VIVEKANANDA COLLEGE

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NAAC ACCREDITED 'A' GRADE

Topic: Diagrammatic Representation of Data

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CONCEPT OF DIAGRAMMATIC REPRESENTATION OF DATA

Diagrammatic Presentation of Data gives an immediate understanding of the real situation to be defined by data in comparison to the tabular presentation of data or textual representations. Diagrammatic presentation of data translates pretty effectively the highly complex ideas included in numbers into more concrete and quickly understandable form. Diagrams may be less certain but are much more efficient than tables in displaying the data. There are many kinds of diagrams in general use. Amongst them the significant ones are the following:

(i) Geometric diagram
(ii) Frequency diagram
(iii) Basics of Diagrammatic Presentation

CONCEPT OF DIAGRAMMATIC PRESENTATION

- Diagrammatic presentation is a technique of presenting numeric data through Pictograms, Cartograms, and Bar Diagrams & Pie Diagrams etc. It is the most attractive and appealing way to represent statistical data. Diagrams help in visual comparison and have a bird's eye view.
- Under Pictograms, we use pictures to present data. For example, if we have to show the production of cars, we can draw cars. Suppose, production of cars is 40,000. We can show it by a picture having four cars, where 1 Car represents 10,000 units.
- Under Cartograms, we make use of maps to show the geographical allocation of certain things.
- Bar Diagrams are rectangular in shape placed on the same base. Their height represents the magnitude/value of the variable. Width of all the bars and gap between the two bars is kept the same.
- Pie Diagram is a Circle which is sub-divided or partitioned to show the proportion of various components of the data.
- Out of the above, only One Dimensional Bar Diagrams and Pie Diagrams are in our scope.

ADVANTAGES OF DIAGRAMMATIC PRESENTATION

The following are the advantages:

Diagrams Are Attractive and Impressive:

- Data presented in the form of diagrams are able to attract the attention of even a common man.

Easy to Remember

- Diagrams have a great memorizing effect.
- The picture created in the mind by diagrams last much longer than those created by figures presented through the tabular form.

Diagrams save Time

- It presents complex mass data in a simplified manner.
- Data presented in the form of diagrams can be understood by the user very quickly.

Diagrams Simplify Data

- Diagrams are used to represent a huge mass of complex data in a simplified and intelligible form, which is easy to understand.

Diagrams Are Useful in Making Comparisons

- It becomes easier to compare two sets of data visually by presenting them through diagrams.

More Informative

- Diagrams not only depict the characteristics of data but also bring out other hidden facts and relations which are not possible from the classified and tabulated data.

LIMITATIONS OF DIAGRAMMATIC DATA PRESENTATION

You need to exercise caution while drawing inferences from diagrams. Here are some of their limitations:

- **Provides vague ideas** – While diagrams offer a vague idea about the problem, it is useful only to a common man. An expert, who seeks an exact idea of the problem cannot benefit from them.
- **Limited information** – Classified and tabulated data provides more information than diagrams.
- **Low precision** – Diagram offer a low level of precision of values.
- **Restricts further data analysis** – Diagrams do not allow the user to analyze the data further.

- **Portrays limited characteristics** – Diagrams tend to portray only a limited number of characteristics. Therefore, it is difficult to understand a large number of characteristics using diagrams.
- **A possibility of misuse** – Sometimes diagrams are misused to present an illusory picture of the problem.
- **Fail to present a meaningful look in certain situations** – If the data has various measurements and wide variation, then diagrams do not present a meaningful look.
- **Careful usage** – If diagrams are drawn on a false baseline, then the user must analyze them carefully.

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 information's.

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**: It 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 25 Diagrammatic Presentation of Data 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.

