# BUSINESS STATISTICS

"A knowledge of statistics is like a knowledge of foreign language of algebra; it may prove of use at any time under any circumstance"… Bowley.

STRUCTURE:

- ➢ Introduction
- ➢ Meaning and Definitions of Statistics
- ➢ Characteristics of statistics
- ➢ Importance of Statistics in Business
- ➢ Limitations of statistics
- ➢ Types of Data and Data Sources

STATISTICS – is a branch of mathematics that deals with the collection, organization, presentation, analyzation and interpretation of numerical data.
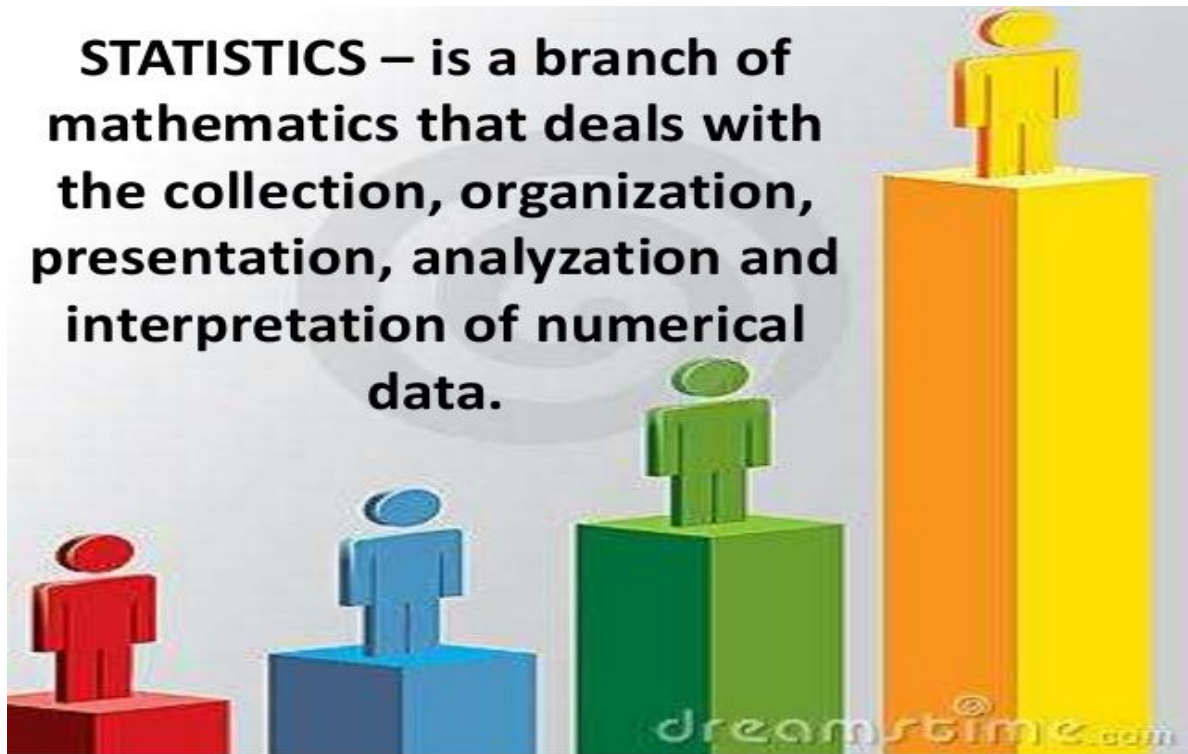
MEANING

In the beginning, it may be noted that the word 'statistics' is used rather curiously in two senses plural and singular.

In the **plural sense**, it refers to a **set of figures or data.**

In the **singular sense,** statistics refers to the whole body of tools that are used to **collect data, organise and interpret them and, finally, to draw conclusions from them.** It should be

noted that both the aspects of statistics are important if the quantitative data are to serve their purpose.

