1. Introduction

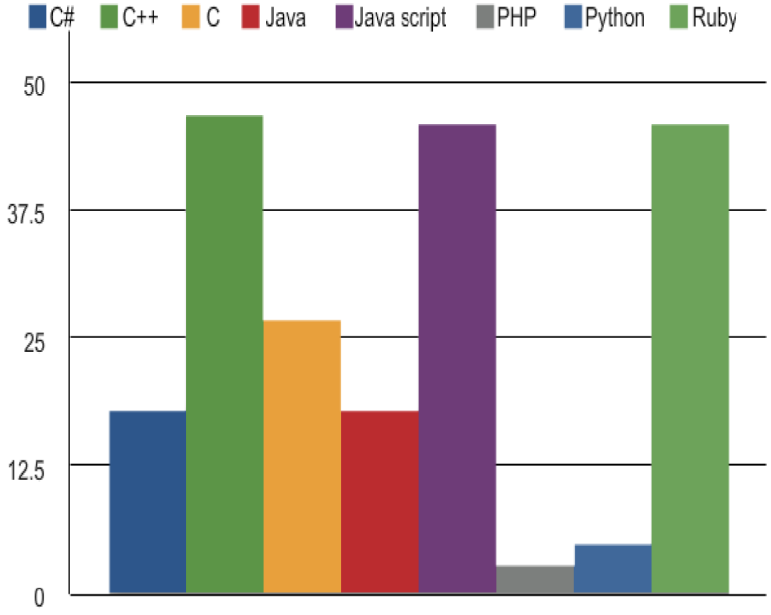
Welcome to the series of e-learning modules on Diagrammatic & Graphical Representation of Grouped Data.

At the end of this session, you will be able to:

- Explain the meaning and types of diagrams
- Explain the meaning and type of graphs
- Explain the representation of the group data using diagrams and graphs

Introduction:
Data once collected and summarized are presented in a systematic manner using statistical techniques. However, we need to keep in mind that most of the statistical data is used by the common man and an easy representation of the same is needed for easy understanding of the concepts. The best way for such a representation is usage of diagrams and graphs.

Figure 1



Various sources like magazines, newspapers, journals use diagrams and graphs to display results pictorially. This kind of representation needs a lot of artistic talent and imagination on the part of the person preparing the diagrams and graphs.

Diagrams are useful for the following reasons:

- Diagrammatic representation of data gives a bird's view of the entire data leading to an easy understanding of the data
- When the quantity of data is large then it becomes confusing and strenuous to understand, hence a pictorial representation makes it simple and interesting. It helps in data condensation
- Diagrammatic representation can easily help in understanding the significance

of the figures and follow it easily

- Diagrams have an attractive value and it delight the eye of the reader and also get a prominent place for displays in conference, meetings, fair, exhibition, etc
- Diagrams help in easy comparison between data. Quick and accurate comparison can be made without the usage of statistical techniques
- Diagrams have memorizing effect as they leave long lasting impression in the mind of readers
- Diagrams help in analytical thinking and investigation by bringing out the hidden facts and relationship in the data

Comparison of Tabulation and Diagrammatic representation of the data:
Data can be represented in the form of tables, diagrams and graphs. All this form of representation is useful depending on the purpose of usage. Hence the proper selection of the presentation form is to be made with due thought and care. The following points can be kept in mind:

Table 1

Tabulation	Diagrammatic
Tables give precise figures.	Diagrams and graphs give approximate ideas.
Tables help in reading exact values.	Diagrams and graphs do not help in reading exact figures.
More data can be represented in a single table.	More data cannot be represented in a single diagram or graph.

Tabulation	Diagrammatic
Tables are difficult to read and interpret.	Diagrams and graphs are easy to read and interpret.
Tables do not have a visual appeal and hence it is difficult to create an impression.	Diagrams and graphs have visual appeal and hence create an impression.

Differences between diagrams and graphs:
Diagrams and graphs are two pictorial method of representing the data. Though there is no clear cut demarcation between the two. The following points can be kept in mind for easy understanding:

Table 2

Diagram	Graph
Diagrams are drawn on plain paper.	Graphs are drawn on graph papers.
Diagrams do not represent any relationship between two variables.	Graphs generally represent mathematical or functional relationship between two variables.