TYPES OF DIAGRAMS

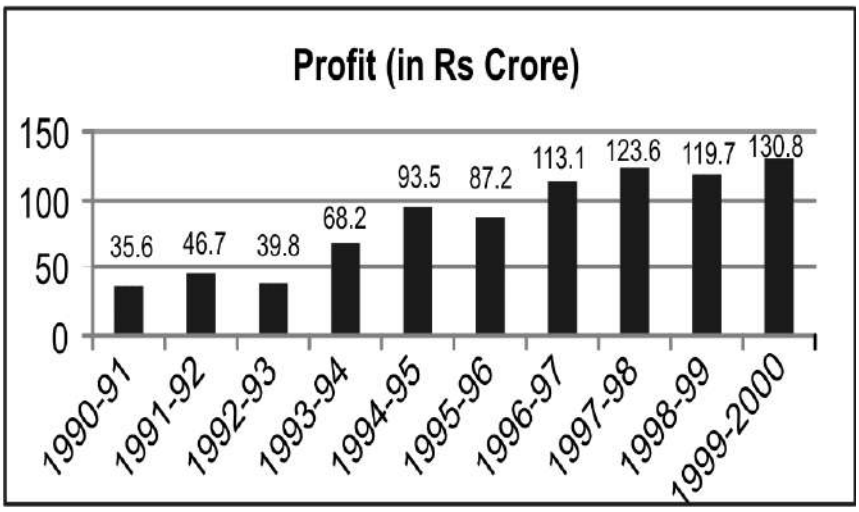
SIMPLE BAR DIAGRAM

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

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



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:

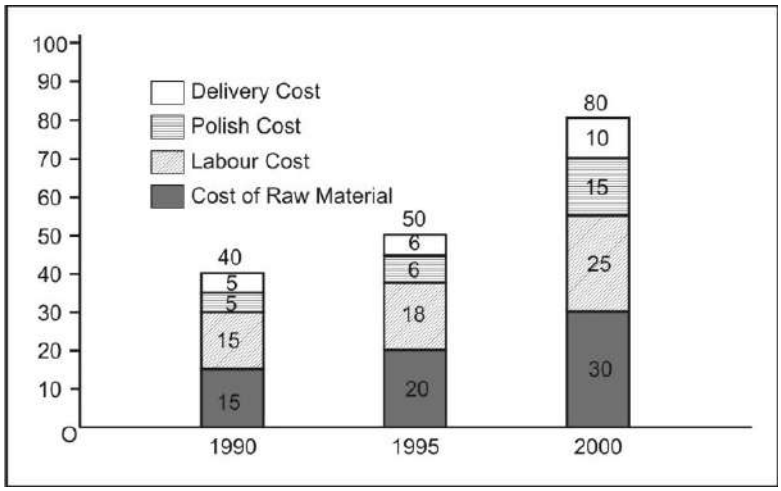
Category	Cost per chair (in Rs) year wise		
	1990	19 95	20 00

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:



MULTIPLE BAR DIAGRAM

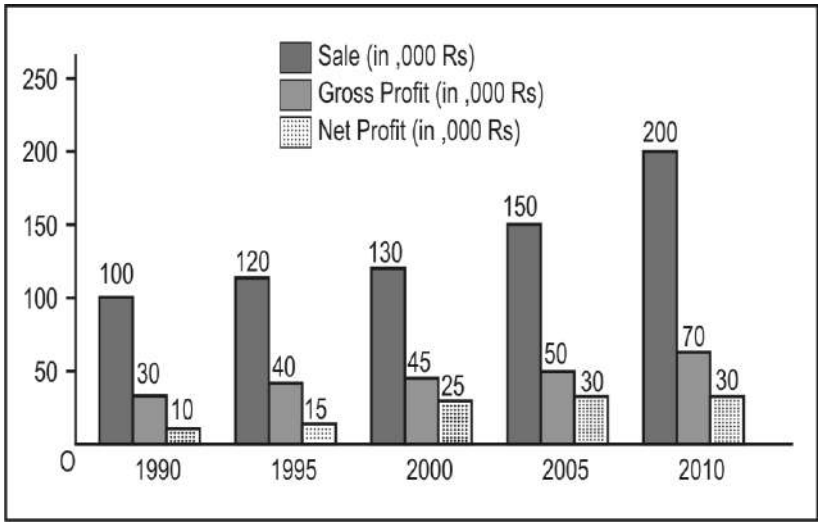
In multiple bar diagram, we construct two or more than two bars together. The multiple bars are constructed for either the different components of the total or for the magnitudes of the variables. All the bars of one group of data are made together so that the comparison of the bars of different groups 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 component 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 bars diagram for the above data is given below:



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.

