22. MEANING OF DIAGRAMMATIC PRESENTATION:-
Diagrammatic presentation is a technique of presenting data in the form of diagrams such as bar diagrams, rectangles, pictograms & cartograms etc.

Importance of Diagrams:-

(1) Attractive & Popular:- Diagrams are attractive & interesting. They are very easy to understand even for the layman who has no statistical background.

(2) Simple & Easily Understandable:- Diagrams make data simple and easily understandable. In this regard, the old saying, 'a picture is worth 1,000 words' seems to be very true.

(3) Effective:- Diagrams are more effective than tables as they have a long lasting effect on the mind.

(4) Helpful in Comparison:- Diagrams help us to make comparative studies. They facilitate comparison of data relating to different periods or different regions.

(5) Universal Applicability:- Diagrams are very useful in the fields of production, trade, business, transportete.

In fact, diagrams have universal applicability.

⑥ Helpful in forecasting :- Diagrams also help in forecasting. The future trend can easily be estimated by a mere look on them.

⑦ Information and Entertainment :- Diagrams do not only provide information but also entertain us. We don't get tired when we study them rather they create interest in our studies.

33 Limitations of Diagrams :-

(i) Diagrams are constructed on the basis of approximation. Exact measurement is not possible here.
(ii) Diagrams give only a limited amount of information.
(iii) Diagrams are liable to be easily misinterpreted.
(iv) Diagrams cannot be alternative to tables. They can at the most be supplementary to tables.
(v) Diagrams cannot show a large number of facts at a time.
(vi) Diagrams are not of any use in heterogeneous conditions

34. General Rules for Constructing Diagrams :-

The following general rules should be observed while constructing diagrams:

(i) Attractive :- Diagrams should be attractive so as to attract reader's eye immediately. The diagrams should be absolutely net & clean.

(ii) Title :- Every diagram should be given a brief suitable title. The title should convey the subject matter & facts depicted in the diagram.

(iii) Proper Size:- The size of the diagram should be proper. It should be neither too small nor too big. The diagram should generally be displayed in the middle (centre) of the page.

(iv) Selection of Scale:- The diagrams should be drawn to proper & accurate scale. The scale showing the values should be in even numbers or in multiples of 5, 10, 20 etc. The scale should also specify the unit of measurement for eg, in lakh tonnes, persons in thousands etc. The scale should be mentioned at the top of right hand of diagram.

(v) Footnote:- In case any feature of the diagram has not been adequately made clear, foot-note should be given at the bottom of the diagram.

(vi) Index:- Different types of lines, or shades, colours etc should be used so that the reader can easily understand the diagram.