Diagram	Graph
Diagrams are attractive to eye and are better suited for publicity and propaganda.	Graphs are simple representation and helps in easy understanding of the data.
Diagrams are not helpful in analysis as they do not add meaning to the data.	Graphs are helpful in analysis as they add meaning and support the data.
Diagrams are used to represent general data.	Graphs are used for representing frequency distribution data's.

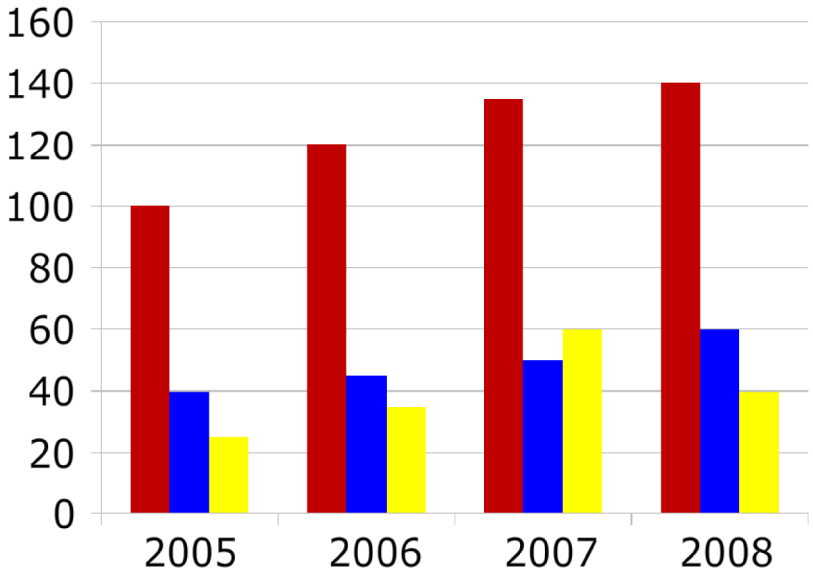
2. Rules for Construction of Diagrams

General rules for construction of Diagrams:

1. Title
2. Size
3. Scale
4. Foot Note
5. Index
6. Simplicity
7. Neat and clean
8. Effective

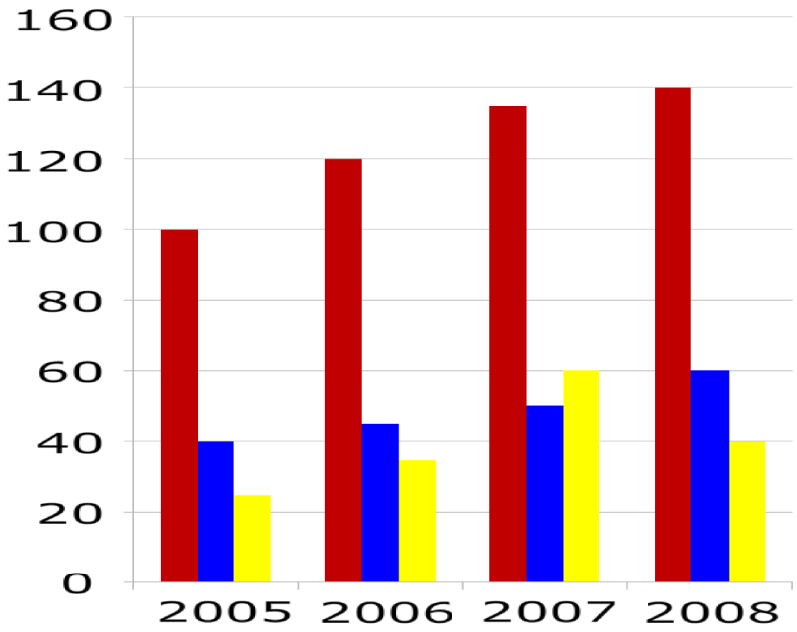
Title: Every diagram should be given a suitable title which will explain the main idea the diagram wants to portray. Brevity of the title should not be at the cost of its clarity or omission of details. The title can be mentioned at the top or bottom of the diagram.