DEFINITIONS OF STATISTICS

1. A.L. Bowley has defined statistics as:

(i) statistics is the science of counting,

(ii) Statistics may rightly be called the science of averages, and

(iii) statistics is the science of measurement of social organism regarded as a whole in all its manifestations.

2. Boddington defined as:

Statistics is the science of estimates and probabilities.

3. Seligman explored that

Statistics is a science that deals with the methods of collecting, classifying, presenting, comparing and interpreting numerical data collected to throw some light on any sphere of enquiry.

CHARACTERISTICS OF STATISTICS

From the above definitions, we can highlight the major characteristics of statistics as follows:

1. **Statistics are the aggregates of facts.** It means a single figure is not statistics.

For example, national income of a country for a single year is not statistics but the same for two or more years is statistics.

2. **Statistics are affected by a number of factors.**

For example, sale of a product depends on a number of factors such as its price, quality, competition, the income of the consumers, and so on. Statistics must be reasonably accurate. Wrong figures, if analysed, will lead to erroneous conclusions. Hence, it is necessary that conclusions must be based on accurate figures.

3. **Statistics must be collected in a systematic manner.** If data are collected in a haphazard manner, they will not be reliable and will lead to misleading conclusions. Collected in a systematic manner for a pre-determined purpose

4. **Lastly, Statistics should be placed in relation to each other.** If one collects data unrelated to each other, then

such data will be confusing and will not lead to any logical conclusions. Data should be comparable over time and over space.

Importance of Statistics:

1. **Statistics in Planning**
2. **Statistics in Mathematics**
3. **Statistics in Economics**
4. **Statistics in Social Science**
5. **Statistics in Business**

6. Statistics in Research Work

7. Statistics in Programming

8. Statistics in Health Industry

9. Statistics in Government

10.   Statistics in Education

1. Statistics in Planning

Statistics is one of the crucial parts of planning. Without statistics, the plan can't be possible. Statistics helps to do planning in business, economics, and government level.

In the modern era, planning is everything. And almost every governmental organization, as well as a private one, are using statistics to formulate their policy and to do adequate planning.

As I mentioned earlier, statistics is all about the collection of data. **To do solid planning, companies use the data related to production, consumption, birth, death, income, and so on.** Statistics is helping the countries to do adequate planning that is crucial for them—the best examples of planning we see on **COVID 19 pandemic**. We have seen that the Government

of Newzealand has created the plan to fight against COVID 19, and they have successfully handled the situation to get rid of COVID 19. This pandemic show the importance of statistics in our daily life.

2. **Statistics in Mathematics**

Statistics is an essential part of mathematics. In other words, it is related as well as **entirely depends upon mathematics.**

3. Statistics in Economics

Whenever you are going to study statistics, you would also learn statistics. **Statistics and Economics are interrelated with each other**.

 Economics uses statistics, i.e., consumption, production, distribution, public finance. All these Economic branches use statistics for comparison, presentation, interpretation, and so on.

Income spending problems on and various sections of the people. National wealth production, demand, and supply adjustment, the effect of economic policies. All these indicate the importance of statistics in the field of economics and its

various branches. Basically, the government uses statistics in economics to calculate its **GDP and Per capita Income.**

4. Statistics in Social Sciences

Statistics are also used to conduct social surveys. The social survey uses the Sampling techniques and estimation theory. **Actually, these are the most powerful tools for conducting a social survey.**

Sociology is a crucial part of social studies. Statistics is also playing a critical role in sociology. It helps in studying **mortality, fertility, population growth, and so on.**

5. Statistics in Business

There are three **major functions** in any business enterprise in which the statistical methods are useful. These are as follows:

The planning of operations: This may relate to either special projects or to the recurring activities of a firm over a specified period.

The setting up of standards: This may relate to the size of employment, volume of sales, fixation of quality norms for the manufactured product, norms for the daily output, and so forth.