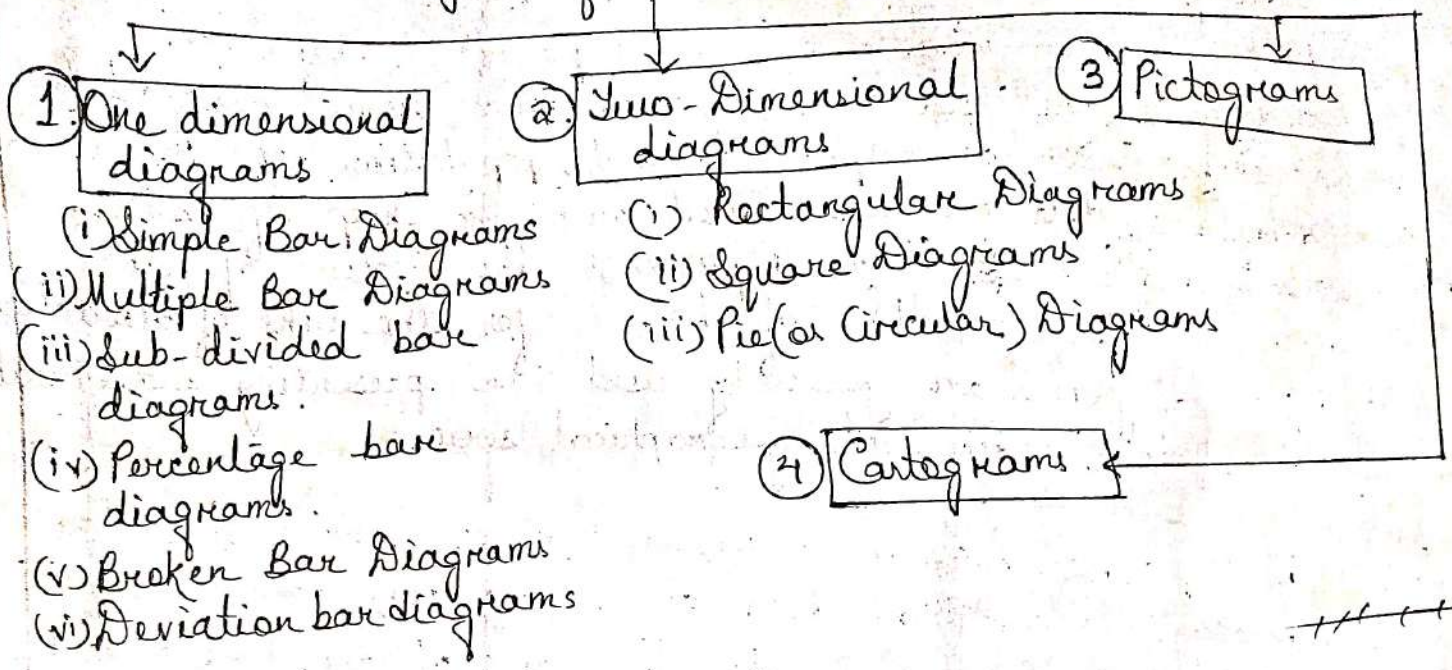
(vii) Simplicity:- Diagrams should be simple as far as possible so that even the laymen can understand them quickly.

(viii) The diagrams should generally be constructed either from left to right or from bottom to the top.

(ix) Proper Choice of Diagram:- The diagrams are of many types which are suitable for different kinds of statistical information. The selection of the proper diagram requires the following considerations:-

i) Nature of data
ii) Purpose of presentation
iii) The ratio of minimum and maximum value.
iv) The intellectual standard of people for whom diagrams are to be constructed.

Types of Diagrams



36. **One dimensional Diagrams :-**

One dimensional diagrams are most commonly used. In these types of diagrams, it is only the length of the diagram that matters & not the width. That is why they are called one-dimensional diagrams.

Features of Bar Diagrams:-

Bar means a rectangle or some rectangular form showing the value of a variable. It has the following features:-

i) The length or height of the bars differs according to the values of the variable.
ii) All bars of a diagram are of the same width.
iii) Bars are equi-distant from each other.
iv) All bars are based on some common base line.
v) Bars may be either vertical or horizontal.
vi) To make the bars attractive, these may be shaded with different colours.

21. Kinds of One-dimensional Diagrams :-

(i) Simple Bar Diagram: Simple bar diagrams are very common. But only one variable can be represented by them. These diagrams are used when two or more items related to a variable (such as output, demand, population etc) In these diagrams, data are represented with the help of bars. The length of the bars represents the value of the variable. Here width of bar is for the sake of attraction only. These diagrams are generally used in presenting individual values, time series and geographical series.

(ii) Multiple Bar Diagrams :- When two or more than two sets of inter-related data are to be compared, multiple bar diagrams are used. All the bars of different variables are made together adjacently pertaining to a year or place.

(iii) Sub-divided Bar Diagrams :- Subdivided bar diagrams are used when various components of a variable are to be represented. Such diagrams are also known as 'Component bar diagrams'. In these diagrams, we not only present the different values graphically but can also compare parts of one with another. In order to distinguish the various components, different shades or colours of bars are used. Note, various components should be kept in the same order in each bar.

