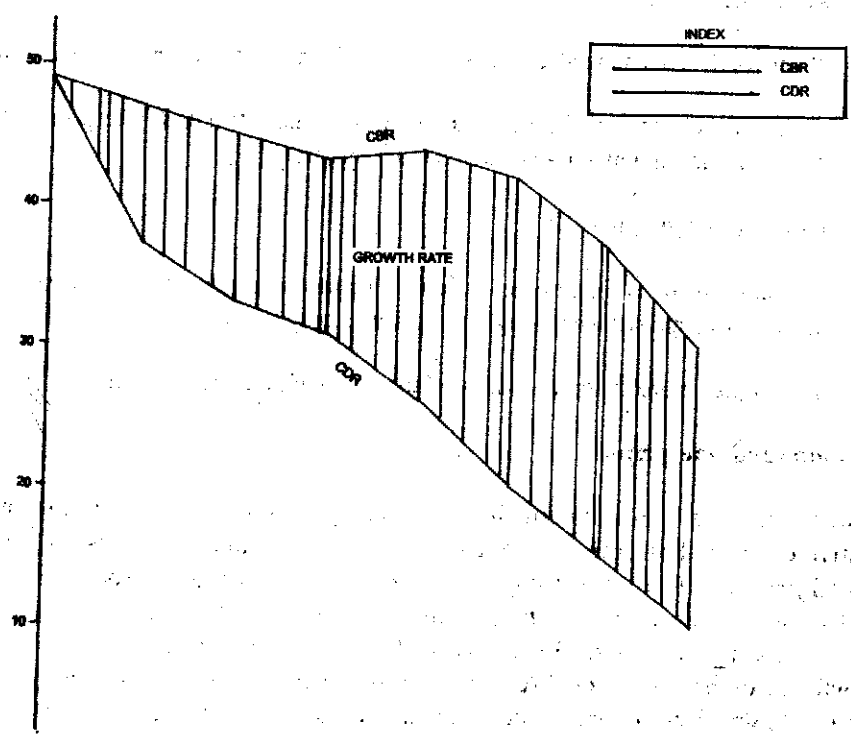

Fig. 36.2 A Compound Line Graph

36.5 A BAR DIAGRAM

Some times the values of a variable are given for areas, commodities or for anything other than time. In such cases these values are represented by bar diagram instead of a line graph.

HOW TO CONSTRUCT A BAR DIAGRAM

1. First of all, constant (or independent variable) data (here major parts) are shown on the 'x' axis and variable data (here tonnage) on the 'y' axis. The bars are drawn vertically.

Three scales are assumed:

2. Scale for width of the bars: the width of all the bars must be equal.

3. Scale for interval between two bars: The interval should be less than the width of the bars.

4. Scale for variable data is to be shown on 'y' axis. It should be in round figures. The principle of selecting scales is the same as in case of linegraph.

5. Now length of the bars are calculated as per the scale and the data.

6. Then points are marked and bars are drawn.

7. Labelling of the diagram is done in the same manner as is done in the linegraph.

In a bar diagram y-axis has a numerical scale but values on x-axis differ nominally i.e. values can be plotted any where with the only restriction that no two areas or categories will overlap each other. Here also areas or other categories are plotted on x-axis and their magnitude is plotted on y-axis. Unlike line graph in bar diagram the points are not joined. These points are shown by vertical bars from the x-axis. The heights of these bars are directly proportional to their magnitude

In vertical bar diagrams, on x-axis, instead of time, some areas, commodities etc are shown without any numerical scale. Y-axis, however, has a numerical scale and shows the magnitude of the values. The height of the bars in this bar diagram are proportional to the magnitude of the values.

Example

Population of the major states in India is given below for 1991. Represent the data graphically using the bar diagram.

	State	Population (in million)
1.	Andhra Pradesh	66.5
2.	Assam	22.4

	State	Population (in million)
3.	Bihar	86.4
4.	Gujarat	41.3
5.	Haryana	16.5
6.	Himachal Pradesh	5.2
7.	Jammu & Kashmir	7.7
8.	Karnataka	45.0
9.	Kerala	29.1
10.	Madhya Pradesh	66.2
11.	Maharashtra	78.9
12.	Orissa	31.7
13.	Punjab	20.3
14.	Rajasthan	44.0
15.	Tamil Nadu	55.9
16.	Uttar Pradesh	139.1
17.	West-Bengal	68.1

Source: Census of India 1991

The above data is plotted on a graph paper by bar diagram as shown in (see fig. 36.3 A). You will note that the states are plotted on x-axis in the order these are given in the table. Equal distance from one state to another state has no meaning here. It is only a nominal distance we have taken to separate any one state from any other state. On the y-axis, however, the height of the bars in the case of each state is in proportion to their population and it has a scale (half an inch is equal to 10 million population).

