Introduction to Biostatistics
For Students' YBPH Program

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Lecture 1, Review of Principle Concepts in Biostatistics (1)

✓ What is statistics- Biostatistics, their sections and fields?

✓ Data and Variables with their types.

✓ Collection Data Methods.

✓ Measurement Levels

✓ Population and Sample with their types.

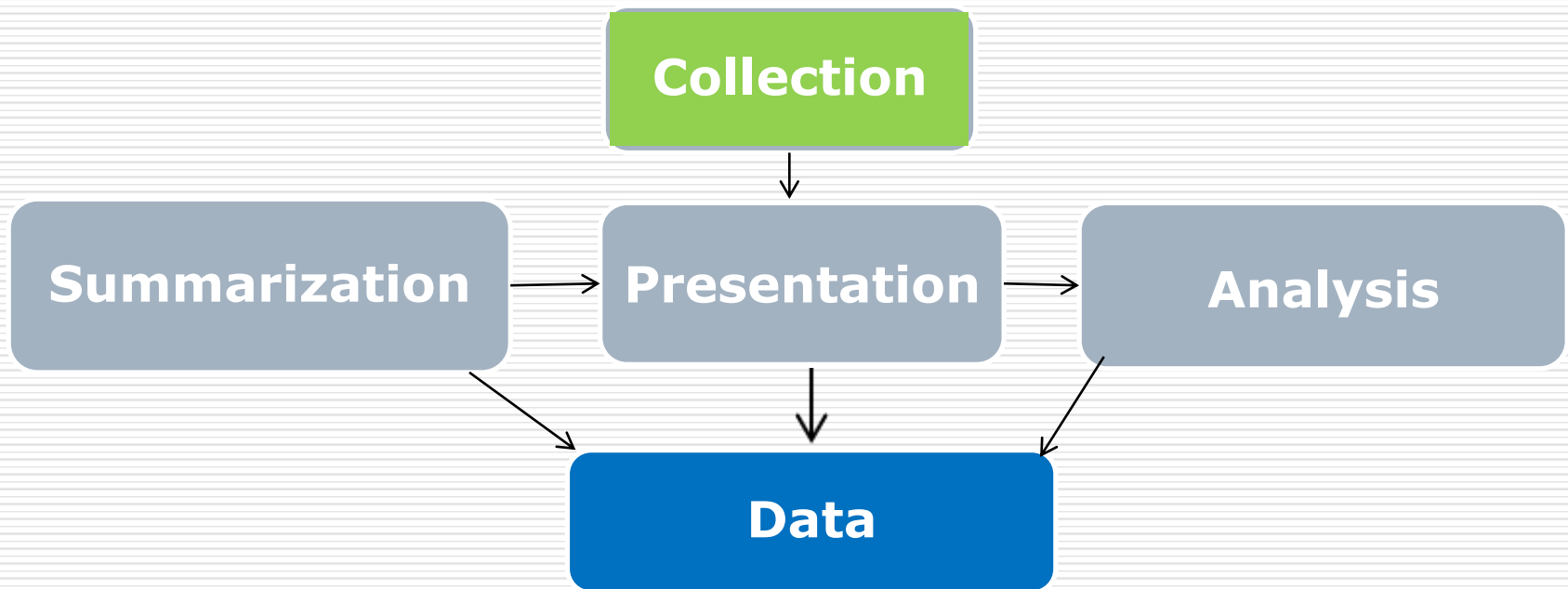✓ Some statistical data analysis software.

Statistics and Biostatistics

❖ **Statistics:** is the science that interest with collection, summarization, presentation, analysis, and illustration the data for obtain acceptable scientific results, to make a suitable decisions.

❖ **Biostatistics:** Biostatistics is a branch of statistics that applies statistical methods to biological, health, and medical researches.

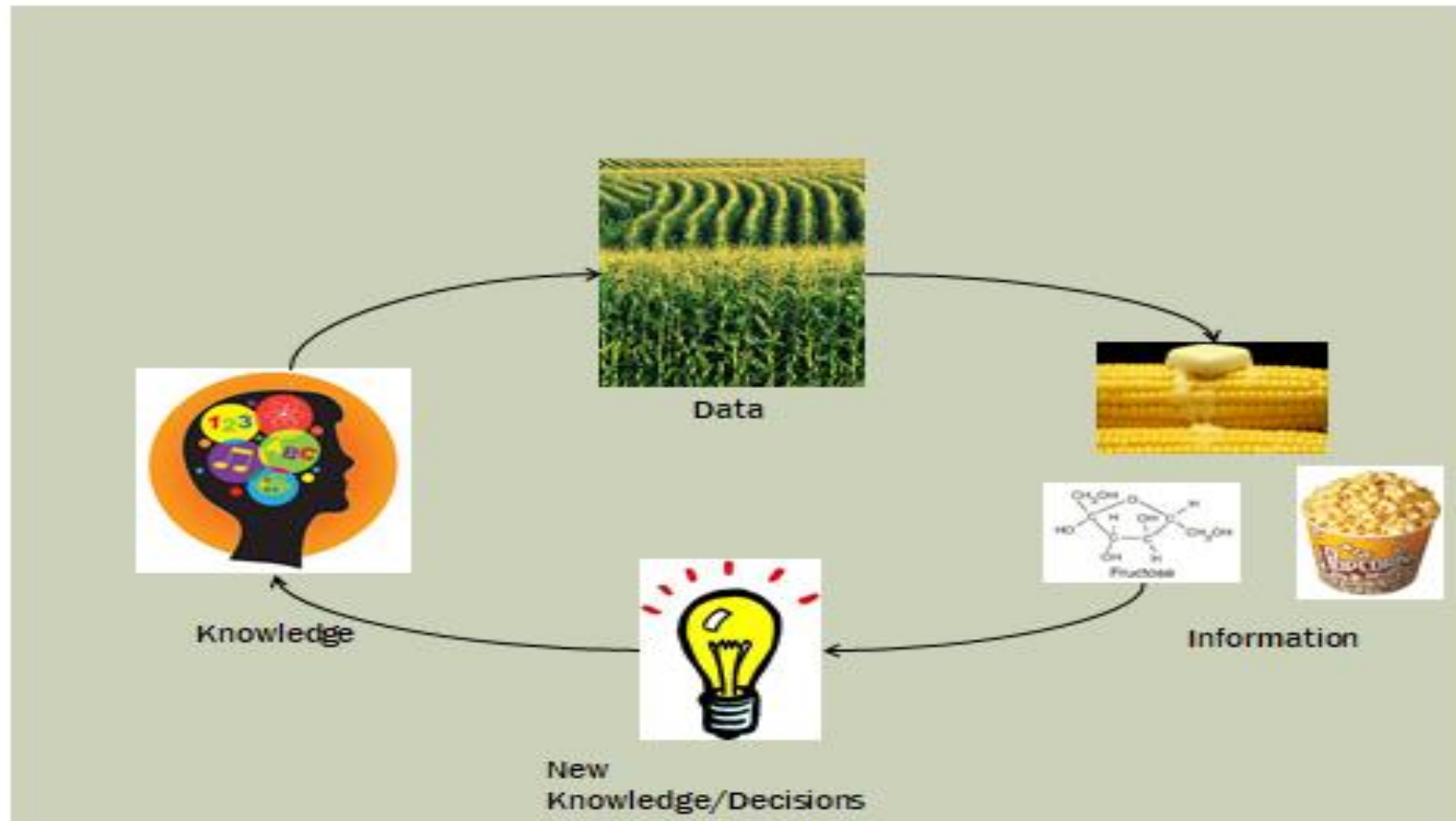# Basics of Statistics

Statistics: is the science concerned with:

```
                    ┌──────────────┐
                    │  Collection  │
                    └──────┬───────┘
                           │
                           ▼
┌──────────────┐    ┌──────────────┐    ┌──────────────┐
│ Summarization│───▶│ Presentation │───▶│   Analysis   │
└──────┬───────┘    └──────┬───────┘    └──────┬───────┘
       │                   │                    │
       ▼                   ▼                    ▼
              ┌────────────────────────┐
              │          Data          │
              └────────────────────────┘
```

In order to obtain acceptable scientific results, to make appropriate decisions.