(iv) Percentage Bar Diagrams :- Sub-divided bar diagrams when presented graphically on percentage basis are known as Percentage Bar Diagrams. These diagrams are used for comparing the relative changes in percentages. The length of each bar is kept equal to 100%. For constructing these diagrams, firstly total value of the variable is

3. Kinds of One-dimensional Diagrams :-

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indicated by portioning a circle into various parts. This is pie diagram because the entire graph look like a pie & its components resemble slices cut from a pie. For example, expenditure of a family on different heads such as food, clothing, education etc. can be shown with a pie diagram.

Construction of Pie-Diagram :-

assumed to be 100 percent. Then segments are converted into percentages. And then all these percentages are added to become 100. In the end, various segments are cut according to their percentage values.

The percentage ~~to~~ sub-divided bar diagrams may be used to show relative changes in various components of cost & profit & loss & so they are called Profit or loss Diagram.

(v) Broken Bar-diagrams :- In certain cases, there are wide variations in values. Some values may be very small while others may be very large. In such a situation, the largest bar or bars may be broken so as to to gain space for the smaller bars of the series. The value of each bar is written on the top of the bar.

(vi) Deviation Bar Diagram :- Deviation bar diagrams are generally used for representing net quantities excess or deficit, eg. net profit or net loss, net exports or imports etc. In such diagrams, both positive or negative values are shown.

(vii) Pie Diagrams or Circular Diagrams :- In this type of diagram, various parts of a variable can be indicated by portioning a circle into various parts. This is pie diagram because the entire graph look like a pie & its components resemble slices cut from a pie. For example, expenditure of a family on different heads such as food, clothing, education etc. can be shown with a pie diagram.

Construction of Pie-Diagram :-

1.1. Meaning

The collected data are always in an unorganised form which are called **raw-data**. Raw data are in crude form and thus are highly disorgamsed. Such data are large in number and very difficult to handle. One cannot understand such a complex, varied and unorganised data. It is necessary to make them comparable by proper grouping and arrangement in condensed form. The process of arranging data into different groups or classes according to their characteristics is called classification. Classification is grouping of data according to their identity, similarity, or resemblances. For example, students in a class may be grouped in respect of sex, age, marital status etc. Similarly letters in the post office are sorted out in groups of cities and towns of destination viz., Delhi, Kolkata, Mumbai, Chennai, Agra, Jaipur, etc.

make unity in diversity.

1.2. Objectives of Classification

The chief objectives of classification are :

1. **To present data in simple form :** Main objective of classification is to present data in a simple form. Through classification unnecessary details are eliminated and mass of complex data are made simple.
2. **Similarities and dissimilarities :** Classification brings out similarities and dissimilarities of the data.
3. **To facilitate comparison :** Classification makes data comparable.
4. **Scientific Arrangement :** Classification facilitates arrangement of data in a scientific manner which increases their reliability.

5. **Attractive and Effective :** Classification makes data more attractive and effective. Classified data can be presented in tables.
6. **To bring out relationship :** Classification helps in finding out cause-effect relationship, if there is any, in the data.

1.3 Characteristics of a Good Classification :

It is very difficult to lay down any hard and fast rules for the classification of data. The classification would mainly depend upon the nature of the data given and the purpose of classification. However, the classification should possess the following characteristics:

1. **Suitability.** It is necessary that the classification should be done strictly in accordance with the purpose of study. For example. in order to know about the economic position of the people of Delhi and Chennai, the basis of classification should be income instead of other bases such as age, height, weight etc.
2. **Homogeneity.** There must be homogeneity among all items of a class-group. All the values of a particular group should be according to the characteristics for which classification is being made.
3. **Wide.** The classfification should be wide so as to include all the values in one group or the other.
4. **Simplicity.** A good classification should also possess the quality of simplicity. It should be very simple and clear. There should be no doubt or confusion about the value to be included in a particular group.
5. **Stability.** A good classification should be based upon a particular principle. The basis of classification should not be changed off and on. For example, the basis of occupational distribution of population in different censuses in India has been different. The data, thus, received are not comparable.
6. **Flexibility.** A good classification must also possess the principle of flexibility so that different class-groups can be changed according to requirements.
7. **Mutual Separacy.** An ideal classification is one in which there should not be even a single item whose value is likely to be included in more than one clas-group.