Some time the states can be rearranged on the basis of ascending or descending order of the population size also as shown in (see fig. 36.3 B).

The bar diagrams discussed above are known as vertical bar-diagrams since the bars are shown vertically. We can show these bars as horizontal bars also. In that case it will be known as horizontal bar diagram. In horizontal bar diagram vertical scale i.e. y-axis, will be nominal and horizontal scale i.e. x-axis will be a numerical scale.

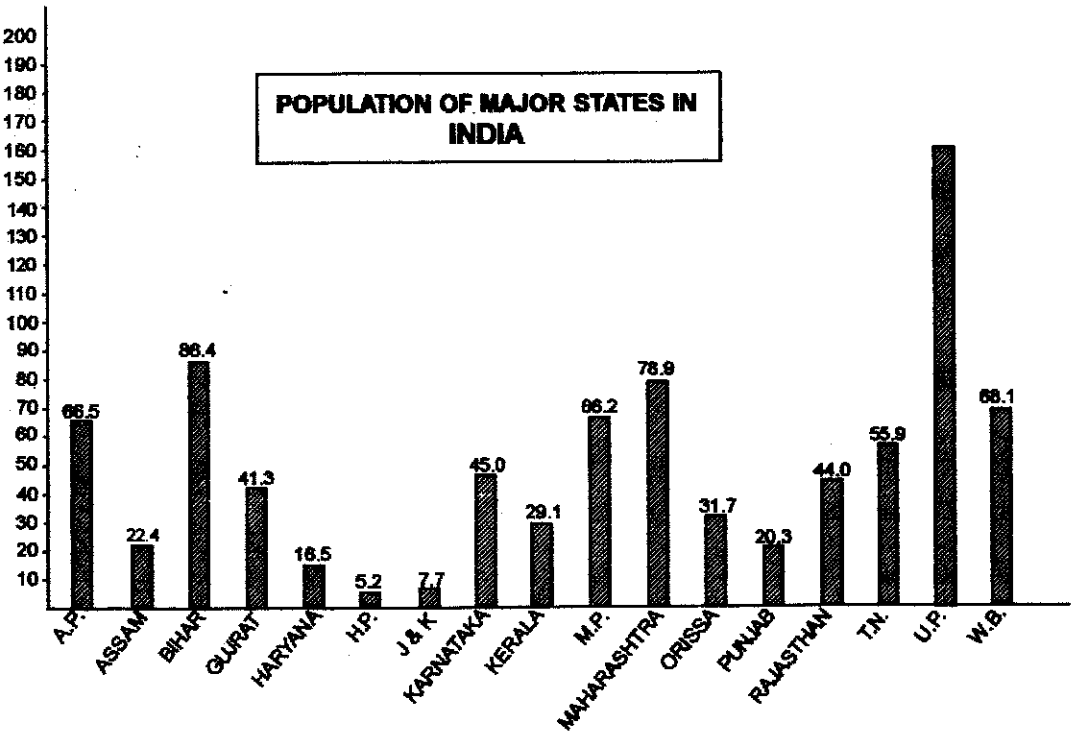

Fig. 36.3 A Bar Diagram

A Compound Bar Diagram

Quite often the variable being shown by the bars may consist of few different categories. These categories can also be shown on the bar itself. Such a bar diagram shows the magnitude of different values as well as share of its different categories and is known as compound bar diagram. It is also known as stacked bar diagram. In a compound bar diagram alongwith the magnitude bars also show the share of different categories of the variable which is shown by the bars.

Example

The population of the major states of India is given below with rural and urban breakup. Plot the data on a compound bar diagram showing rural and urban break up of each state.