The function of control: This involves comparison of actual production achieved against the norm or target set earlier. In case the production has fallen short of the target, it gives remedial measures so that such a deficiency does not occur again.

6. Statistics in Research Work

Research work is all about statistics.

Statistics are the basics of every research activity. In other words, research can't be possible without statistics. The researcher should have excellent statistics skills to be a good researcher. It helps to keep the interest of the researcher in the research work.

7. Statistics in Programming

You may not be aware that **statistics is playing a crucial role in programming**. It also helps you to improve your programming logic. If you do a daily practice of statistics, then you will enhance your programming logic. Statistics is widely

used in some of the **most popular programming languages i.e., Java, Python, Swift, C, and** C++.

8. **Statistics in the Health Industry**

Statistics is playing its part in the health industry. It helps the doctor to take and manage the data of their patients. Apart from that WHO is also using statistics to generate their annual report on the heath populations of the world. Due to statistics, the medical scientist has invented lots of vaccines to fight against major diseases.

We have seen that in this **COVID 19** Pandemic, the statistics are playing a crucial role in analyzing how much patience is all around the world, which region has the most number of cases and much more. All this happening is all because of statistics.

9.Government

The importance of statistics in government is utilized by making judgments about health, populations, education, and much more. It may help the government to check out what education schedule can be beneficial for students. What is the progress report of high school students using that particular curriculum? The government can assemble specific data about the population of the country using a census.

10. Education

The beneficial importance of statistics in education are that teachers can be considered to be supportive as researchers during their classrooms to recognize what education technique works on which pupils and know the reason why. They also need to **estimate test details to determine whether students are working expectedly, statistically, or not.** There are statistical studies about student achievement at all levels of testing and education, from kindergarten to a College.

LIMITATIONS OF STATISTICS

Statistics has a number of limitations, pertinent among them are as follows:

1. **Qualitative Aspect Ignored**
2. **It does not deal with individual items**
3. **It does not depict entire story of phenomenon**
4. **It is liable to be misused**
5. **Laws are not exact**
6. **Results are true only on average**
7. **To Many methods to study problems**
8. **Statistical results are not always beyond doubt**

1. Qualitative Aspect Ignored:

The statistical methods don't study the nature of phenomenon which cannot be expressed in quantitative terms.

Such phenomena cannot be a part of the study of statistics. These include **health, riches, intelligence etc. It needs conversion of qualitative data into quantitative data.**

2. It does not deal with individual items:

It is clear from the definition given by Prof. Horace Sacrist, "By statistics **we mean aggregates of facts**…. and placed in relation to each other", that statistics deals with only aggregates of facts or items and it does not recognize any individual item.

Thus, individual terms as death of

6 persons in a accident,

85% results of a class of a school in a particular year, will not amount to statistics as they are not placed in a group of similar items. It does not deal with the individual items, however, important they may be.

3. It does not depict entire story of phenomenon:

When even phenomena happen, that is due to many causes, but all these causes can not be expressed in terms of data. So we cannot reach at the correct conclusions. Development of a group depends upon many social factors like, parents' economic condition, education, culture, region, administration by government etc. But all these factors cannot be placed in

data. So **we analyse only that data we find quantitatively and not qualitatively. So results or conclusion are not 100% correct because many aspects are ignored.**

4. It is liable to be misused:

As W.I. King points out, "One of the short-comings of statistics is that do not bear on their face the label of their quality."

The data may have been collected by inexperienced persons or they may have been **dishonest or biased. As it is a delicate science and can be easily misused by an unscrupulous person.** So data must be used with a caution. Otherwise results may prove to be disastrous.

5. Laws are not exact:

As far as two fundamental laws are concerned with statistics:

(i) Law of inertia of large numbers and

(ii) Law of statistical regularity, are not as good as their science laws.