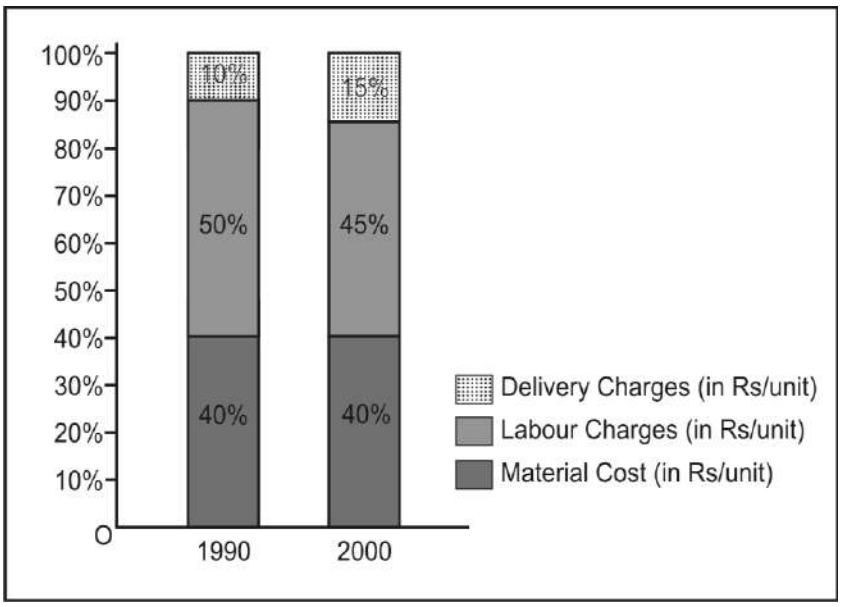
Example 4: Draw a percentage bar diagram for the following data:

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:



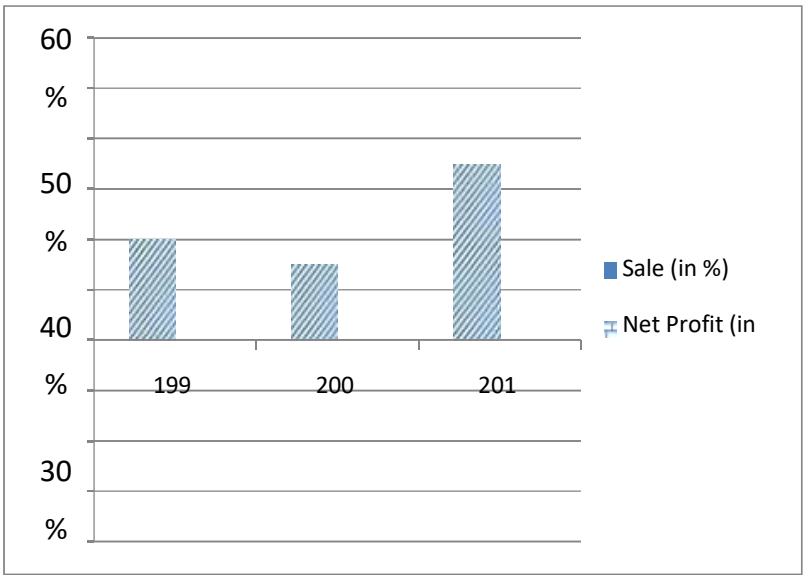
DEVIATION BAR DIAGRAM

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:

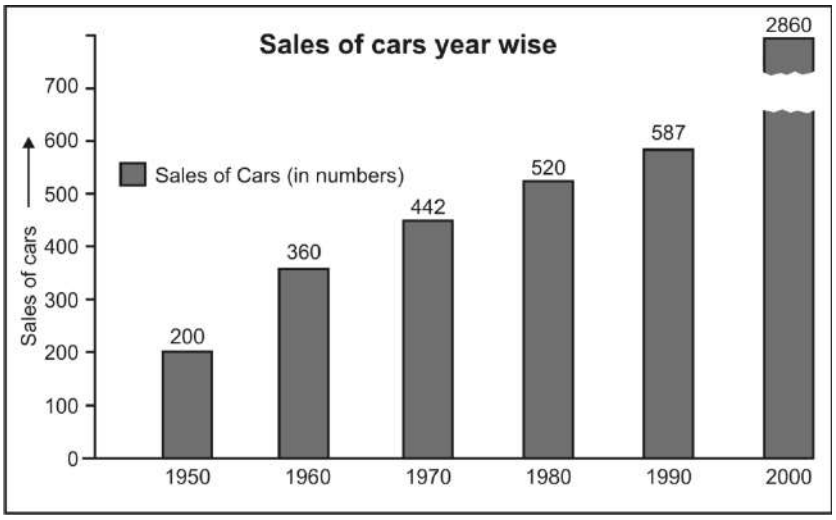


BROKEN BAR DIAGRAM

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.