Population (in million)

	State	Rural	Urban	Total
1.	Andhra Pradesh	48.6	17.9	66.5
2.	Assam	19.9	2.5	22.4

	State	Rural	Urban	Total
3.	Bihar	75.0	11.4	86.4
4.	Gujarat	27.1	14.2	41.3
5.	Haryana	12.4	4.1	16.5
6.	Himachal Pradesh	4.7	0.5	5.2
7.	Jamu & Kashmir	5.9	1.9	7.7
8.	Karnataka	31.1	13.9	45.[illegible]
9.	Kerala	21.4	7.7	29.1
10.	Madhya Pradesh	50.8	15.4	66.2
11.	Maharashtra	48.4	30.5	78.9
12.	Orissa	27.4	4.3	31.7
13.	Punjab	14.3	6.0	20.3
14.	Rajasthan	34.0	10.0	44.0
15.	Tamil Nadu	36.8	19.1	55.9
16.	Uttar Pradesh	111.5	27.6	139.1
17.	West Bengal	49.4	18.7	68.1

Source: Census of India 1991

Construction of compound bar diagram is not very much different from the ordinary bar diagram. In the final form the bars are divided into their categories using the same scale. These categories are indicated in the index. The above data is plotted by a bar diagram and is shown in (see fig. 36.4).

In the present case only two categories are there. In some other cases there may be several categories. In such cases each bar will be subdivided into several categories. All these categories, however, will have to be shown in an index.

In some cases the differences in absolute values may not be as important as their proportional distribution in different categories. In such cases the categories are converted into percentages such that these percentages add to 100. Each unit in this case therefore is represented by bar of equal size symbolising total of all the percentages as 100. Percentages of different sub categories are then shown on each bar by different sheds or colours.

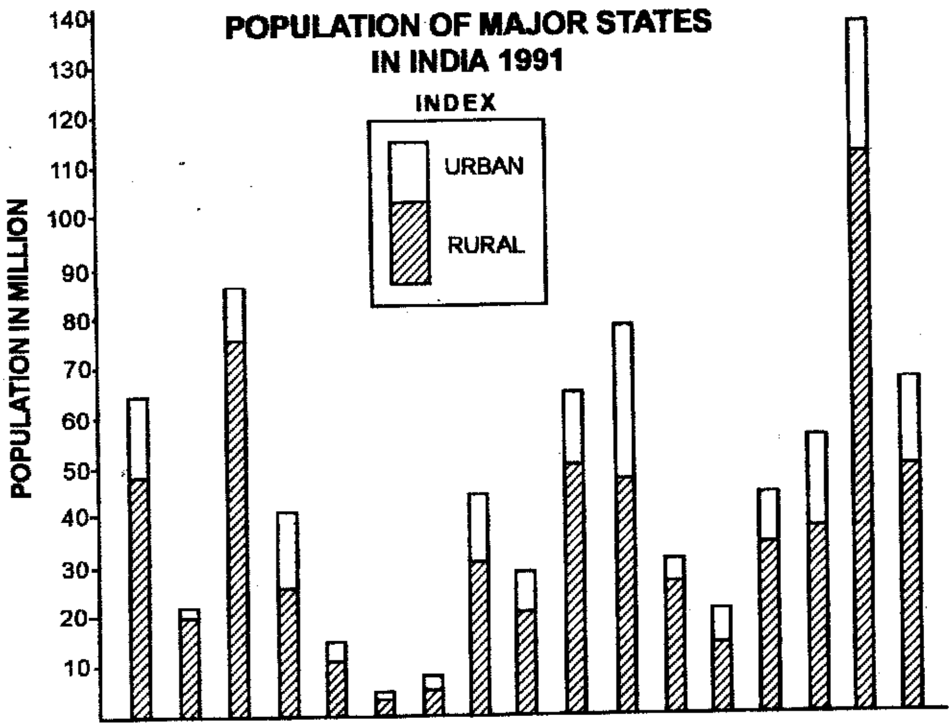

Fig. 36.4 A Compound Bar Diagram

A Multiple Bar diagram

Many a time it is more useful to plot sub-categories of a variable side by side. In these cases the bar of one category is placed alongwith the bars of other categories for each area. Each category is shown by a separate shade and is given in the index. The advantage of multiple bar diagram over compound bar diagram is that in this case camparision is direct. In compound bar diagram the categories are placed one over the other, whereas in multiple bar diagram these are placed side by side making comparison more direct and quicker. When there are many categories and less observations/units, multiple bar diagram is more appropriate. On the other hand, there are more observations/units and lesser categories, a compound bar diagram is always better.