# Knowledge, Data, Information, Analyze, Decisions

importance of statistics

The importance of statistics is can be summarized in the following points:

- ✓ Statistics is the main tool in scientific research.
- ✓ It is considered one of the important tools for drawing strategic policies for development.
- ✓ It is used in various areas of life on the personal and institutional level in managing life affairs.

Fields of statistics
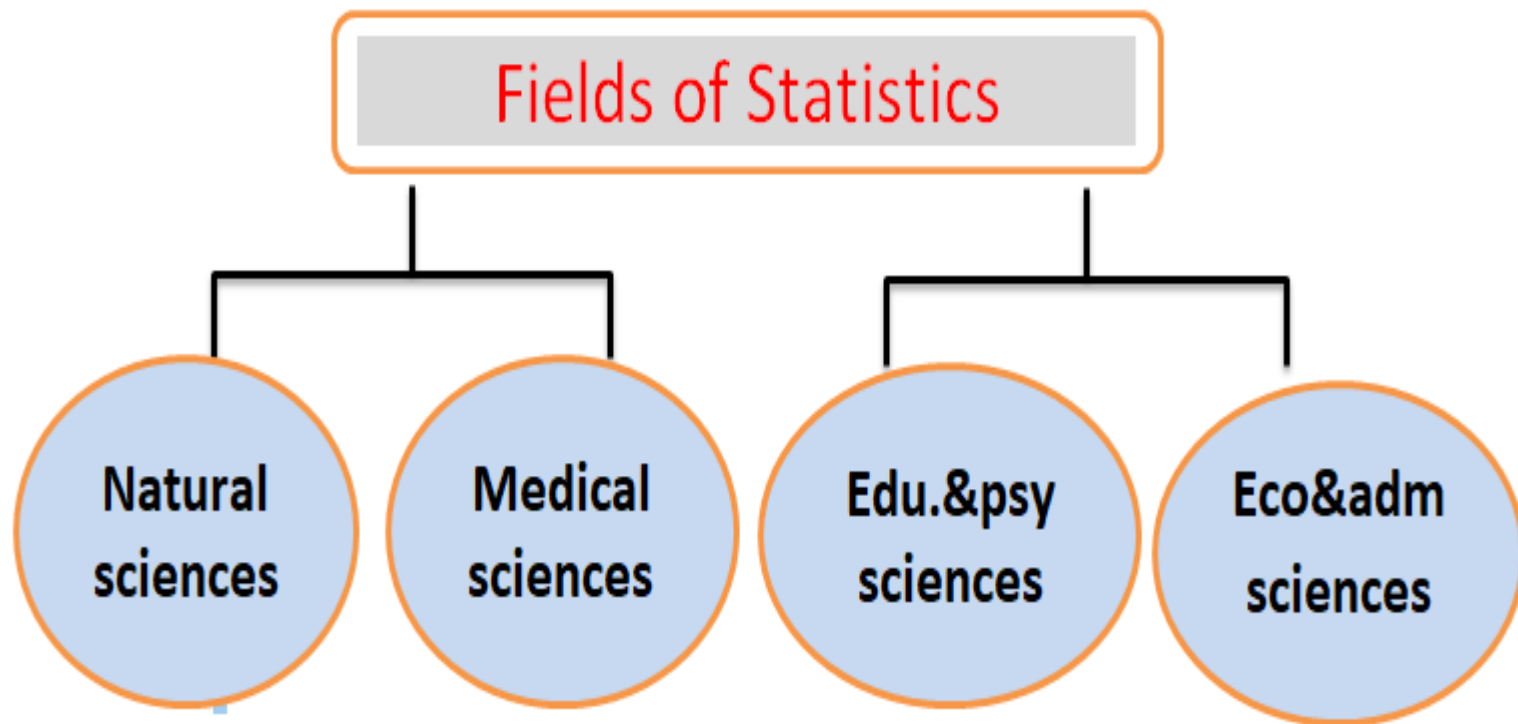
Main sections of Statistics

Main sections of Statistics

Descriptive statistics

It is the branch that is concerned with:
- collecting, summarizing and presenting data. To,
- Extract some results and statistical indicators for the cases studied.

Inference statistics

It is the branch that is concerned with:
- generalizing the results obtained from the sample study on the population,
- prediction and estimating population parameters.
- Testing the validity of scientific hypotheses.

Variables and Data

Variable:
is a characteristic or attribute that can have different values or attributes, such as age, gender, level education, Marital status, Blood groups.