They are **based on probability**. So these results will not always be as good as of scientific laws. On the basis of probability or

interpolation, we can only estimate the **production of paddy in 2019 but cannot make a claim that it would be exactly 100 %. Here only approximations are made.**

6. Results are true only on average:

"**Statistics largely deals with averages** and these averages may be made up of individual items radically different from each other." —W.L King

If average of two sections of students in statistics is same, it does not mean that all the 50 students is section A has got same marks as in B. There may be much variation between the two. So we get average results.

7. To Many methods to study problems:

In this subject **we use so many methods to find a single result.** Variation can be found by quartile deviation, mean deviation or standard deviations and results vary in each case.

8. Statistical results are not always beyond doubt:

"Statistics deals only with measurable aspects of things and therefore, can seldom give the complete solution to problem. **They provide a basis for judgement but not the whole judgment.**" —Prof. L.R. Connor

Meaning of Data

Data are individual pieces of factual information recorded and used for the purpose of analysis. It is the raw information from which **statistics** are created

TYPES OF DATA AND DATA SOURCES

In statistics, data are classified into two broad categories:

      A. Quantitative Data
      B. Qualitative data.

  A.Quantitative data are those that can be quantified in definite **units of measurement**. Depending on the nature of the variable observed for measurement, quantitative data can be further categorized as

1. Continuous
2. Discrete data.

1. Continuous data represent the **numerical values of a continuous variable**. A continuous variable is the one that can assume any value between any two points on a line segment, thus representing an interval of values.

Example : weight, length, height, thickness, velocity, temperature, tensile strength, etc., represent continuous variables.

2. Discrete data are the **values assumed by a discrete variable**. Such data are essentially count data.

Example : The number of customers visiting a departmental store everyday, the incoming flights at an airport, and the defective items in a consignment received for sale, are all examples of discrete data.

B. Qualitative data refer to qualitative characteristics of a subject or an object.

These data are further classified as

1. Nomimal Data

2. Rank Data

1. Nominal data are the outcome of classification into two

or more categories of items or units comprising a sample or a population according to some quality characteristic.

Example:

Classification of students according to sex (as males and females), of workers according to skill (as skilled, semi-skilled, and unskilled), and of employees according to the level of education (as matriculates, undergraduates, and post-graduates), all result into nominal data.

2. Rank data, on the other hand, are the result of assigning ranks to specify order in terms of the integers 1,2,3, ..., n. Ranks may be assigned according to the level of performance in a test. a contest, a competition, an interview, or a show. The candidates appearing in an interview, for example, may be assigned ranks in integers ranging from I to n, depending on their performance in the interview. Ranks so assigned can be viewed as the continuous values of a variable involving performance as the quality characteristic.

DATA SOURCES

Data sources could be seen as of two types, viz.,

1. Primary Data

2. Secondary data

The two can be defined as under:

1. Primary data

As the name suggests, are **first-hand information collected by the surveyor**. The data so collected are pure and original and collected for a specific purpose. They have never undergone any statistical treatment before. The collected data may be published as well.

Example : The Census is an example of primary data.

Methods of primary data collection:

Personal investigation: The surveyor collects the data himself/herself. The data so collected is reliable but is suited for small projects.

Collection Via Investigators: Trained investigators are employed to contact the respondents to collect data.

Questionnaires: Questionnaires may be used to ask specific questions that suit the study and get responses from the respondents. These questionnaires may be mailed as well.

Telephonic Investigation: The collection of data is done through asking questions over the telephone. To give quick and accurate information.

INTERVIEW

An interview is a face-to-face conversation between two individuals with the sole purpose of collecting relevant information to satisfy a research purpose.

Pros

In-depth information

Freedom of flexibility

Accurate data.

Cons

Time-consuming

Expensive to collect.

<u>QUESTIONNAIRES</u>

This is the process of collecting data through an instrument consisting of a series of questions and prompts to receive a response from individuals it is administered to. Questionnaires are designed to collect data from a group.