Example

Electricity sold for different purposes in four states of India is given below for 1994-1995. Plot the data on multiple bar diagram and compare its use for different purposes

Electricity used (in crores kw/h) for different purposes in selected states.

State	Domestic Purposes	Commercial Purposes	Industrial Purposes	Other	Total
1. Andhra Pradesh	332.0	68.3	754.9	1208.6	2363.8
2. Bihar	73.6	42.2	637.0	219.0	971.8
3. Maharashtra	685.3	256.5	1665.1	1481.9	4088.9
4. Uttar Pradesh	613.3	190.5	482.7	1566.2	2552.4

Source: Statistical Abstract of India 1997.

Multiple bar diagram is shown in figure 36.5. As there are four categories, of use of electricity there are four bars for each state–one bar for each category. The heights of these bars are proportional to their magnitude of the electricity used (in crores kwh)

The multiple bar-diagram given in fig. 36.5 very clearly shows that in Maharashtra, Andhra Pradesh and Bihar consumption of electricity for industrial purpose is quite high and in Uttar Pradesh it is very low. The diagram also shows that consumption of electricity for domestic and commercial purpose is strikingly rather low, in all the four states of India.

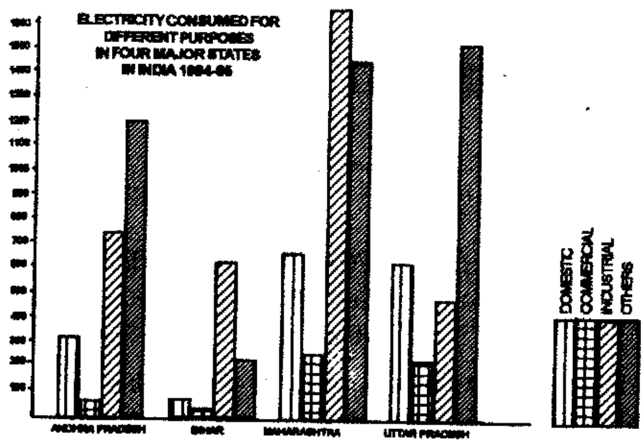

Fig. 36.5 A Multiple Bar Diagram

Merits of a Bar Diagram

1) Bars give a visual comparison which is more effective than the quantitative comparison.

2) Multiple classifications are easily compared by a bar-diagram, compound or a multiple bar diagram

3) It can be shown on maps also

4) It is easy to prepare and understand.

Demerits of a Bar Diagram

1) For minor differences bar diagram or any other graph is not suitable because these are less accurate than numerical values.

2) It occupies more space.

36.6 A PIE DIAGRAM

In a multiple bar diagram we compare categories of a variable for different areas. However, when number of categories increase further and number of observations are only a few, pie diagram is found to be more handy to represent these categories than the bar diagram. In a pie diagram each category is represented by different segments of a circle. The proportional share of each category is reflected in the area of the segment as well in the angle it makes at the centre.

In the construction of pie diagram one has to find out the angle of each category of the diagram. These angles are then drawn at the centre of a circle of suitable size. It will be observed that the proportional share of each category will be reflected in the area of the corresponding segment as well as in the angle.

The angle of each category is worked out by taking the ratio of the component value C to the total value (T) and multiplying it by 360 i.e. (C T)x360. In case component values are given in percentages, each percentage is multiplied by 3.60 to convert it into corresponding angles. Sum of all such angles has to be 360°. Before making any pie diagram one should always verify this fact.

Example

Land use categories of India are given below for 1950 and 1992. Show the shift in the land use graphically with the help of a pie diagram.

Land under different uses in India (in million)

Year	Forrest	Non-Ag. use	Barren	Pastures	Groves	Culturable Waste	Fallow	Net Sown Area	Total
1950	40.5	9.4	38.1	6.7	19.8	22.9	28.1	118.8	284.3
1992	68.1	21.9	19.4	11.3	3.7	14.7	23.6	142.5	305.2

Source: Statistical Abstract of India 1997.