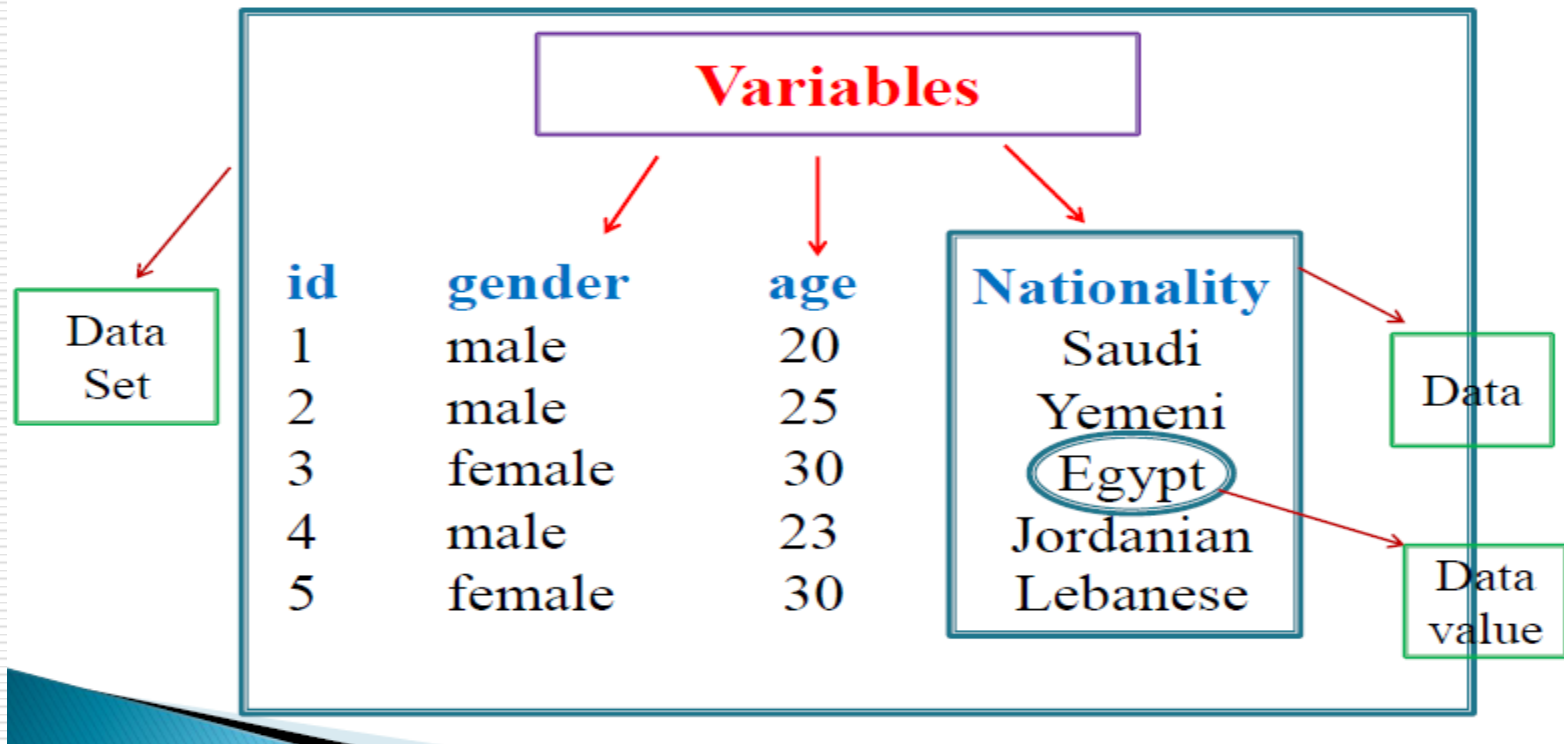- The variables whose values are determined by chance they are called random variables.

Data:
is the values that a variable can take it.
- A collection of data values forms a data set.

Variables and Data

For example: A data set in table

	Variables					
Data Set	id	gender	age	Nationality		Data
	1	male	20	Saudi		
	2	male	25	Yemeni		
	3	female	30	Egypt		Data value
	4	male	23	Jordanian		
	5	female	30	Lebanese		

Some principle concepts

- A population: consists of all subjects (human or elements or otherwise) that are studied.

- A sample: is a subset of the population or (is a group selected from a population).

Sample   Population
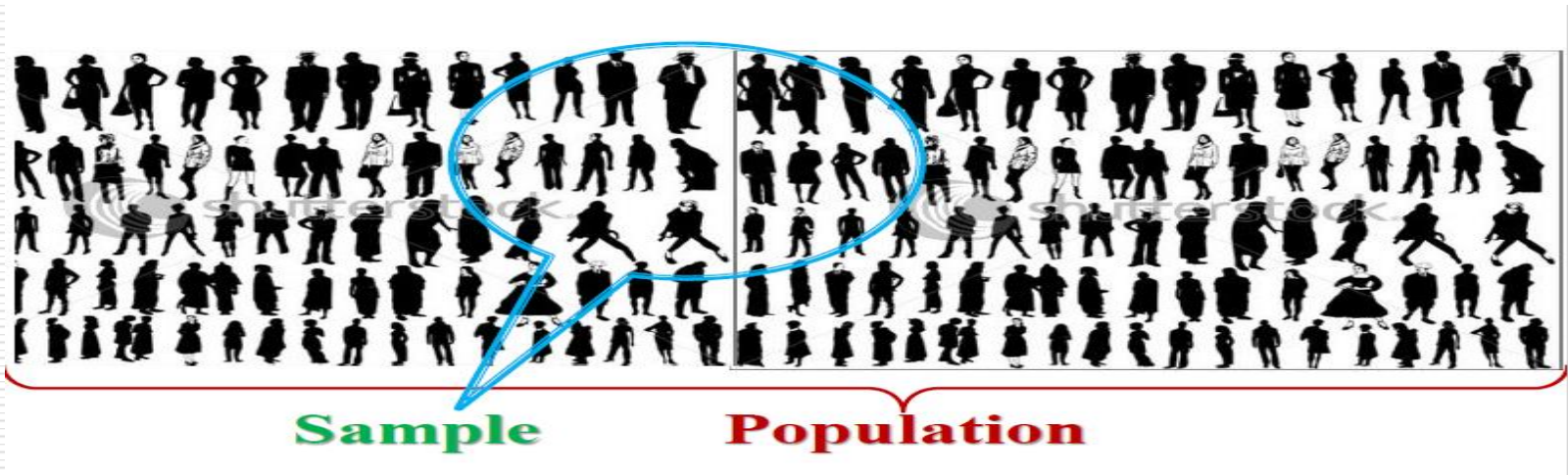
Some basic concepts
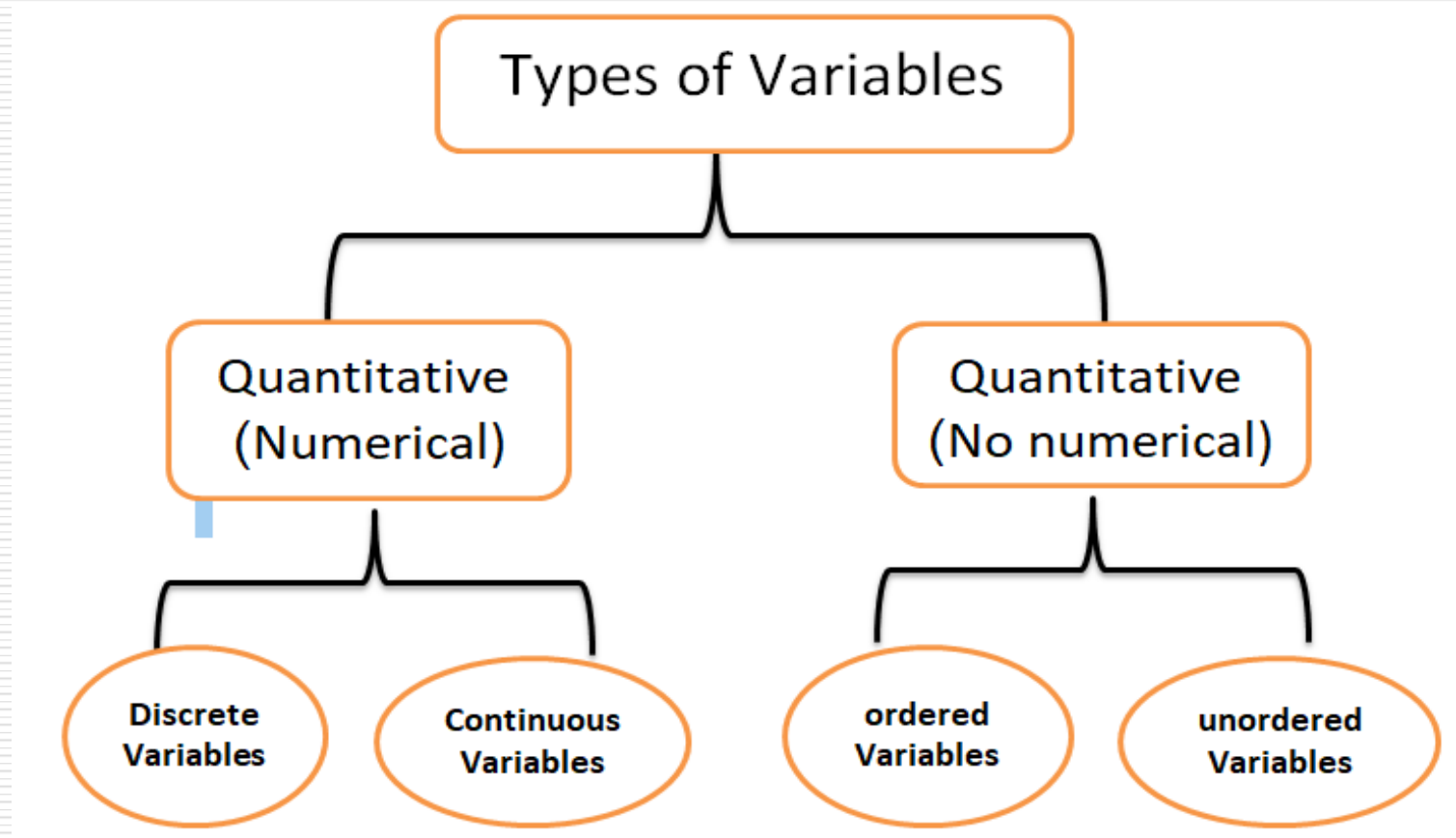
Some basic concepts