Figure 2



Size: The proportion of the width and height of the diagram should be maintained. The size of the diagram should be maintained in a right proportion as a short or a long size would make the diagram look ugly. See this diagram.

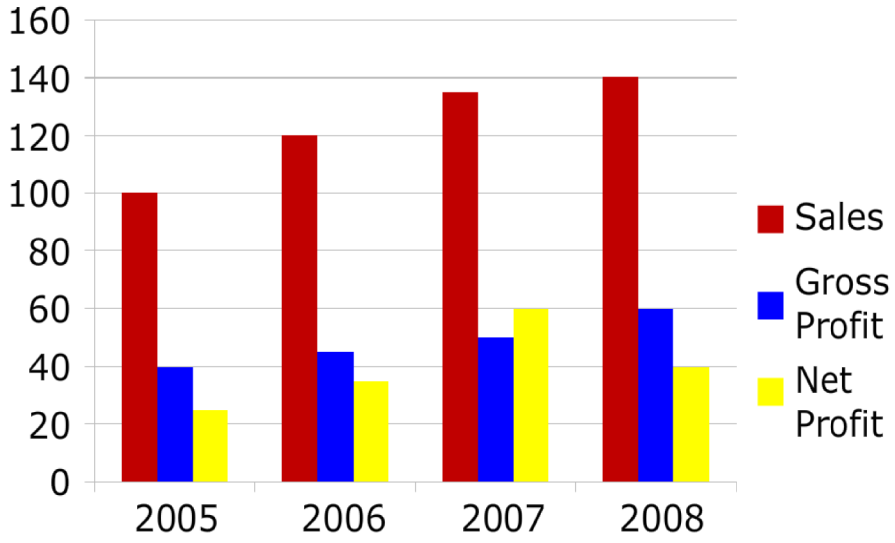
Figure 3



Though there is no standard mentioned about the size it is better to have a convenient dimension to maintain the appearance of the diagrams.

Scale: There are no standards mentioned but it is preferable to have scales in even numbers or in multiples of fives. It should also mention the size of the unit and what it represents. For example: units produced in lakhs, persons in thousands, etc. The lettering should be readable without turning the chart up and down.

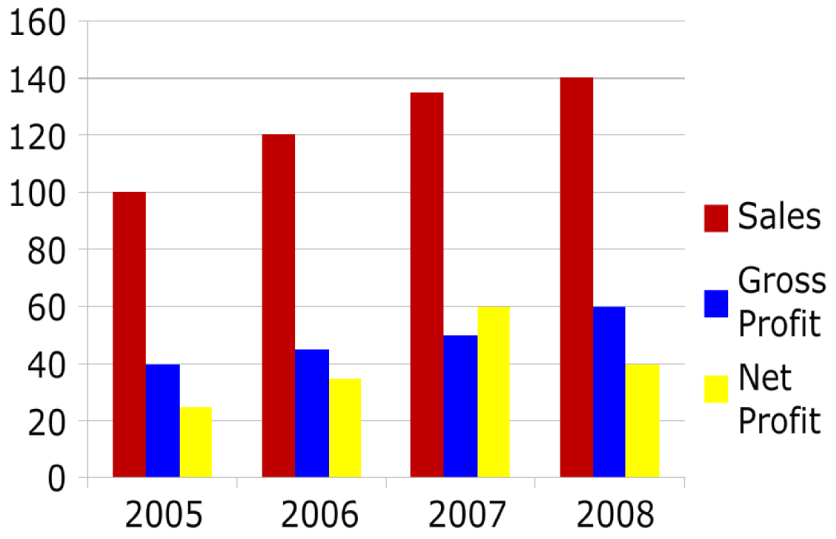
Figure 4



Foot Note: To have an insight in to the visual diagram it is better to have clarity of the ambiguities in the form of notes in the foot of the diagram.

Index: An index should be mentioned in the diagram indicating the different lines, shades, colours, etc used so that the reader can easily make out the meaning of the diagram.

Figure 5



Simplicity: The diagram representation should be simple that is, it should be able to convey the meaning clearly and easily. To achieve this it is better to have simple effective charts than having complex charts containing too much material in a single diagram.

