

# BIostatISTICS AND ITS MEASURES

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# Statistics

Statistic

Statistics



- **STATISTIC** : It means a measured (or) counted fact (or) piece of information stated as figure such as height of one person, birth of a baby, etc.,
- **STATISTICS** : It is also called Data. It is Plural. Stated in more than one figures such as height of 2 persons, birth of 5 babies etc. They are collected from experiments, records, and surveys.

# Definition of Statistics

Statistics means that the collection of data, tabulation, analysis and interpretation of quantitative information.

- In other words, Statistics is a **branch of science** used in dealing with phenomena that can be described numerically by counts or by measurements.
- **Quantitative information:** population, birth, fertility, production and etc.

## Statistics:

- It is a tool
- It is a branch of science

**Statistical Method:** It refers Both data and Methods

## Definition of Statistics (contd...)

**Statistics** : used in two sense viz., singular and plural.

- In singular noun, it deals with collection, analysis and interpretation of quantitative information.
- In plural sense, statistics denote some numerical data such as birth, death etc.

# Statistics is used in many fields

- ✓ Medical Statistics
- ✓ Agricultural Statistics
- ✓ Economical Statistics
- ✓ Mathematical Statistics
- ✓ And so on.....
  
- ✓ Bio-Statistics



# Definition of Bio-Statistics

- **Bio-statistics:** means when we use the statistical tools on the Biological Problems and derived some results about that. Example: **Medical Science**
- It is also called **Bio-metry**. It means **measurement of life**.
- Normally, in medicine for precision, facts, observations or measurements have to be expressed in figures.
- Bar diagrams, Multiple Bar diagram, Histogram, Pie chart and etc.,

# Uses of Bio-Statistics

- o To calculate average, median, mode standard deviation of the given collected data
- o To compare two sets of data
- o To get a conclusion (or) result
- o To find the association between the two variables
- o To find the correlation bet. the two variables
- o To give the results in a tabular or diagrammatic form.



# Bio-Statistics in Various areas

Health Statistics

Medical Statistics

Vital Statistics



## Bio-statistics (Contd....)

- In Public Health or Community Health, it is called **Health Statistics**.
- In Medicine, it is called **Medical Statistics**. In this we study the defect, injury, disease, efficacy of drug, Serum and Line of treatment, etc.,
- In population related study it is called **Vital Statistics**. e.g. study of vital events like births, marriages and deaths.

## Measurement Scale

**Variable:** A characteristic that varies from one biological entity to another is termed as variable.

### Various Measurements:

#### Ratio Scale:

The measurements scales having a constant size interval and true zero point are said to be ratio of measurement. Besides heights and numbers, ratio scales include weights (mg, g), volumes (cc, cu.m), capacities (ml, l), rates (cm/sec., Km/h) and lengths of time (h, Yr) etc.,

## Interval Scale:

Some measurement scales possess a constant interval size but not a zero, they are called interval scales.

A good example is that of the two common temperature scales. Celsius (C) and Fahrenheit (F). We can find the same difference exists between 25 degree Celsius and 30 degree Celsius as between 10 degree Celsius and 15 degree Celsius.

## Ordinal Scale:

The data consist of an ordering or ranking of measurement and are said to be on an ordinal scale.

**For example:** The examination marks of 75, 80, 87, 92, and 95% (ratio scale) might be recorded as A, B, C, D and E (ordinal scale) respectively.

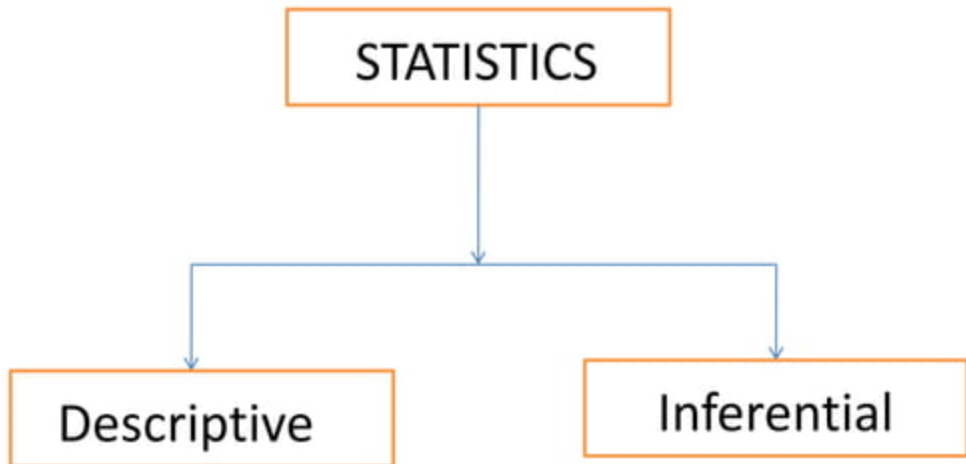
## Normal Scale:

The variables are classified by some quality rather than by a numerical measurement. In such cases, the variable is called an attribute and said to using a nominal scale of measurement.

**For example:**

1. Data are represented as male or female.
2. Heights may be recorded as tall or short.

# Types of Statistics



# Types of Statistics (Contd...)

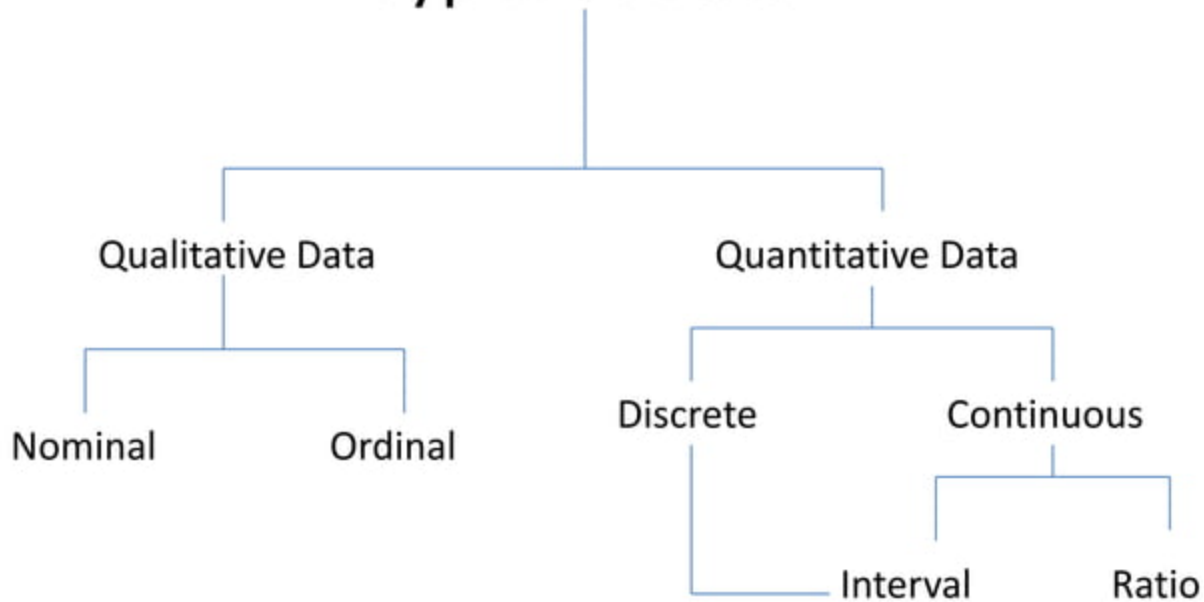
- **Descriptive Statistics:**

Once the data have been collected, we can organize and summaries in such a manner as to arrive at their orderly presentation and conclusion. This procedure can be called Descriptive Statistics.

- **Inferential Statistics:**

The number of birth and deaths in a state in a particular year.

# Types of Data





# Types of Data (contd...)

- Quantitative Data

There is a natural numeric scale (numerical Value)  
( can be subdivided into interval and ratio data )

Example: age, height, weight

- Qualitative Data

Measuring a characteristic for which there is no natural numeric scale

( can be subdivided into nominal and ordinal data )

Example: Gender, Eye color

# Definition of Biostatistics

- The statistical methods applied to biological problems is called as Biostatistics.
- It is also called Biometry.
- Biometry means Biological Measurement or Measurement of Life.