1.4 Methods of Classification

Data can be classified on the following basis in accordance with their characteristics:

1. Geographical classification
2. Chronological (Temporal) classification
3. Qualitative classification
4. Quantitative classification.

1. **Geographical Classification.** *This type of classification is based on geographical or locational differences between the various items.* Data are classified area-wise, such as states, districts, etc. For example, production of foodgrains in India may be presented state wise say Haryana, Punjab, Uttar Pradesh, Gujarat and so on.

Example :

2. Chronological (Temporal) Classification. *When data are classified on the basis of time (such as years, months, weeks), this type of classification is known as chronological or temporal classification.* For example, we may present population figures on the basis of time as given in the following manner:

...simple method of presenting

1. Meaning of Graphic Presentation

Graphic presentation is a technique of presenting data on a graph paper. Statistical data are presented in a simple, beautiful and attractive manner in the form of graphs. While presenting data on a graph paper, we obtain lines or curves which indicate the behaviour of data or relationship between different variables.

2. Advantages of Graphic Presentation

The advantages of graphic presentation are almost the same as in the case of diagrammatic presentation namely (i) Graphs one attractive are impressive than table of figures (ii) Graphs help to present complex data in a simple and understanable way. However, there are some special advantages of graphic presentation vis-a-vis diagrammatic presentation which are discussed below:

1. **Presentation of Times Series and Frequency Distribution.** Graphs are very useful in presenting data relating to time series and frequency distribution. They, particularly, are very useful when comparisons are to be made between two or more sets of data.
2. **Location of Averages.** They are helpful in determining the location of positional averages. The special types of graphs, such as histogram, cumulative frequency curve (or Ogive curve), etc., help in the determination of positional averages such as median and mode. They serve as a tool of analysis.
3. **Study of Correlation.** With the help of graphs, correlation between various variables can be studied such as price and demand, cost and output etc.

3. Constructing Graphs

Solution:

(2) Histogram :

This is the most popular method of representing frequency distribution. It is also called as the continuous series *graph*. **The basic difference between a Line Frequency Graph and Histogram**

is that the former is drawn in case of frequency array (i.e. discrete frequency distribution), while the latter is drawn in case of frequency distribution (i.e. continuous series).

Histograms are drawn only when data are in the form of grouped frequency distribution. Histogram is a two dimensional figure in which both length and width of the rectangles are significant. In this type of graph, class-intervals are taken on X-axis and frequencies on Y-axis. Each rectangle represents the class interval with frequency. According to this method, frequencies of class-intervals are represented through adjacent rectangles. In this way, we have a series of rectangles. There are mainly four types of histograms:

(a) Histogram with equal class-intervals.

(b) Histogram with unequal class-intervals.

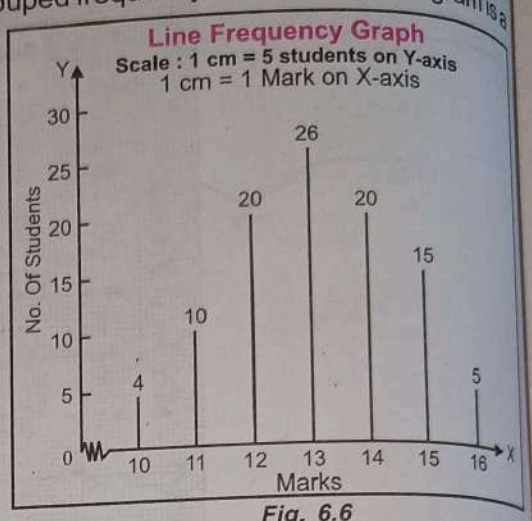

Fig. 6.6

(a) Histogram with Equal Class intervals. Let us first consider a histogram having equal class-intervals. The sizes of class-intervals are drawn on X-axis with equal distances and their corresponding frequencies are taken on Y-axis. The length of each rectangle would be proportional to the frequency of the respective class intervals. Class and its respective frequency form a histogram. **The area of the rectangles are proportional to their respective frequencies. All rectangles would have the same base in their width.** (Refer Fig 6.7)

Example 3. Draw a histogram from the following data relating to marks obtained by 112 students of a school.