Neat and clean: As diagrams leave an impression in the minds of the reader its representation should be neat and clean, thus care should be taken to avoid vagueness or overwriting in the diagrams.

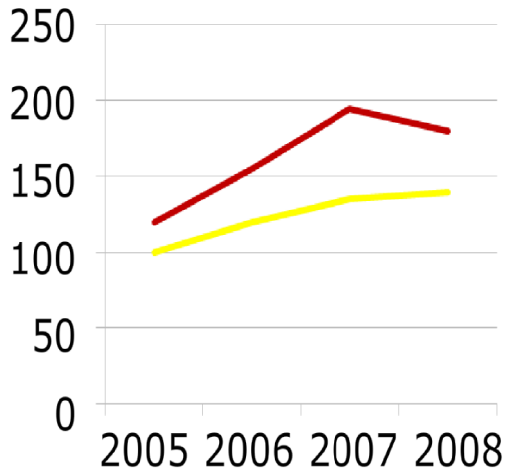
Effective: To have an effective impact on the reader it is good to have a self-explanatory diagram indicating the nature, source and place of the data. It should adopt different shades and colours, preferably have a vertical representation and maintain accuracy as far as possible.

3. Types of Diagram

Types of diagram:
There are a large variety of diagrams used in the representation of the data, new methods are added up but the most commonly used once are mentioned here. They are:

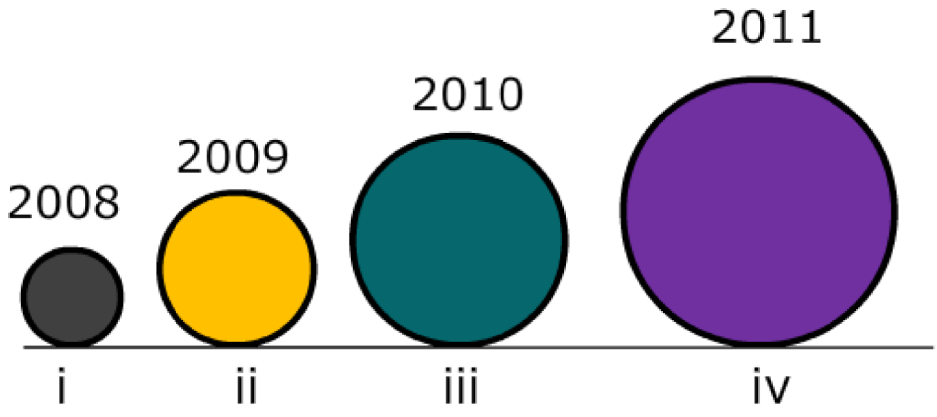
- One – dimensional diagram. Example:-Bar & Line diagram

Figure 6



- Two – dimensional diagram. Example:- Rectangles, Squares, Circles

Figure 7



- Three – dimensional diagram. Example:- Cubes, Cylinders
- Pictograms and cartograms

Let us have a detail understanding of the diagrams one by one.

One-dimensional Diagrams:
A one dimensional diagram is one in which only the length of the diagram matters. Bar diagram are the commonly used diagram where the length of the bar matters and not the width. A bar is a thick line whose width is merely shown for attention and when there is a large number of items bar is replaced by line to economize the space.

A bar diagram is useful when:

- The reader of the chart is not accustomed to it or to those who are not chart-minded
- They are the simplest and the easiest to make
- It is an effective method when large numbers of data needs to be compared

For the construction of a bar diagram the following points should be kept in mind:

1. The width and gap of the bars should be uniform throughout.
2. Bars can be vertical or horizontal. It is preferred to have vertical bar for easy comparison and better look.
3. While preparing the bar it is better to represent the data in the end of the bar for easy understanding of the precise value.

Types of bar diagram are:

- Simple bar diagram
- Sub-divided bar diagram
- Multiple bar diagram
- Percentage bar diagram and
- Deviation bars

Two Dimensional diagrams:
A two dimensional diagram is one in which the length as well as the width of the diagram is taken into account. These diagrams are also called as area diagram or surface diagram. Rectangles, squares and circles are the commonly used diagram in this type where the length as well as the width is considered. Thus, the area of the bar considers the data.