Pros

- Cost-effective.
- It can be used to compare and contrast previous research to measure change.
- Easy to visualize and analyze.
- Questionnaires offer actionable data.
- Respondent identity is protected.
- Questionnaires can cover all areas of a topic.
- Relatively inexpensive.

Cons

- Answers may be dishonest or the respondents lose interest midway.

- Questionnaires can't produce qualitative data.

- Questions might be left unanswered.

- Respondents may have a hidden agenda.
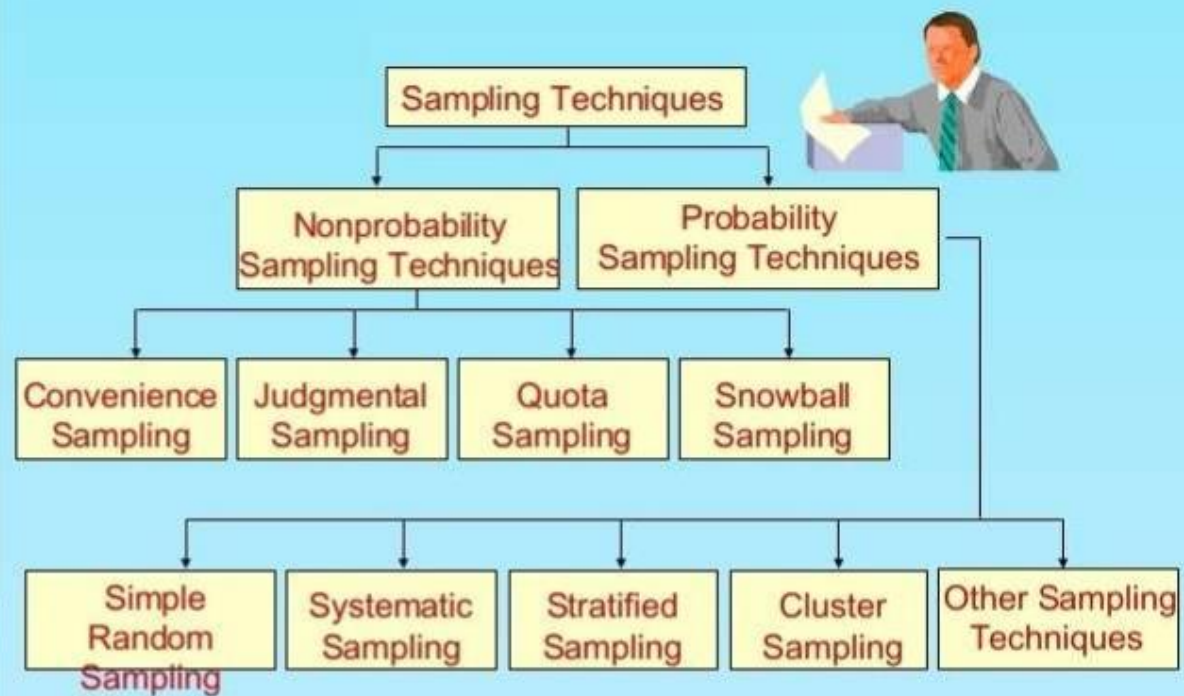
- Not all questions can be analyzed easily

Sampling:

Sampling is a process used in statistical analysis in which a predetermined number of observations are taken from a larger population.