Marks :	0—10	10—20	20—30	30—40	40—50	50—60	60—70
No. of students :	5	12	20	35	24	12	4

Solution :

In the above example class interval is constant throughout, but each class has different frequency. The area of each rectangle is 10 times the class interval. For example, area of class 0-10 is 50 (10 x 5), of class 10-20, it is 120 (10 x 12) and for class 20-30, it is 200 (10 x 20). The whole histogram represents the total area of all rectangles.

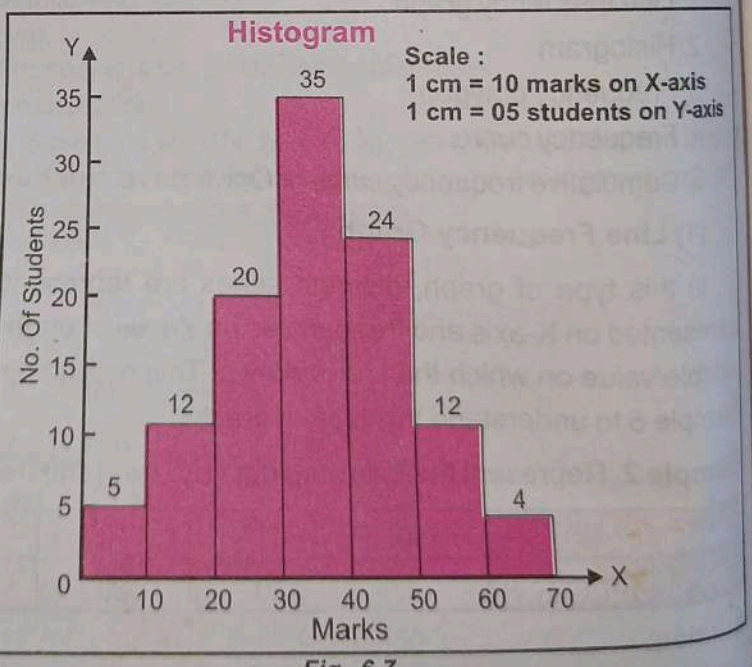

Fig. 6.7

(b) Histogram with Unequal Class-intervals. *If the class-intervals are unequal, frequencies are first adjusted before constructing the histogram. Adjustments are made in respect of lowest class-interval. Leave the frequencies in classes with the lowest width unchanged and adjust frequencies in other classes proportionately. For example, if one class-interval is twice as wide as the one having the lowest class-interval, we will divide the frequencies by 2. The height of the rectangle will be according to the adjusted frequencies. If it is three times more, we will divide its frequency by 3 and the height of the rectangle will again be according to the adjusted frequency and so on. In simple words,* **the heights**

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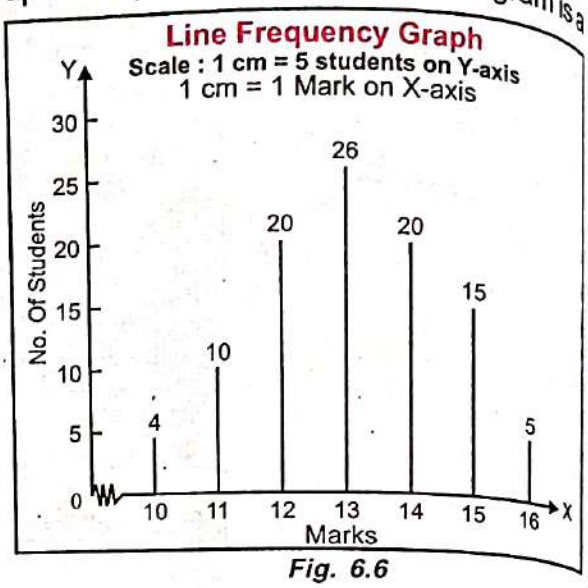