Rectangles:
Rectangles are the most popular form where the area of a rectangle is equal to the product of its length and width. The construction of such a diagram is done by considering the length and width and two sets of data are represented by percentage method or the data as given.

Squares:
When the values are widely varying it is difficult to represent it through rectangles. Then we use the squares where the square root of the values of various items that has to be shown in the diagram is taken.

Circles:
Circle is a way of representing data in the two dimensional diagram where both the total and the component part can be shown. The construction of the circle is done by considering the square root of the values and deciding the radius by dividing it by the pie value. The circles are difficult to compare and is not very popular in statistical work.

Three Dimensional diagrams:
These diagrams are also known as volume diagrams and consists of cubes, cylinders, spheres, etc. In these diagrams three things namely length, width and height are taken into account. These diagrams are used when the range in the data is very large.

Pictograms & Cartograms:
Pictograms are popular presenting method in statistical data where the presentation is done of the actual data dealing with. Pictures are attractive and easy to comprehend.

Cartograms or statistical maps used to represent quantitative information on geographical basis. The quantities are represented through shades or colours, by dots, by placing the pictograms in each geographical unit.

4. Limitations and Uses of Diagrammatic Presentations

Limitations of Diagrammatic Presentation:

1. Diagrams do not represent small differences properly
2. Diagrams can be easily misused
3. Multi-dimensional diagrams can be well drawn by artists
4. Diagrams are of no use in statistical analysis
5. Diagrams are supplement to tabulation
6. Diagrams can be used to present only limited set of data
7. Diagrammatic representation is time consuming
8. Diagrams represent only the estimates of the actual; behavior of the variables

Graphical representation of data:
A large variety of graphs are used in practice. Presentation of data in the form of graph facilitates many processes in economics and statistics.

The main uses of graphs are listed below:

- Attractive and effective presentation of data
- Simple and understandable presentation
- Useful in comparison and interpretation
- Helpful in predictions and transmission of information

Techniques for construction of graph:

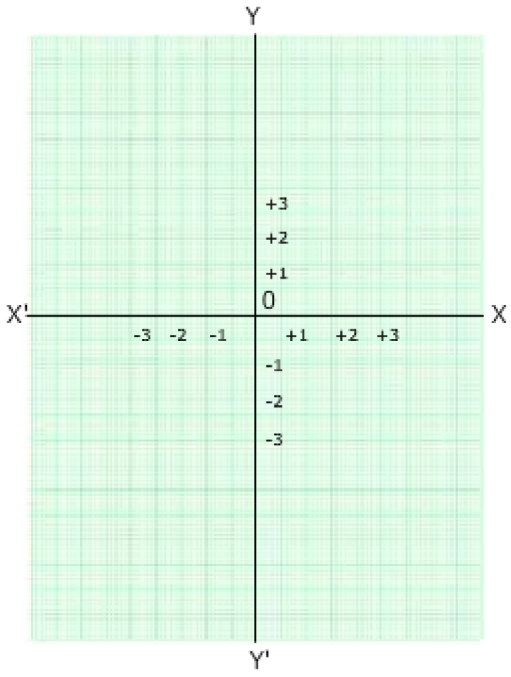
1. Rules:
    a. Every graph should have a suitable title which should clearly convey the main idea, that the graph intends to portray
    b. The graph must suit the size of the paper
    c. The scale of the graph should be in even numbers or multiples of five
    d. A foot note should be given to highlight the key points in the graph
    e. A graph should be as simple as possible
    f. Graph should contain an index to indicate the items in the graph
    g. A graph to be attractive should be neat, clean and appealing
    h. Every graph should be accompanied with a table to ensure the data presented

2. Construction of Graph:
    a. Graphs are drawn on a special type of paper called graph paper. A graph paper is divided into small equal squares of 1/10 cm.
    b. Two straight lines are drawn which intersect each other at right angle. The lines are known as coordinate axes. The point of intersection is known as the point of origin or the ‘Zero’ point.
    c. The horizontal line is called the ‘X’ axis or abscissa and denoted as X’OX. The vertical line is called the ‘Y’ axis or ordinate and denoted as Y’OY.
    d. Both positive and negative values are represented in the graph. The positive

values of X are on the right side on the horizontal line and of Y on the upper side of the vertical line. The negative values of X are taken towards the left side of the horizontal line and of Y towards the lower side of the vertical line.