The land use categories given above are converted into the angles using the method given above and are given (in °)

Year	Forrest	Non-Ag. use	Barren	Pastures	Groves	Culturable use	Fallow	Net-sown Area	Total
1950	51.3	11.9	48.2	8.5	25.1	29.0	35.6	150.4	360
1992	80.3	25.8	22.9	13.3	4.4	17.3	27.8	168.2	360

To explain the calculation of angles let us take area under culturable waste in 1950 which is 22.9. Its corresponding angle would be 22.9/284.3 x 360 = 28.9975° which after rounding upto one decimal place is 29.0. Similarly the angle of the same culturable waste in 1992 will be 14.7/305.2 x 360 = 17.3394° which after rounding upto one decimal place would be 17.3 only. Note that as has been mentioned in demerits of a bar diagram, all graphical methods are less accurate than numerical methods. Rounding, therefore, upto only one or two decimal places is sufficient. Minute differences can not be depicted on the graph effectively.

The proportional composition of land use categories given in angles are shown below in fig. 36.6.

A close look of fig 36.6 will not only show proportional composition of various land use categories but also show a change that has taken place between 1950 and 1992. Pie diagram very clearly shows that forest cover has increased quite substantially between 1950-92. Also it shows a significant increase in net area sown. The diagram on the other hand shows a decline in fallow land, culturable waste, barren land and area under groves.

If we show the categories of two different areas such that one is very high and the other is low, in absolute term the size of the circle of the pie diagram can be taken in proportion to the total size. For example if we show the land utilisation of two states like Uttar Pradesh and Haryana, the size of the circle for these states may be in proportion to their area. Rest of the procedure will remain the same. One of the pie diagrams will be larger and the other will be smaller in size. Internal division of the circle, however, will show relative position of land use in two states.

Merits of a Pie Diagram

1) It highlights the proportional composition of a phenomenon in a better way since it uses two dimensional space, unlike bar diagram which uses only heights, length for differentiating the values.

2) When there are large number of components in compound or multiple bar diagram it becomes very difficult to show them. The pie diagram is more convenient of way of handling such cases.

3) It occupied lesser space as compared to bar diagram

Demerits of a Pie diagram

1) It requires more mathematical calculations

2) It is effective only when proportional comparison of a few units is to be made (say two or three). In case large number of units are to be compared, a Pie diagram may not be preferred over multiple bar diagram.

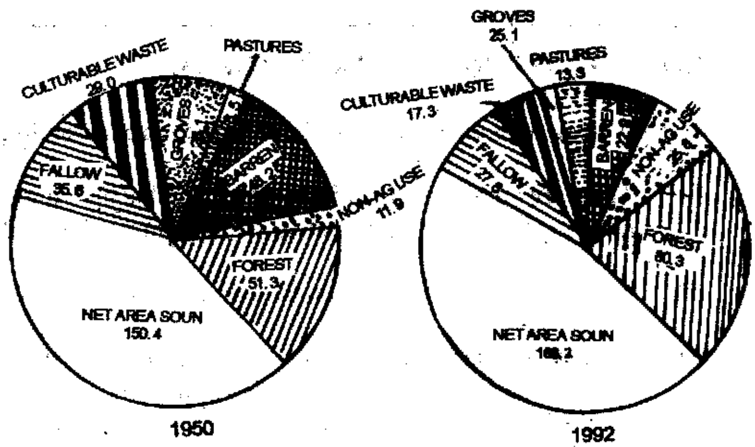

Fig. 36.6 A Pie Diagram

36.7 A STAR DIAGRAM

In this diagram radiating lines are drawn from a centre to represent a certain quantity or number of days etc. The length of the lines is proportional to the quantity which is to be represented. When the outer points of the lines are joined together, they give the appearance of a star. Hence, the diagram is named as a star diagram. Wind rose is a typical example of star diagrams.

Example

Construct a star diagram for the following data.

Wind coming from	No. of days
North (N)	51
North East (NE)	22
East (E)	17
South East (SE)	42
South (S)	55
South West (SW)	57

West (W)	32
North West (NW)	52
Calm Days	37
Total	365

HOW TO CONSTRUCT A STAR DIAGRAM

The following steps are involved in the construction of a star diagram:

(i) There are eight directions from which wind is blowing. Hence, we draw eight lines radiating from a centre indicating all the eight directions of the wind.

(ii) Now write eight directions on these lines as N, NE, E, SE, S, SW, W and NW.

(iii) Assume a suitable scale for showing the flow of the wind from various directions keeping the size of the paper in view. Each line will depict the number of days the wind is blowing from each direction. Here the scale is I Cm = 20 Days.