Types of Variables

Qualitative Variables:

are variables that can be placed into distinct **categories** , according to some characteristic or attribute.

For example: Gender ,Marital status ,Color……etc

Quantitative variables

are **numerical** and can be ordered or ranked.

For example: Age ,Height , Weight ,temperature …..etc

Some basic concepts

Quantitative variables classified into two groups

Discrete Variables

assume values that can be **counted** .

For example:
- Number of children in a family ,
- Number of student in classroom,
- Number of DVDs rented each day ......etc

Continuous Variables

assume **an infinite number** of values between any two specific values.

For example:
- Temperature ,
- Height
- Weight
- Time .....etc

Presentation Methods of Data

For examples of graphical Methods

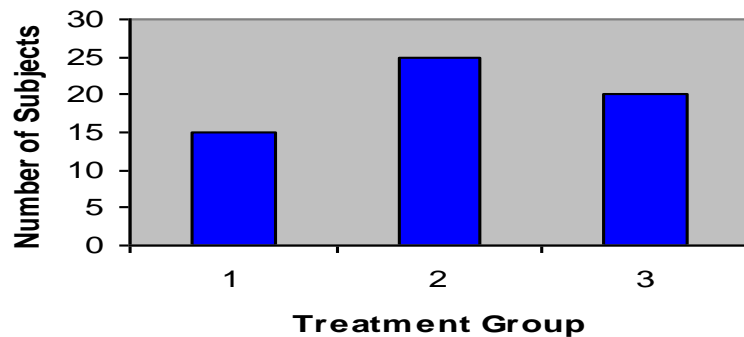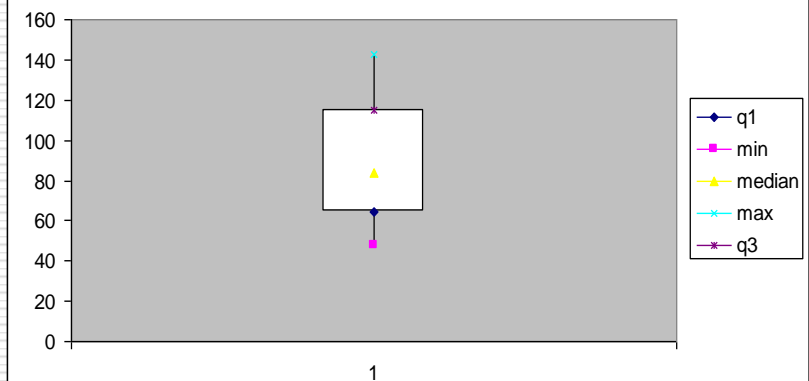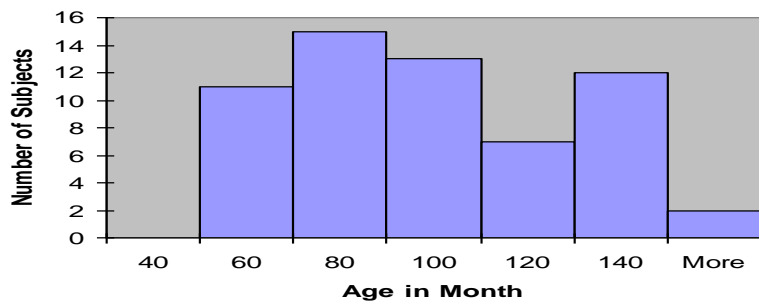Figure 1: Bar Chart of Subjects in Treatment Groups
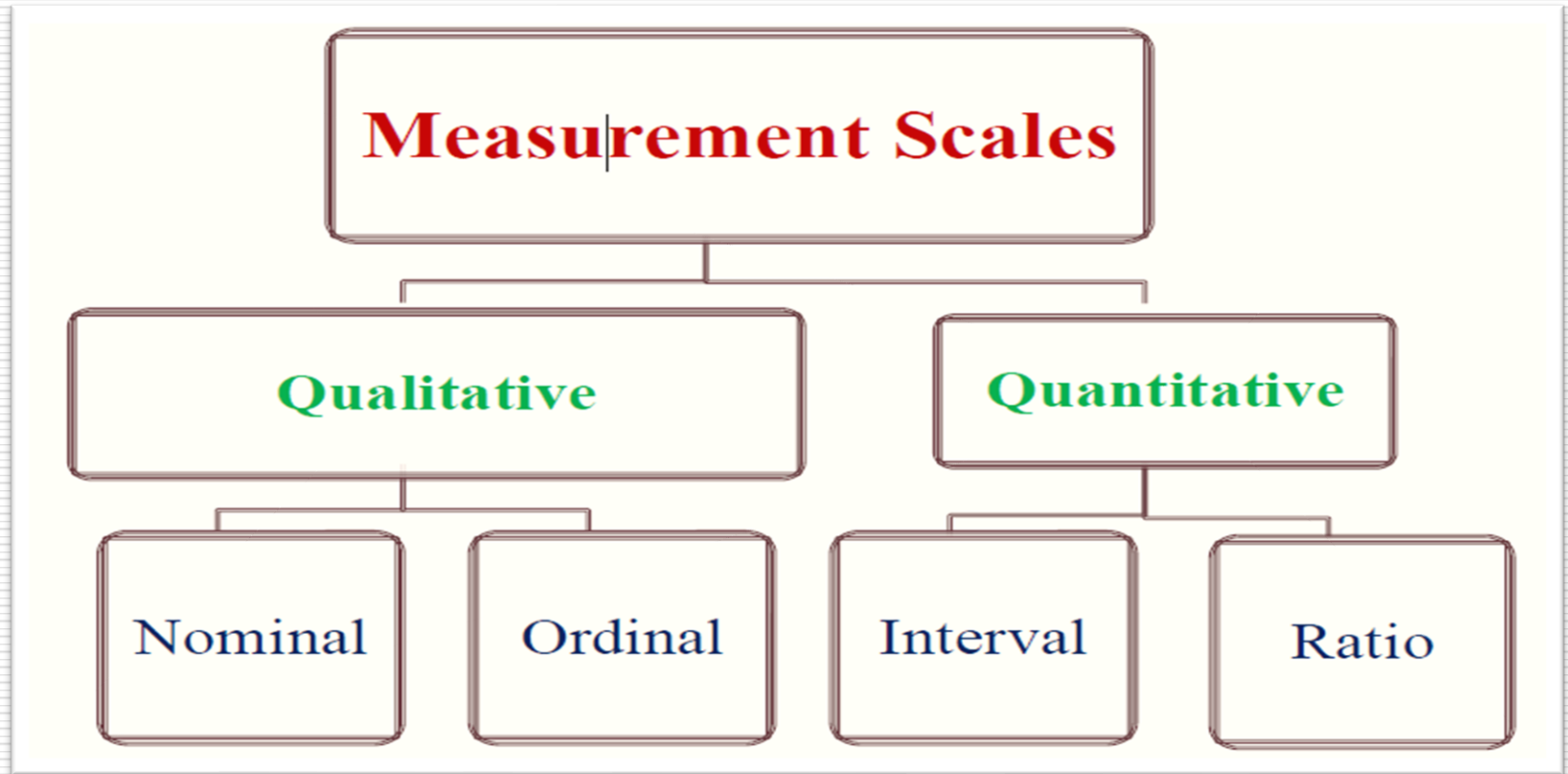