Sample
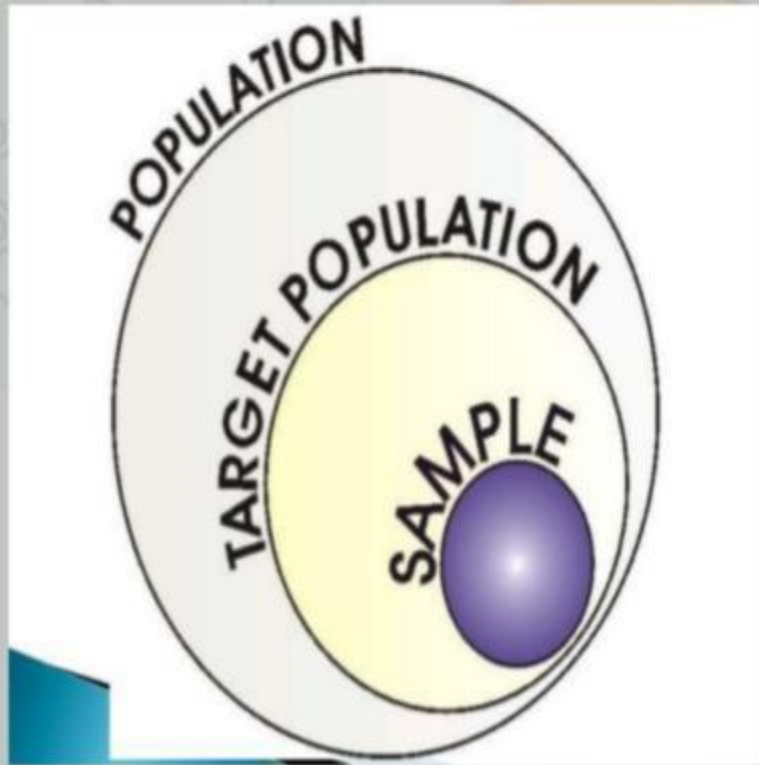
Classification of Sampling Techniques

2. Secondary data

Secondary data are opposite to primary data. **They are collected and published already (by some organization, for instance**).

As the name suggests, are **Second-hand information collected by the surveyor**

Secondary data are impure in the sense that they have undergone statistical treatment at least once.

Methods of secondary data collection:

Official publications such as the Ministry of Finance, Statistical Departments of the government, Federal Bureaus, **Agricultural Statistical boards**, etc. Semi-official sources include State Bank, Boards of Economic Enquiry, etc.

Data published by **Chambers of Commerce** and trade associations and boards.

Articles in the **newspaper, from journals and technical publications**

CLASSIFICATION

Meaning;

It is the process of arranging data into homogeneous (similar) groups according to their common characteristics.

Raw data cannot be easily understood and it is not fit for further analysis and interpretation. This arrangement of data helps users in comparison and analysis.

For example,

The Population of town can be grouped according to sex, age, marital status etc.
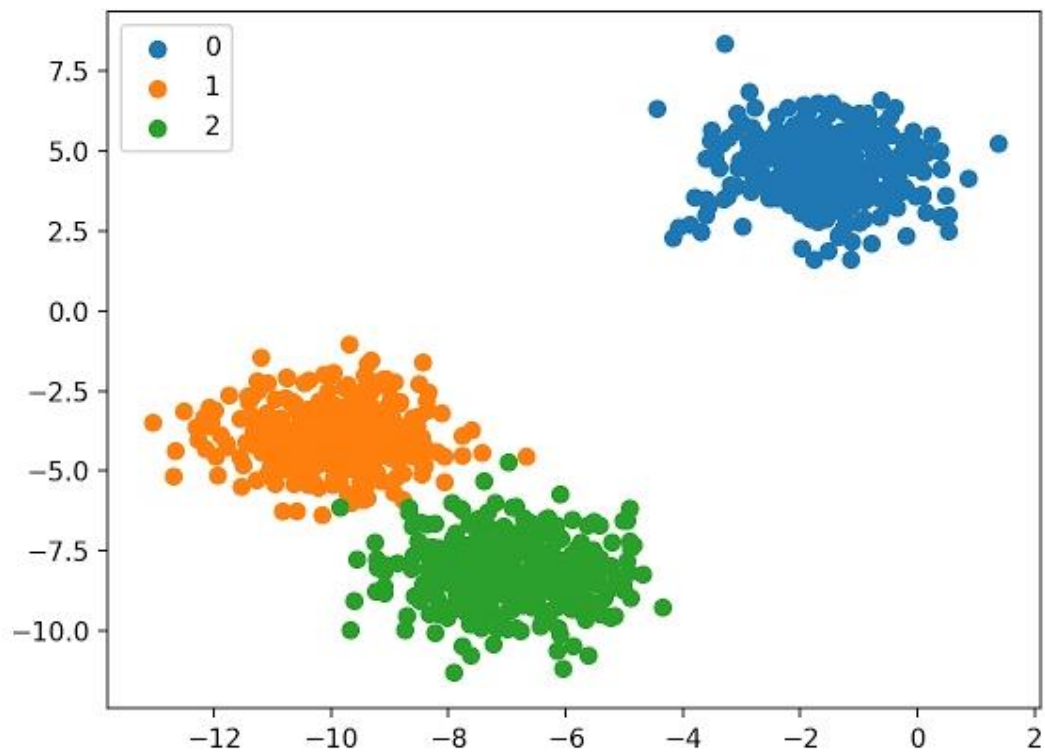
Types of Classification of Data.