On the basis of the scale, the length of the lines from Centre will be calculated as under:

L = D + S

Where L stands for length of the line

D stands for no. of days for which wind is blowing from a direction.
S stands for scale (here 1 cm = 20 days)

Thus the length of lines of each direction will be

N = 2.55 cm

NE = 1.1 cm

E = .85 cm

SE = 2.1 cm

S = 2.75 cm

SW = 2.87 cm

W = 1.6 cm

NW = 2.6 cm

Calm = 1.85 cm

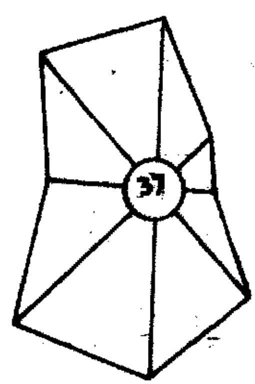

Fig. 36.7 A Star Diagram

Now put points for the calculated length on each line. For the number of calm days, a circle of 1.85 cm radius will be drawn at the centre. (see fig. 36.7)

(iv) The terminal points of each line are joined together to form the star diagram.

(v) Number of calm days is written in the centre of the circle for which it has been drawn.

Construction of star diagram is very simple. It does not involve any mathematical calculation except the calculation of the length of lines.

(vi) Use

Star diagrams are shown on climatological maps and pilot charts. They give us an understanding about the weather conditions (windy or calm) in an area of a region.

36.8 A DOT MAP

(a) Meaning

A dot map provides a visual impression of relative density of phenomena with the help of dots of uniform size. It uses discrete data or absolute figures, which are later converted into certain number of dots.

The *dot* is a point symbol used to represent the spatial distribution of phenomena. An individual dot and the total number of such dots indicate the quantitative aspects, whereas their placement on the map reveals the density and the pattern of distribution. A dot map employs either *mono-dot method or multiple-dot* method in representing the data.

In *mono-dot method,* the size or the radius of the dots is kept uniform throughout the region to be mapped. The dots in this case may be single coloured, when one phenomenon is to be shown, e.g, population distribution by numbers; or multicoloured where more than one feature of the same phenomena are mapped. For example, in a map showing distribution of tribes, dots of different colours indicate different tribes, but the size of dots is uniform all over, irrespective of the colour.

Multiple dot method is applied where the range in the density of the element to be represented is so high that no matter how one proceeds, mono dot method cannot give good results. For example, if the population of two areas is 1500 and 1,50,000, what ever scale you may select, the number of dots in the area having the larger population will be too large to be properly placed while the area with lesser population will remain blank. There are other problems also in mono dot method. For instance an area having 1,075,200 persons will be represented by 10 to 11 dots, if one dot represents 100,000 persons. In this case, the representation will not be correct, because if 10 dots are used, the problem comes of the large residual value i.e. 75,200 which is un-represented, and if 11 dots are used, the data is over represented. The errors so generated can be minimized by reducing the value represented by each dot. But this generated can be minimized by reducing the value represented by each dot. But this procedure will give more dots, which will eventually coalesce while plotting. Here, multiple dot method is an answer to the problem.

In multiple dot method, we have two or three sizes of dots standing for different values, in the above example, we can have a large dot representing 100,000 persons, a medium size dot representing 50,000 persons and a small size dot representing 25,000 persons. So, instead of putting 10 or 11 dots, we can have ten large dots, one medium size dot and one small size dot. This method is specially useful in showing variable population distribution in a country like India.

The dot technique is applied to depict a variety of socio-economic data, e.g. the pattern of distribution of population, livestocks, crops, minerals, industries, etc. It is also applied for the data which are directly available and no further computations are required.

The dot method may also be used with other symbols like circles or spheres, to show two or more varying features together on the map, e.g., rural population by dots and urban population by circles or spheres.

(b) ***Example 1***

Fig. 36.8 is a dot map showing rural population distribution in Rajasthan in 1981 (Table 1). In column 4 of the Table 1 we have worked out the number of dots to be placed in each district. The scale selected for the purpose is one dot representing 50,000 persons. The method of construction is elaborated.

TABLE: Rural Population Distribution in Rajasthan, 1981.