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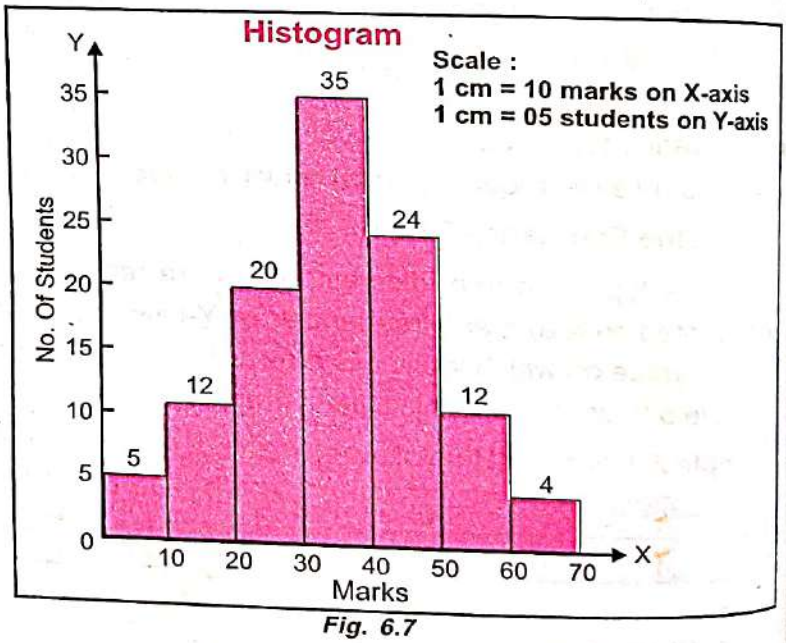

Fig. 6.7

(b) Histogram with Unequal Class-intervals. If the class-intervals are unequal, frequencies are first adjusted before constructing the histogram. Adjustments are made in respect of lowest class-interval. Leave the frequencies in classes with the lowest width unchanged and adjust frequencies in other classes proportionately. For example, if one class-interval is twice as wide as the one having the lowest class-interval, we will divide the frequencies by 2. The height of the rectangle will be according to the adjusted frequencies. If it is three times more, we will divide its frequency by 3 and the height of the rectangle will again be according to the adjusted frequency and so on. In simple words, **the heights**

will be in proportion to the ratios of the frequencies to the width of the classes. When intervals are unequal, bases vary in their width. To have comparable measurements, the heights of rectangles are to be adjusted.

Adjusted frequencies will decide the heights of each rectangle of histogram but widths will be according to class-intervals.

$$\text{Height of the Rectangle} = \frac{C \times \text{Frequency}}{\text{Class Interval}}$$

where C s range of the lowest class-interval with a fixed value.

The following illustration (Example 4) will make this fact clear.

Solution:

Adjusted Frequencies		
Daily Wages (`)	**Frequency**	**Adjusted Frequency**
10-20	5	5
20-30	20	20
30-40	30	30
40-60	40	$\frac{10\times40}{20} = 20$
60-100	20	$\frac{10\times20}{40} = 5$

In the above example, the class-interval are quequal. Therfore, for preparing histogram, the frequencies are to be adjusted.

Step 1 : Take the width of the lowest class-interval. The width of lowest class-interval is 10.

Step 2 : Do not adjust the frequencies of the lowest classes.

Step 3 : Frequencies of other classes are adjustted with this lowest interval as under

$$\text{Adjusted Frequency} = \frac{C \times \text{Frequency}}{\text{Class Interval}}$$