Figure 2: Pie Chart of Subjects in Treatment Groups
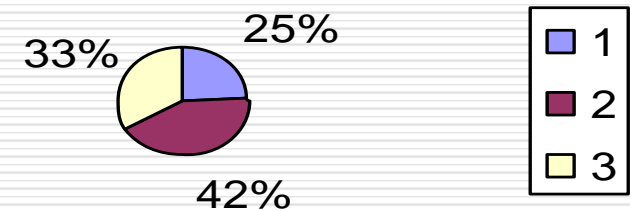
Figure 3: Age Distribution

Measurement System

Measurement System

Measurement scale of qualitative

Nominal level

- Use only for classification without order
- The operations (+,-,*, /) have not meaningful
- The variables are text not numbers. May be take values but the operation on it not meaningful.
- For example: gender, names, cases numbers etc.

Ordinal level

- Use to classifies and order data in categories.
- The operations (+,-,*, /) have not meaningful .
- For example, education level (low, moderate, high). Can be compared for equality, or greater or less. Grad of course (A,B,C,D), rating of scale.

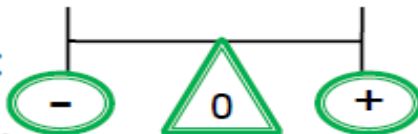# Measurement System

Measurement Scale of Quantitative

Interval level

ranks data and precise differences between units of measure do exist ,however there is **no meaningful zero**.

For example: Temperature , IQ test…etc

Ratio level

possesses all the characteristics of interval and there exist **a true zero**.

For example: Height , Weight, Time, Salary , Age …etc

Measurement System

Measurement scale of quantitative

Interval level

- Values of the variable are ordered as in Ordinal,
- differences between units do exist.
- however, the scale is not absolutely fixed.
- For example, Calendar dates and temperatures.
- Zero here has a relative meaning only.