Sl. No. 1	District 2	Number of persons 3	Number of Dots 4
1.	Jaisalmer	2,10,155	4
2.	Bikaner	5,13,664	10
3.	Jodhpur	10,87,946	22
4.	Barmer	10,20,663	20
5.	Jalore	8,30,283	17
6.	Sirohi	4,45,048	9
7.	Pali	10,39,739	21
8.	Nagaur	13,91,592	28
9.	Churu	8,34,807	17
10.	Ganganagar	16,11,669	32
11.	Jhunjhunu	9,60,316	19
12.	Sikar	10,98,309	22
13.	Alwar	15,74,972	32
14.	Bharatpur	15,62,432	31

Sl. No. 1	District 2	Number of persons 3	Number of Dots 4
15.	Jaipur	21,70,042	43
16.	Ajmer	8,23,960	16
17.	Bhilwara	11,21,816	22
18.	Udaipur	20,01,840	40
19.	Dungarpur	6,38,719	13
20.	Banaswara	8,31,413	17
21.	Chitiorgarh	10,70,073	21
22.	Bundi	4,87,153	10
23.	Tonk	6,39,791	13
24.	Sawai Madhopur	13,29,780	27
25.	Kota	10,61,690	21
26.	Jhalawar	6,93,482	14

(i) Careful selection of the unit-value and size of the dots;

(ii) Proper placing of the dots.

Construction of dot map

First of all you need a base-map of the region to be mapped and the data in numbers. The boundaries of the individual administrative units, for which the figures are obtained are drawn in pencil or light ink. Such administrative units are called unit-areas and the value represented by each dot is the unit-value. In Example, illustrated here, 'district' is the unit-area and "50,000 persons per dot" is the unit-value. The preparation of dot map depends on:

It is only after the unit-value of the dot and its proper place on the map are decided, the dots of uniform size are put within the unit-areas demarcated on the map.

(i) Selection of unit-value and size of the dots

Unit value determines the number of dots to be placed in each unit area. The first step is to examine the range of quantities involved, and then to select a value to be represented by each dot. The selected unit value is always a round number (and generally a multiple of 10). Secondly, the fractions of the actual figure are never plotted.

The unit value adopted should neither be so low that it creates difficulty in inserting dots in high density areas, nor it should be so high that the area units with low density should loose their significance. The best approach is by experimenting. Dot Map in fig. 36.8 uses the unit-value of 50,000 persons per dot. A value of 40,000 persons per dot will also give a fairly meaningful picture. But the unit-value lesser than that will increase the number of dots in the districts with a large population, i.e. Jaipur, Udaipur, Alwar, Bharatpur and Ganganagar. A unit-value greater than 50,000 will further lower the number of dots and will not represent satisfactorily the districts with low rural population, e.g. Jaisalmer and Bikaner.

The actual size of the dots to be used presents a further problem. Their size must depend on the scale of the base map, space available on the map and on the number of the dots to be inserted. At the sametime dots must be neither so big that they may coalesce in dense areas and a coarse generalization effect is produced, nor so small that a blur and insignificant pattern of distribution emerges. The size is so determined that the number of dots should remain countable and they must not be allowed to merge with one another in areas of high density.

The size of the dot cannot possibly be made uniform by ordinary pens. For this purpose various inking pens like Le Roy, Payzant, UNO, etc are used. However, the basic idea is to make the dots of uniform size or of the same radius. In the absence of inking pens, some form of stamp or dye or any other local material may be used to serve the purpose. Yet another method, but tedious one, is to stick black dots, punched out of adhesive paper, directly on the base-map.

(ii) Placing of Dots

In an overall sparse distribution, one dot may represent one value, like paper mills or gold mines distributions; but in most of the cases one dot shows several units together. In such cases it is helpful to consider that these values have a kind of centre of gravity and dots for them should be placed as near as possible to that pivotal point. For example, an uneven distribution will have more dots in the dense region and lesser in the sparse area (see fig. 36.8). The dots should be placed evenly by eye and in some continuity with the dots in adjacent areas.

The base maps showing physical and cultural features are of great help for the placement of dots on the maps. On the basis of these the positive and negative areas should be marked first. The positive areas are the parts of the region which are favourable for the distribution of the phenomena while negative areas are the relatively unfavourable parts of the region. In population distribution maps, for instance, these negative areas are known as *non-ecumene* areas, viz. the lands unsuitable for human settlements such as deserts, swamplands, flood plains etc.

In placing the dots, care must be taken not to leave the boundary areas blank. Care must also be taken so that the dotting does not inadvertantly produce lines and clusters of dots that do not occur in reality. In fig. 36.8, dots have been placed after a careful study of the district-wise distribution of population in Rajasthan, and the physical and cultural features of the state.