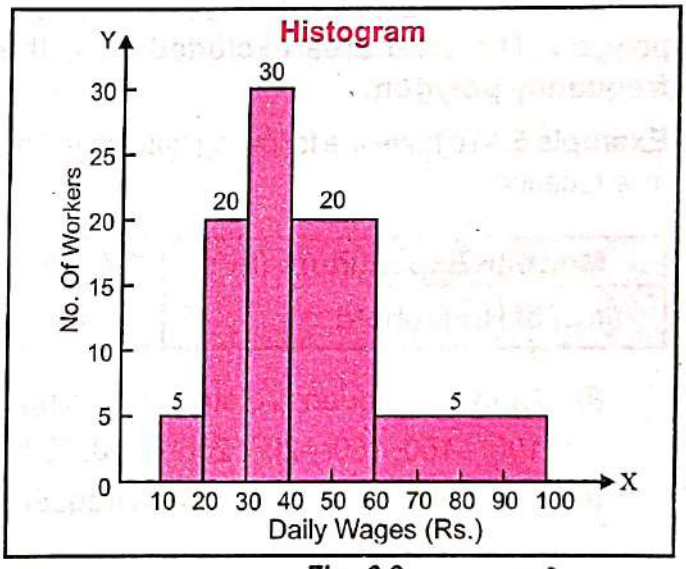

Fig. 6.8

Box 6.1 Difference between a Histogram and Bar Diagram

Both 'Histogram' and Bar Diagram look similar. But there are more dissimilarities than similarities between the two. Firstly, it is the height instead of width of the bar that matters, whereas in histogram, both height and width are important. Secondly, in a bar diagram, some space is left between consecutive bars (except in multiple bars), while in histogram no space is left in-between two rectangles. *Finally,* bar diagram is used both for discrete and continuous variables, but histogram is drawn only for a continuous variable.

(3) Frequency Polygon :

This is another form of graph in which a frequency distribution can be shown. *A frequency polygon is a polygon which is formed by joining mid-points of the tops of rectangles of a histogram and further*

joining these sides with the mid-points of the adjacent classes. Mid-points are joined using a foot rule to make a straight line. There are two methods by which a frequency polygon can be constructed.

(a) By Histogram

(b) Without Histogram

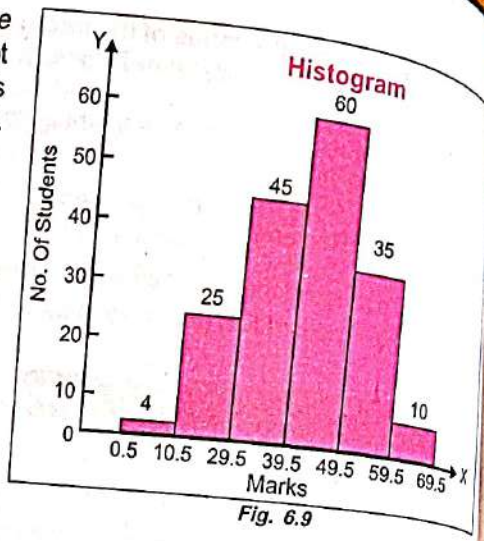

Fig. 6.9

(a) By Histogram. In this method, the construction of a histogram is a pre-requisite for the construction of a frequency polygon. According to this method, the following steps are taken.

(i) *First* of all, draw a suitable histogram.

(ii) Then get the mid-points of the upper horizontal side of each rectangle.

(iii) *Thirdly* join these mid-points of the adjacent rectangles of the histogram by straight line.

(iv) *Finally,* ends of frequency polygon preferably be extended to the base line at the mid-point of classes at both ends.

While drawing the frequency polygon, we observe that some area which was under the histogram has been excluded and some area which was not under histogram has been included under frequency polygon. **The total area excluded from the histogram is equal to the area included under frequency polygon.**

Example 5. We have the following data on the monthly expenditure on food (in rupees) for 30 households in a locality:

Monthly Expenditure (In ₹)	100–150	150–200	200–250	250–300	300–400
No. of Household	4	6	13	5	2

(i) Obtain a frequency distribution using class-intervals:
100—150, 150—200, 200—250, 250—300 and 300—350.

(ii) Make a histogram and daw a frequency polygon.