Ratio level

- Her variables take all properties of pervious level scales plus Zero here is real,
- Also, all variables take numerical values e.g. age, weight, size. In addition, all operations (+,-,*, /) have meaningful.
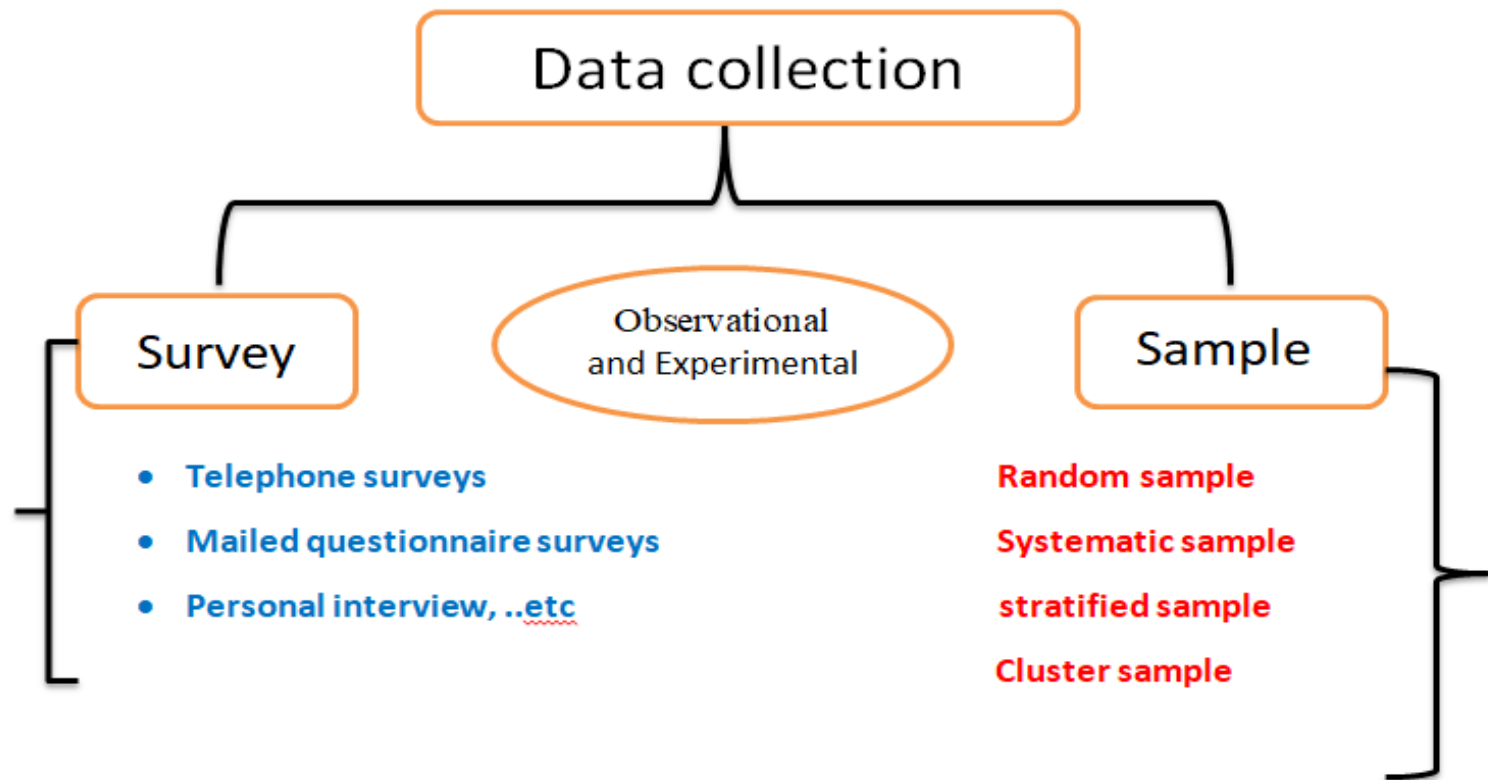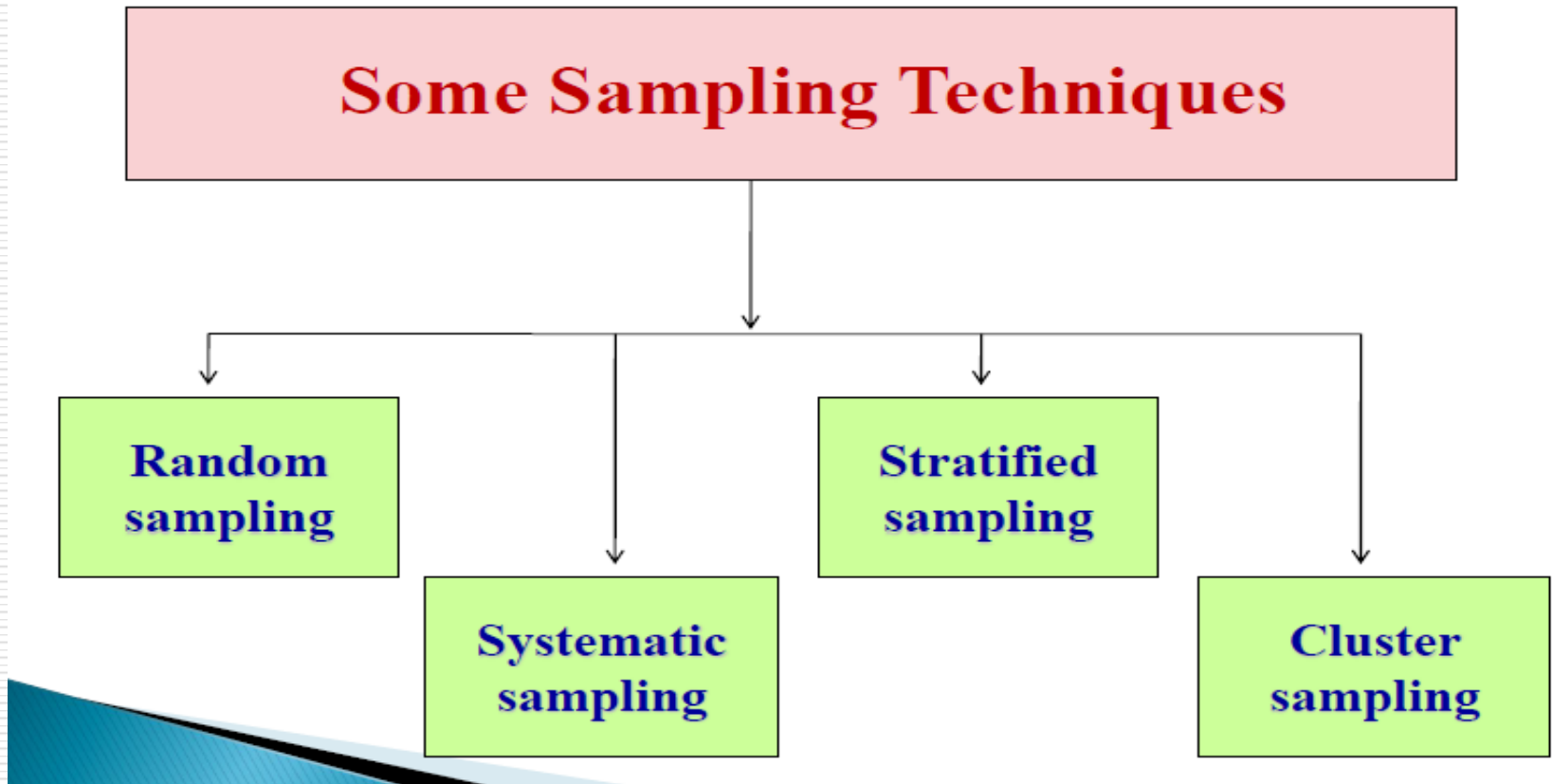- The ratio is the highest level of measurement.

Methods of Data collection

Some Types of Samples

Some Sampling Techniques

- Random sampling
- Systematic sampling
- Stratified sampling
- Cluster sampling

● Random sample:

are selected by using chance methods or random numbers.
For example

| Table 1–3		Random Numbers										
79	41	71	93	60	35	04	67	96	04	79	10	86
26	52	53	13	43	50	92	09	87	21	83	75	17
18	13	41	30	56	20	37	74	49	56	45	46	83
19	82	02	69	34	27	77	34	24	93	16	77	00
14	57	44	30	93	76	32	13	55	29	49	30	77
29	12	18	50	06	33	15	79	50	28	50	45	45
01	27	92	67	93	31	97	55	29	21	64	27	29
55	75	65	68	65	73	07	95	66	43	43	92	16
84	95	95	96	62	30	91	64	74	83	47	89	71
62	62	21	37	82	62	19	44	08	64	34	50	11
66	57	28	69	13	99	74	31	58	19	47	66	89
48	13	69	97	29	01	75	58	05	40	40	18	29
94	31	73	19	75	76	33	18	05	53	04	51	41
00	06	53	98	01	55	08	38	49	42	10	44	38
46	16	44	27	80	15	28	01	64	27	89	03	27
77	49	85	95	62	93	25	39	63	74	54	82	85
81	96	43	27	39	53	85	61	12	90	67	96	02
40	46	15	73	23	75	96	68	13	99	49	64	11

Q: Select random sample of 15 subjects out of 85 subjects:

A: 12, 27, 75, 62, 57, 13, 31, 06, 16, 49, 46, 71, 53, 41, 02

- **Systematic sample**

are obtained by numbering each element in the population and then selecting the kth value. For example,

- Determine the sample size: n

- Determine the systematic period k, where k= N/n

- Randomly Select any number in k

- Add k to this selected number to obtain the next value.