(c) Interpretation of a dot map

As the distributional patterns on the dot map are shown by dots, thoretically one should count the number of dots in each unit area and multiply it with the unit-value assumed for one dot. But, very often, one has to turn to the original source of information to get a more clear picture of the distribution. The following principles should be kept in mind while interpreting a dot map:

- Study the general trend of distribution, i.e. the way the high concentration areas are diffusing towards the lower density areas.
- Identify the important nodes of concentration, if any,
- Subsequently, divide the entire region into high, moderate and low concentration areas and describe each separately.
- The areas or districts not conforming to the general pattern can be discussed as exceptional cases.
- If necessary, the facts of distribution may be supplemented by the absolute figures given in the respective table.

The above principles may, now, be used to interpret the patterns of distribution of rural population in Rajasthan as shown in fig. 36.8. The distribution is uneven in nature. Because of gentle variation in the data, the nodes of very high concentration do not exist on the map, but the general pattern reveals the fact clearly that the eastern region of Rajasthan is more crowded than the western part. In terms of the total numer of dots, the rural population appears to be the highest in Jaipur district. The lowest number of rural people appears to be in Jaisalmer which has only 4 dots. But mere numbers of dots do not give an accurate picture of the distribution. Equally important is the space available within the unit-areas or the scale of the base map. Although many districts in the state are represented with lesser number of dots than in Jaipur, there the dots are more densely placed, giving a picture of higher rural population concentration. Such districts are Jhunjhunu, Sikar, Alwar, Bharatpur, Bhilwara, Udaipur, Banaswara and Dungarpur. Consequently the sparse concentration of dots, especially in the western districts of Jaisalmer, Bikaner, Jodhpur, Barmer, Nagaur, Churu and Bundi suggests low rural population density. Moderate situation exists in the rest of the districts i.e., Jalor, Sirohi, Ajmer, Chittorgarh, Tonk, Kota, Jhalawar, and Sawai Madhopur.

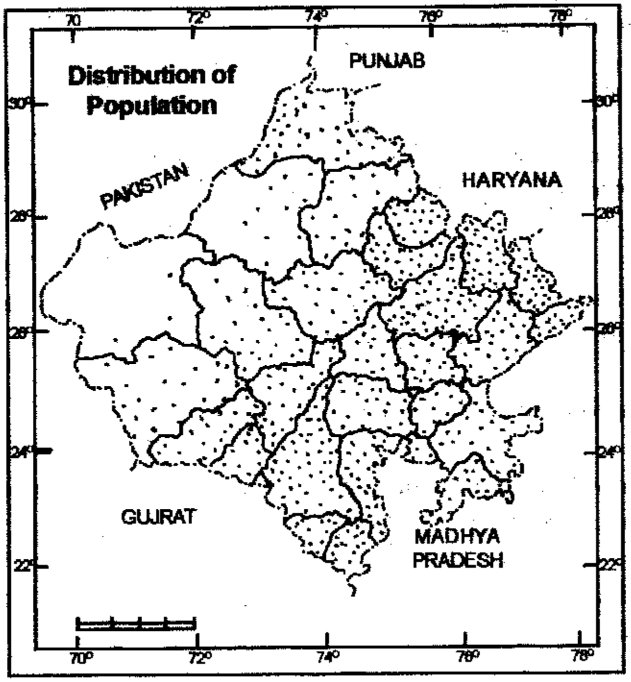

Fig. 36.8 A Dot Map

(d) Merits and Demerits of a dot map

Merits

1. A dot map exhibits a more vivid and exact picture of the distributional pattern.

2. It is easily commensurable except when the dots overlap or seen to intermix due to the smallness of the scale.

4. A dot map may be converted into an isopleth or choropleth map, but the reverse is not possible.

5. The dot method is sometimes referred to as the "absolute method", because of the absolute ratio between quantities represented and the number of dots employed.

6. Dot maps are comparatively easier to construct. No computation is ordinarily necessary except determining the number of dots required.

Demerits

1. The dot may not be near the place where feature to be mapped actually exists.

2. Without experience and practice, it is not easy to make dots of uniform shape and size.

3. Dot method fails to show the distribution of a phenomenon having very uneven distribution.

4. Sometimes the dots coalesce in denser areas and are rarely counted. For precise information one has to turn to the basic source of data.