e. The origin divides the graph into four parts called the quadrants. In quadrant I, both the values of X and Y are positive. In quadrant II, X is negative and Y is positive. In quadrant III, both X and Y is negative and in quadrant IV, X is positive and Y is negative.
f. The scale indicates the unit of a variable that a fixed length of axis would represent. Scale may be different for both the axis. The scale should be taken in such a way that it is able to accommodate the entire data in a given graph paper in a lucid and attractive style.
g. The last step in constructing a graph is to plot the given data by taking the corresponding value of X and Y. The various point so obtained are then joined by straight lines.
h. At times it is difficult to take zero as an origin and proceed for the graph then we use a false base line else the graph may look clumsy. False base line can be taken both on the X and Y axis.

Figure 8



5. Types of Graphs

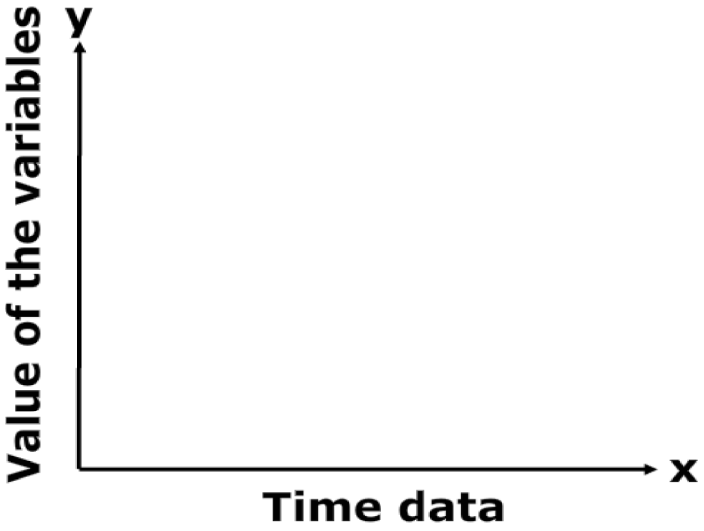
Types of Graphs:
A large variety of graphs are used in practice however all the graphs are broadly classified into two heads:

- Graphs of time series
- Graphs of frequency distribution

Graph of time series:
A Data series of variables collected at different point of time is known as time series. The presentation of such a data through graphic representation will help in analyzing change at different points of time.

Generally we take the time data on the X-axis and the value of the variables on the Y-axis and plot the data. By joining these points by straight lines a line graph is formed. These are graphs that are simple to understand, easiest to make and most adaptable. These are graphs easy to represent and does not need any technical skills. It is also useful when we need to represent complex information in an understandable form. Many variables can be shown in the same graph and easy for comparison. Graphs of time series can be constructed on a natural scale or on a ratio scale.

Figure 9



The types of graph in time series are:

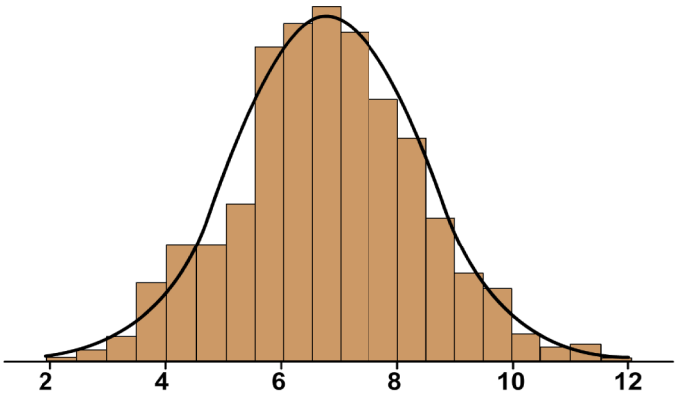
- Graph of one variable: When only one variable is to be represented, on the X axis measure time and on the Y-axis the value of the variable and join the various points and join them by straight lines. The fluctuation of this line shows the variation in the variable.
- Graph of two or more variable: If the unit of measurement is same then we can represent two or more variables on the same graph. This helps in comparison. While representing this data we should use thick, thin, broken or dotted lines to distinguish between the various variables.