First Group

$N = 64$

$n = 8$

$k = 64/8 = 8$
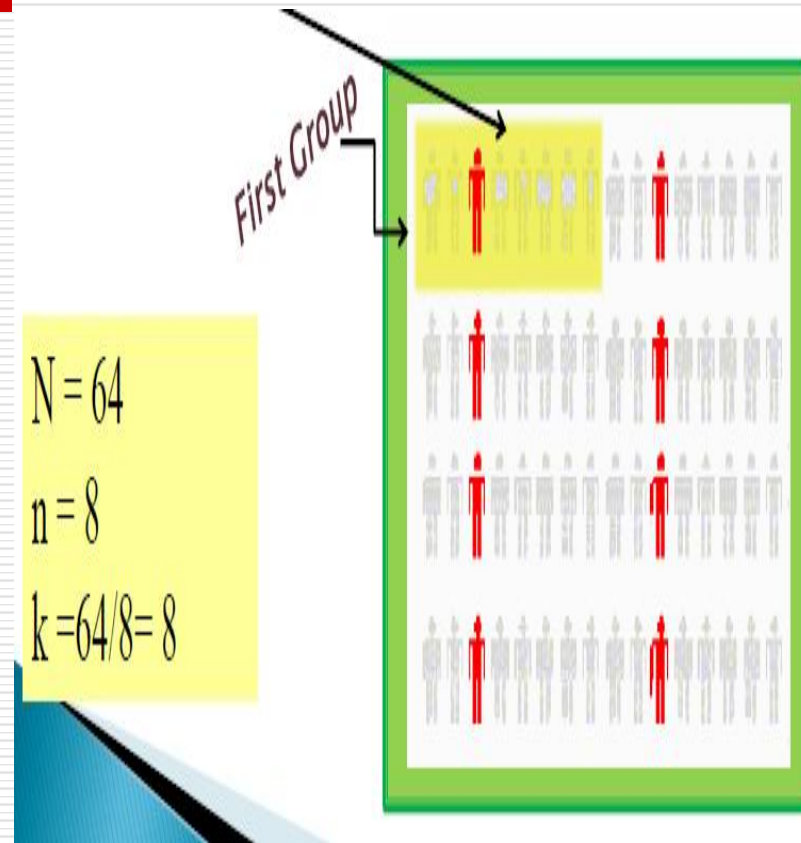
- **Stratified sample:** are selected by dividing the population into groups (strata) according to some characteristic and then taking samples from each group. For example,
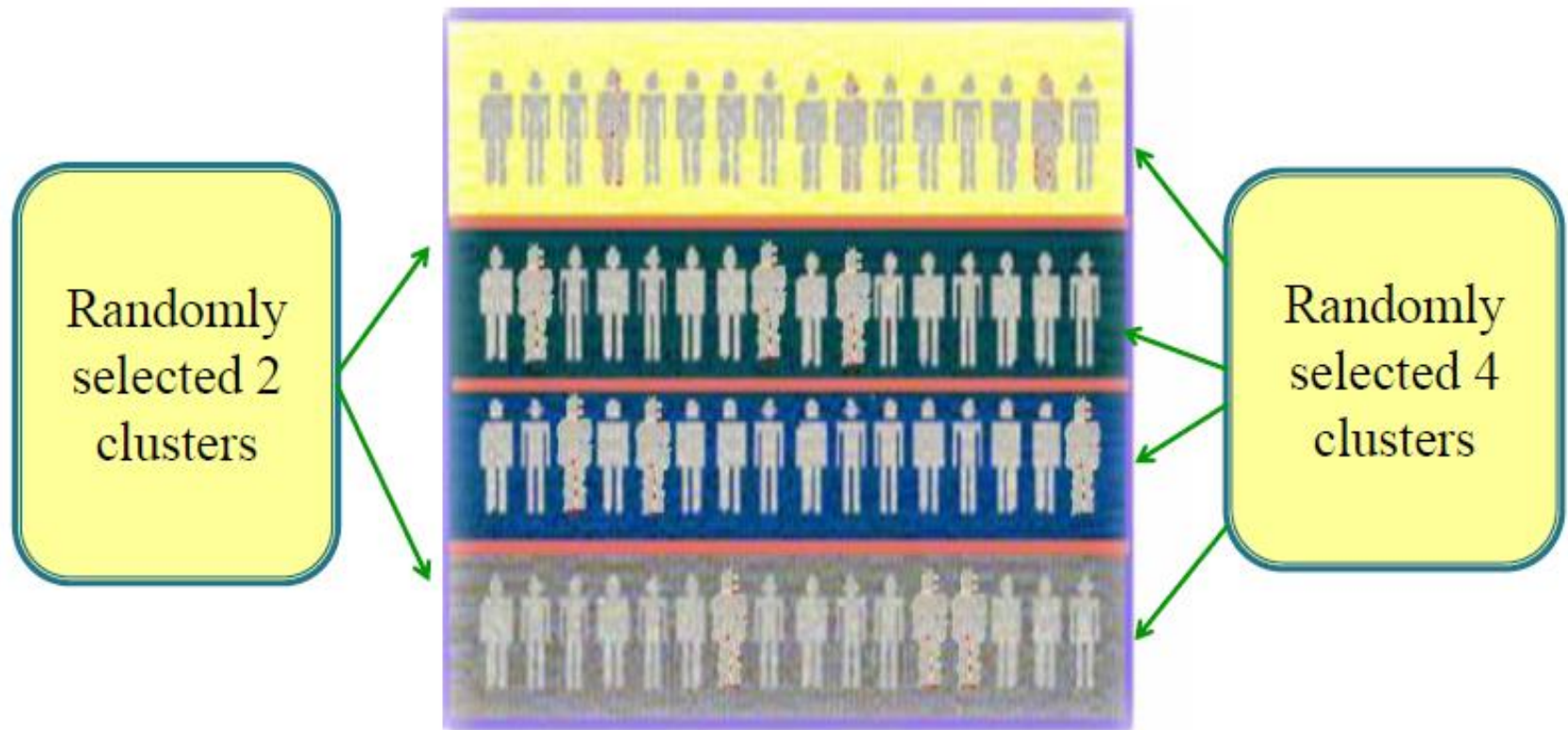
A researcher select a random sample from each gender to check their blood pressure
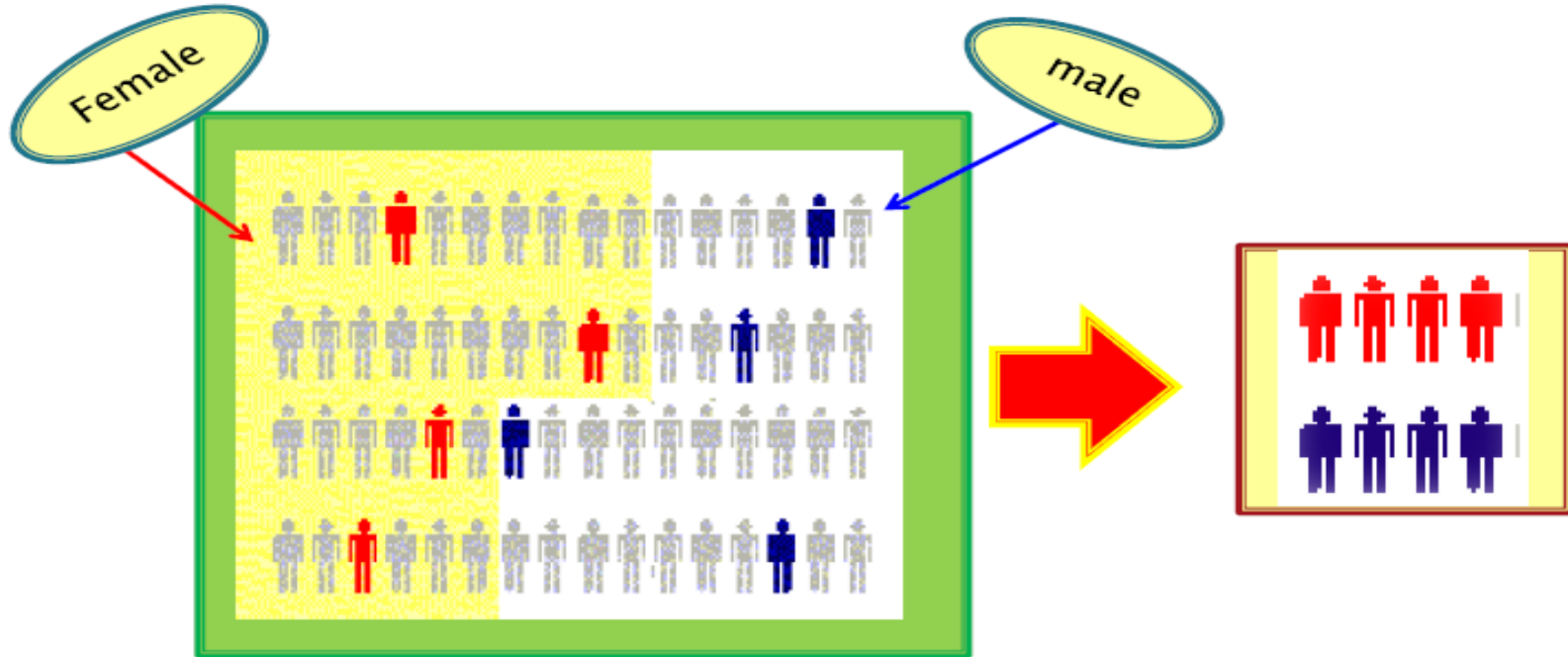
- **Cluster sample**