## STATISTICAL METHODS

Croxton and Gowden said Statistical Method means “ the collection, presentation, analysis and interpretation of numerical data”.

### 1. Collection of Data:

It is the first step in collection of data. Careful planning is essential before collecting the data.

# Statistical methods (contd...)

## Presentation of Data:

- The mass data collected should be presented in a suitable form for further analysis.
- The collected data may be presented in the form of tabular or diagrammatic or graphical form.

## Analysis of Data:

The data presented should be carefully analyzed from the presented data such as measures of central tendencies, dispersion, correlation, regression, etc.

# Statistical methods (contd...)

## Interpretation of Data:

- The final step is drawing conclusion from the data collected.
- A valid conclusion must be drawn on the basis of analysis.
- A high degree of skill and experience is necessary for the interpretation.

# Measures of Central Tendency

- Mean - average (or) A.M
- Median - Positional average (Middle value)
- Mode – Most repeated value ( The frequent value)

## Mean:

### Merits

- Mean can never be biased. It is easy to calculate.
- It is least affected by fluctuations of sampling.
- It is based on all the observations of a series. Therefore, it is a most representative measure.

### Demerits

- It is greatly affected by extreme fluctuations. Thus it is not a true representative value of all the items of the series.
- A.M cannot be used for qualitative characteristics such as colour of flowers, sweetness of orange or darkness of the colour.

## Median: Merits

- Easy to calculate and understand
- It is not affected by extreme observations
- It is best measure for qualitative data.

## Demerits

- It cannot be determined in the case of even number of observations. We merely estimate it as the arithmetic mean of the two middle terms.
- It is a positional average. It cannot be accepted for each and every observation.

### Mode: Merits

- It is easy to calculate and understand
- It is not affected by extreme observations
- It can be calculated from a grouped frequency distribution.

### Demerits:

- Mode is not rigidly defined.
- As compared to mean, mode is affected to a great extent by the fluctuations of sampling.



# Measures of variability (or) Measures of Dispersion

- Range
- Standard Deviation
- Mean Deviation
- Quartile Deviation
- Variance
- Co-efficient of variation

Range: Max. value – Min. value

Standard Deviation: Root Mean Square  
Deviation

# PRACTICAL PROBLEMS

- Measures of Central Tendency

(Both ungrouped and grouped data)

- Measures of Dispersion

(Both ungrouped and grouped data)

# Correlation

- describes the degree of relationship between two variables.
- To define correlation is the average relationship between two or more variables.
- When the change in one variable makes or causes a change in other variable then there is a correlation between these two variables.
- These correlated variables can move in the same direction or they can move in opposite direction.
- Not always there is a cause and effect relationship between the variables when there is a change; that might be due to uncertain change.

## Correlation (Contd...)

- Simple Correlation is a correlation between two variables only; meaning the relationship between two variables.
- Event correlation and simple event correlation are the types of correlations mainly used in the industry point of view.

# Types of Correlation

- (1) Positive Correlation
- (2) Negative Correlation
- (3) Perfectly Positive Correlation
- (4) Perfectly Negative Correlation
- (5) Zero Correlation
- (6) Linear Correlation

### *Positive Correlation*

- When two variables move in the same direction then the correlation between these two variables is said to be Positive Correlation.
- When the value of one variable increases, the value of other value also increases at the same rate.  
**For example:** the training and performance of employees in a company.

### *Negative Correlation*

- In this type of correlation, the two variables move in the opposite direction.  
When the value of a variable increases, the value of the other variable decreases.  
**For example:** the relationship between price and demand.

### **Perfect Positive Correlation**

When there is a change in one variable, and if there is equal proportion of change in the other variable say Y in the same direction, then these two variables are said to have a Perfect Positive Correlation.

### **Perfectly Negative Correlation**

Between two variables X and Y, if the change in X causes the same amount of change in Y in equal proportion but in opposite direction, then this correlation is called as Perfectly Negative Correlation.



## **Zero Correlation**

- When the two variables are independent and the change in one variable has no effect in other variable, then the correlation between these two variable is known as Zero Correlation.

## **Linear Correlation**

- If the quantum of change in one variable has a ratio of change in the quantum of change in the other variable then it is known as Linear correlation.

**THANK YOU**