- Graph having two scales: If two variables are expressed in two different units, then we have two scales one on the left and the other on the right. To facilitate comparison, each scale is made proportional to the respective average of each.
- Range chart: Range charts are graphs used to show the range of variations in the variables. The minimum and maximum values of the variables are represented in two curves and the gap between the curves represents the range of variation.
- Band graph: Band graph is a type of line graph showing how and in what proportion the individual items comprising the aggregate are distributed. The various component parts are plotted over the other and the gaps are filled with different colours and shades such that the chart appears as a series of bands.
- Semi-logarithmic graph: When relative rate of changes has to be studied among the variables then arithmetic scale is of little use. In such a case we should use the ratio scale or the logarithmic scale. In this graph the vertical line is scaled on the ratio principle and the horizontal line is scaled on the arithmetic principle.

Graph of frequency distribution:
Data at times are expressed in terms of an item or class intervals then the data are called frequency distribution data. The class interval or the item is expressed in the X-axis and frequency is taken on Y-axis.

Frequency graphs can be classified into four categories:
Histogram, Frequency polygons, Frequency curves, and Ogives.
Histogram: A histogram is a set of vertical bars whose areas are proportional to the frequencies represented. While preparing a histogram the variable is always taken on the X-axis and the frequency on the Y-axis.

Figure 10

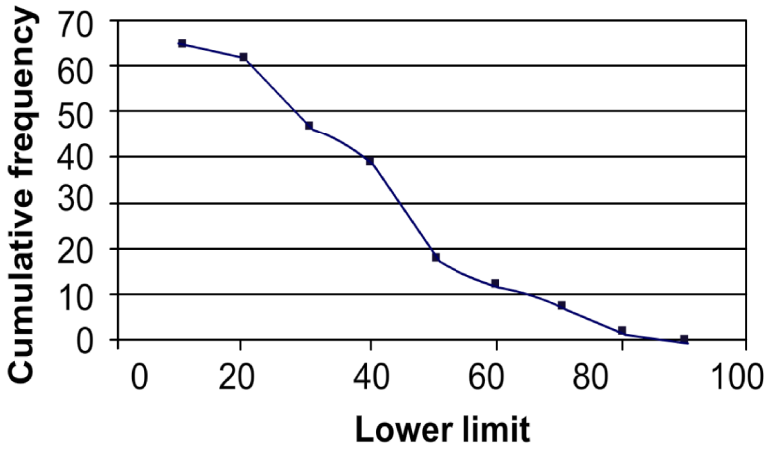


Frequency polygons: Frequency polygon is a graph of frequency distribution. It has more than four sides. It is effective in comparing two or more frequency distributions. Frequency polygon can be constructed using a histogram where the mid points of the upper horizontal side of each rectangle are joined to the adjacent ones. It can also be constructed just by taking the mid points of the class interval in the X axis and the frequency are plotted to each point and join by the straight lines.

Frequency Curves: Frequency curves are similar to frequency polygon but the points here are joined through free hand joining in order to get a smoothed frequency curve. It is used to remove the ruggedness of polygon and to present the data in a good form or shape. The types of frequency curves are – normal or symmetrical curve, positive skewed curve, negatively skewed curve, u shaped curve, j shaped curve and mixed or multimodal curve.

Ogives: Whenever the reader of data would like to know a collective data for a particular period then the question of adding up the frequencies becomes necessary. This adding up of the frequencies is called cumulative frequency distribution and the curve obtained by plotting this is called a cumulative frequency curve or ogive. There are two methods of drawing ogives - less than ogive and more than ogive.

Figure 11



Limitations of Graphs:

- Graphic representation is useful for a common man, but its utility for an expert is limited
- Graphs do not measure the magnitude of the data it only depicts the fluctuation of the data.
- Graphs are subjective in character and its interpretation varies from person to person.
- The person who has no knowledge can draw misleading interpretations from the graph

Here's a summary of our learning in this session:

- Meaning and types of diagrams
- Meaning and type of graphs
- Representation of the group data using diagrams and graphs