Solution:

(i) Frequency Distribution of Monthly Expenditure on Food		
Monthly Expenditure (₹)	**No. of Households**	**Cumulative Frequency**
100-150	4	4
150-200	6	10
200-250	13	23
250-300	5	28
300-350	2	30

(ii) Frequency Polygon :

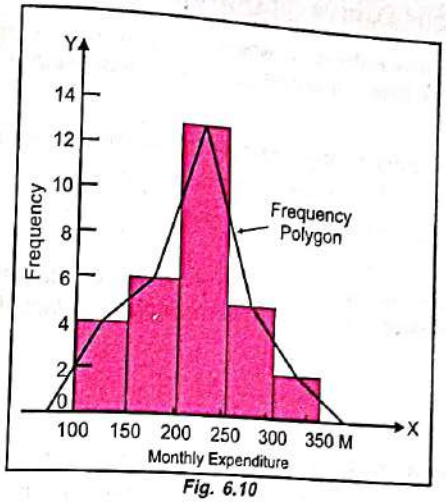

Fig. 6.10

(4) Frequency Curve :

It is obtained by joining the pionts of frequency polygon by a freehand smoothened curve. Unlike frequency polygon, where the points are joined by straight lines, we make use of free hand joining of those points in order to get a smoothened frequency curve. That is why it is known as smoothed frequency curve. We smoothen the angularities of the polygon only without making any basic change in the shape of the curve. In this case also, the curve begins and ends at base line, as is in the case of polygon. Area under the curve must remain almost the same as in the case of polygon. See Fig. 6.10.

Example 6. Construct a frequency polygon and the frequency curve on the basis of the following frequency distribution:

Marks :	10-20	20-30	30-40	40-50	50-60	60-70
No. of Students :	5	12	15	22	14	4

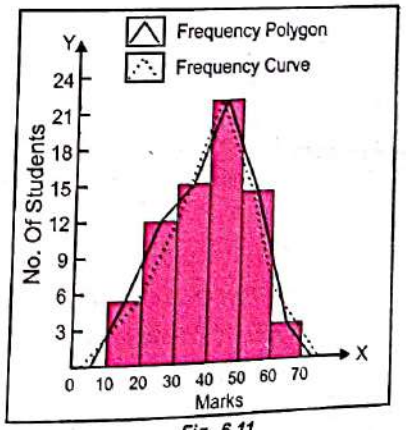

Fig. 6.11

7. Cumulative Frequency Curve (or Ogive).

Cumulative Frequency curve is the curve which is constructed by plotting cumulative frequency data on the graph paper, in the form of a smooth curve or more popularly known as ogive.

Utility of Ogive :

(i) It is drawn to determine the number or proportion of cases below or above a given value.

(ii) It is used to compare two or more frequency distributions.

(iii) It is also drawn to determine certain values graphically such as median, quartilies, declines, etc.

Since there are two types of cumulative frequency distribution viz., 'less than' cumulative frequencies and 'more than' cumulative frequencies, we have accordingly two types of ogives :

(i) 'Less than' ogive

(ii) 'More than' ogive

Less than Ogive :

Following steps are involved while constructing a less than ogive :

(i) In 'less than' mothod, we start with upper limits of the first group and frequencies of all the preceding class-invervals are added to the frequency of a class.

(ii) Then, less than cumulated frequencies are plotted against the upper limit of corresponding class-interval.

(iii) The points so obtained are joined by a smooth free hand curve to give 'less than' ogive. 'Less than' ogive so obtained is an increasing curve, sloping upwards from left to right.

Let up understand the less than ogive with the help of Example 7.

Example 7. On the basis of the following frequency distributions draw 'less than' cumulative frequency curves.

Marks :	0–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40
No. of Students :	4	6	10	10	25	22	18	5

Solution: (a) Less than Ogive Curve:

Marks	No. of Students	Cumulative Frequency
Less than 05	4	4
Less than 10	4+6	10
Less than 15	4+6+10	20
Less than 20	4	30

(iii) The point of intersection of the two ogive gives the value of median. (See Figure 6.27.)

8. Limitations of Graphs

1. Graphic presentation reveals only the approximate position and we can only show exact measurement of data.
2. Graphs do not show details which is possible in tables.
3. Graphs cannot be used by common people who do not understand them.
4. There is always a possibility of their misuse. Advertisers and politicians generally misuse this form of representation of facts and try to mislead the common people.
5. It is very difficult to show minor differences with the help of graphs.
6. Graphs require relatively more time and expertise.