are selected by dividing the population into groups and then taking samples of the groups. For example,

Randomly selected 2 clusters

Randomly selected 4 clusters

Functions of Biostatistics:

Functions of Statistics:

- It presents facts in a definite form.
- It simplifies mass of figures.
- It facilitates comparison.
- It helps in formulating and testing of hypothesis.
- It helps in prediction.
- It helps in the formulation of suitable policies.

Role of statisticians

➢ To guide the design of an experiment or survey prior to data collection.

➢ To analyze data using proper statistical procedures and techniques.

➢ To present and interpret the results to researchers and other decision makers

Some Types of studies:

Types of Studies	
Observational Study	**Experimental Study**
The researcher merely observes what is happening or what has happened in the past and tries to draw conclusions based on these observations. **For example:** ➢ people who sleep 8 hours report better health. ➢A researcher counts the number of people living in each house in specific a street .	The researcher manipulates one of the variables and tries to determine how the manipulation influences other variables. **For examples**: ➢ Patients were randomly assigned to two groups was given drug A and the other group was given drug B to determine if the drug has an effect on patient's blood pressure. ➢ An Instructor has Three Teaching method ,he want to apply a best method by seeing students grades.

Variables of study:

For example

Independent	temperature of water	exercise
Dependent	time to cook an egg	health

Note : Statistical studies usually include one or more independent variables and one dependent variable.

Variables of study:

Any Experiment has 2 Variables

Independent Variable or Explanatory Variable

Dependent Variable or Outcome Variable

(or input) variable is the one that is being manipulated by the researcher.

is the resultant variable

Experimental study:

Types of group

Treatment Group

Control Group

The group that received the special instruction .

The group that dose not received the special instruction.
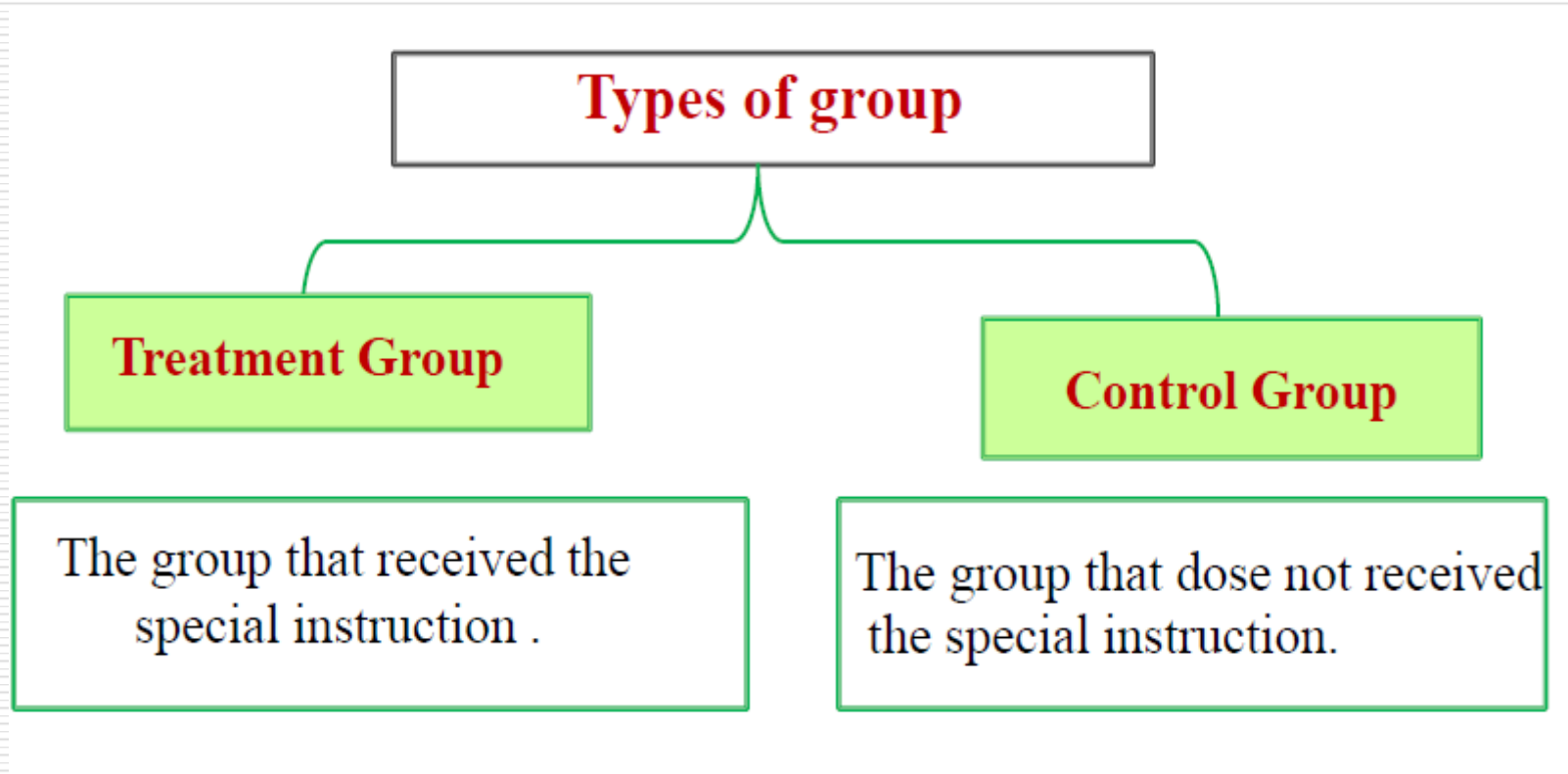
Some Statistical Data Analysis Software

The Best Statistical Software tools:

- IBM SPSS Statistics
- SAS/STAT
- Stata
- Minitab
- Graph Pad Prism
- SmartPLS

Thank you for all..