RECTANGLE DIAGRAM

In rectangles diagram given numerical figures are represented by areas of the rectangles. We know that area of a rectangle = (length) ×(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:

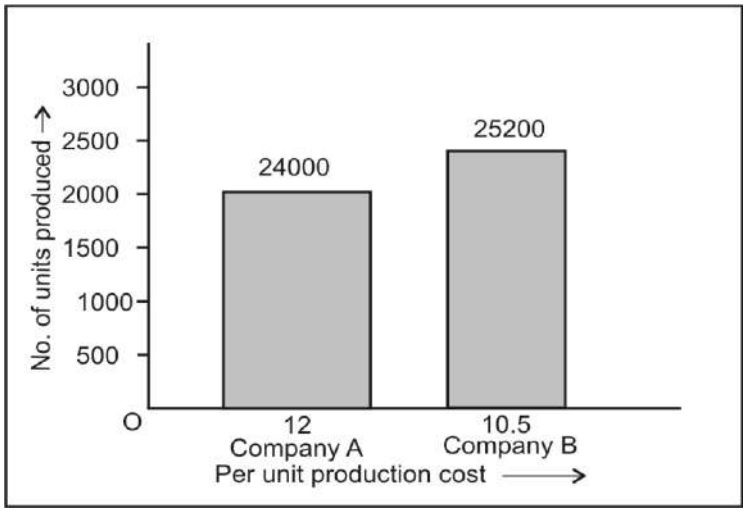
Company A

Length = 2000 (total produced units) Breadth = 12 (per unit production cost) Area = 2000 × 12 = 24000

Company B

Length = 2400 (total produced units) Breadth = 10.5 (per unit production cost) Area = 2400 × 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.



SQUARE 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 = 2 So, we take= ×(side) (side) (side) . 33 Diagrammatic Presentation of Data 2 ven numerical figures= ⇒ =(side) given numerical figure side of square gi 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

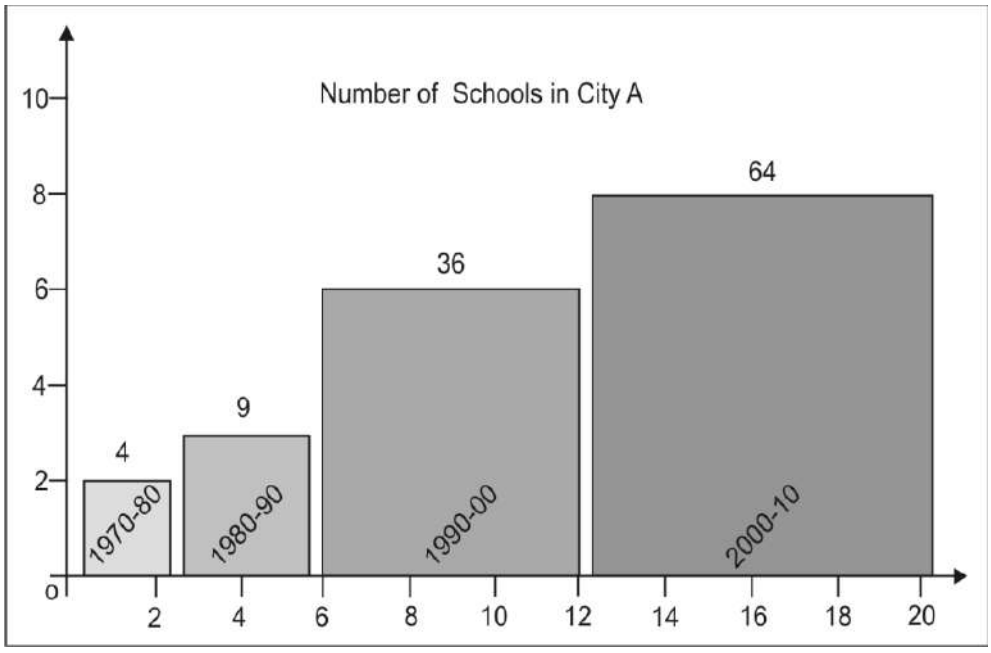
Solution:

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

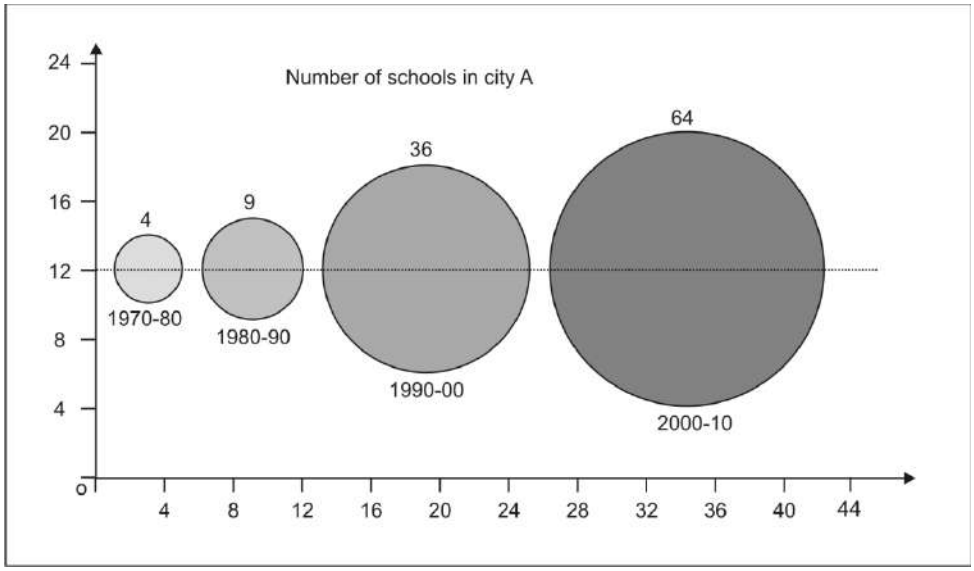
=Step 3 Square diagram for the given data

is shown below.



CIRCLE 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 = r , 2 where r is radius of the circleπ r , read as A is proportional to 2α A $\Rightarrow$2 if y ax, whereas is r constant, then we say that yis proportional to x. = ⎤⎡ ⏐⏐ ⎦⎣ Θ α π $\Rightarrow$ 2 r Given numerical figures/observations α $\Rightarrow$ 2 is constantπr Given numerical figures/observations as Square roots of the given numerical figures/observationsα r $\Rightarrow$ 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 (2 r) 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 (r , r , r , r) 2 4 2 3 2 2 2 = 4, 9, 36, 64π π π 1 π Step 2 Square of radii of corresponding circles are proportional to 4, 9, 36, 64 i.e. r , r , r , r 4,9,36,64 2 4 2 3 2 2 2 α1 Step 3 Radii of corresponding circles are proportional to 4, 9, 36, 64 = αi.e. r , r , r , r 4, 9, 36, 64 2, 3, 6, 8 1 2 3 4 Step 4 Circles diagram for the given data is shown on the next page. Radii of the circles lie on the dotted line.



PIE DIAGRAMS

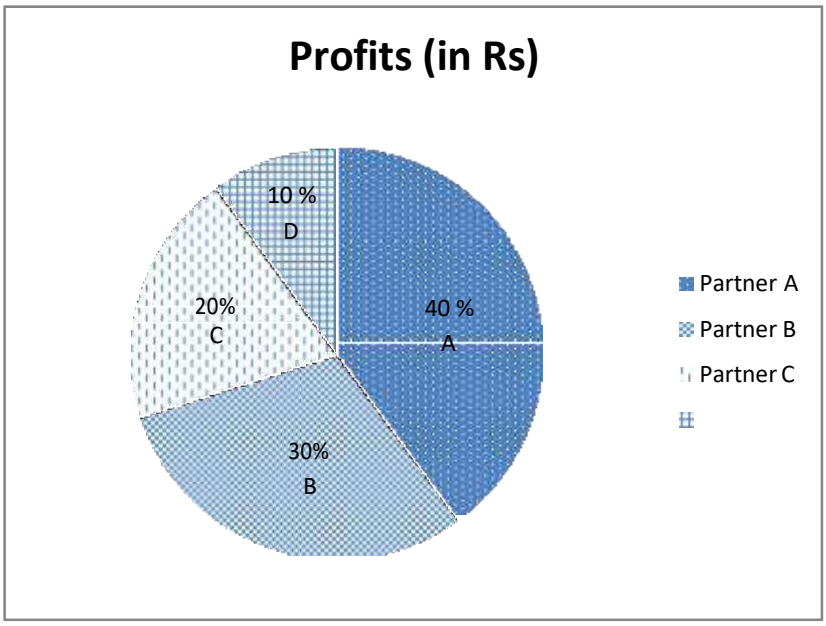
Pie diagram/chart is used when the requirement of the situation is to know the relationship between whole of a thing and its parts, i.e. pie chart provides us the information that how the entire thing is divided up into different parts. For example, if the total monthly expenditure of a family is Rs 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 0 360. 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 of4: 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 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 partner is shown on the next page:


Profits (in Rs)
10 %
D
20%
C
40 %
A
30%
B
Partner A
Partner B
Partner C