There are four types of classification. They are

1. Geographical classification,

2. Chronologicalclassification,

3. Qualitative classification,

4. Quantitative classification.

Tabulation:

The method of placing organised data into a tabular form is called as tabulation. It may be complex, double or simple depending upon the nature of categorisation.

Growth of population in India

(Figures in crores)

Location	Worker	Non-Worker	Total
Rural areas	31	43	74
*Urban areas	9	19	28
Total	40	62	102

* Here, urban areas include both semi-urban and urban

Source: Census of India 2001

5 Major Objectives Of Tabulation:

(1) To Simplify the Complex Data

(2) To Bring Out Essential Features of the Data

(3) To Facilitate Comparison

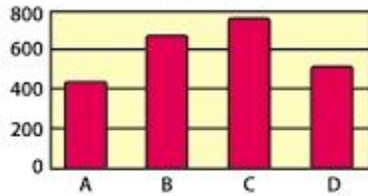(4) To Facilitate Statistical Analysis

(5) Saving of Space

Techniques and presentation of data:

Diagrammatic presentation is a technique of presenting numeric data through Pictograms, Cartograms, 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.
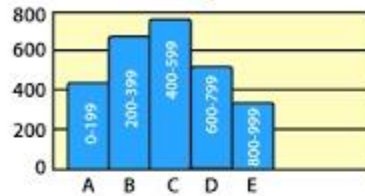
Graphic representation is another way of analysing numerical data. A graph is a sort of chart through which statistical data are represented in the form of lines or curves drawn across the coordinated points plotted on its surface.
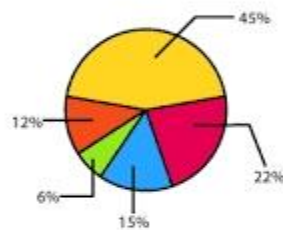
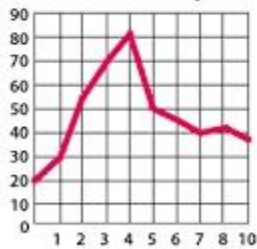# TYPES OF GRAPHICAL REPRESENTATION

Bar Graphs

Histograms

Frequency Table

Rulers of France		
Reign (Years)	Tally	Frequency
1-15	JHT JHT JHT III	18
16-30	JHT JHT I	11
31-45	JHT I	6
46-60	IIII	4
61-75	I	1

Circle Graph

45%

12%

6%

15%

22%

Line Graphs

Stem and Leaf Plot

Stem	Leaf
0	1, 1, 2, 2, 3, 4, 4, 4, 4, 5, 8
1	0, 0, 0, 1, 1, 3, 7, 9
2	5, 5, 7, 7, 8, 8, 9, 9
3	0, 1, 1, 1, 2, 2, 2, 4, 5
4	0, 4, 8, 9
5	2, 6, 7, 7, 8
6	3, 6

Key : 6 | 3 = 63 Year

Line Plot

Box and Whisker Plot