Biostatistic Analytical

Lecture 1

By

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Biostatistic

Introduction

Biostatistics

Biostatistics can be defined as the application of the mathematical tools used in statistics to the fields of biological sciences and medicine.
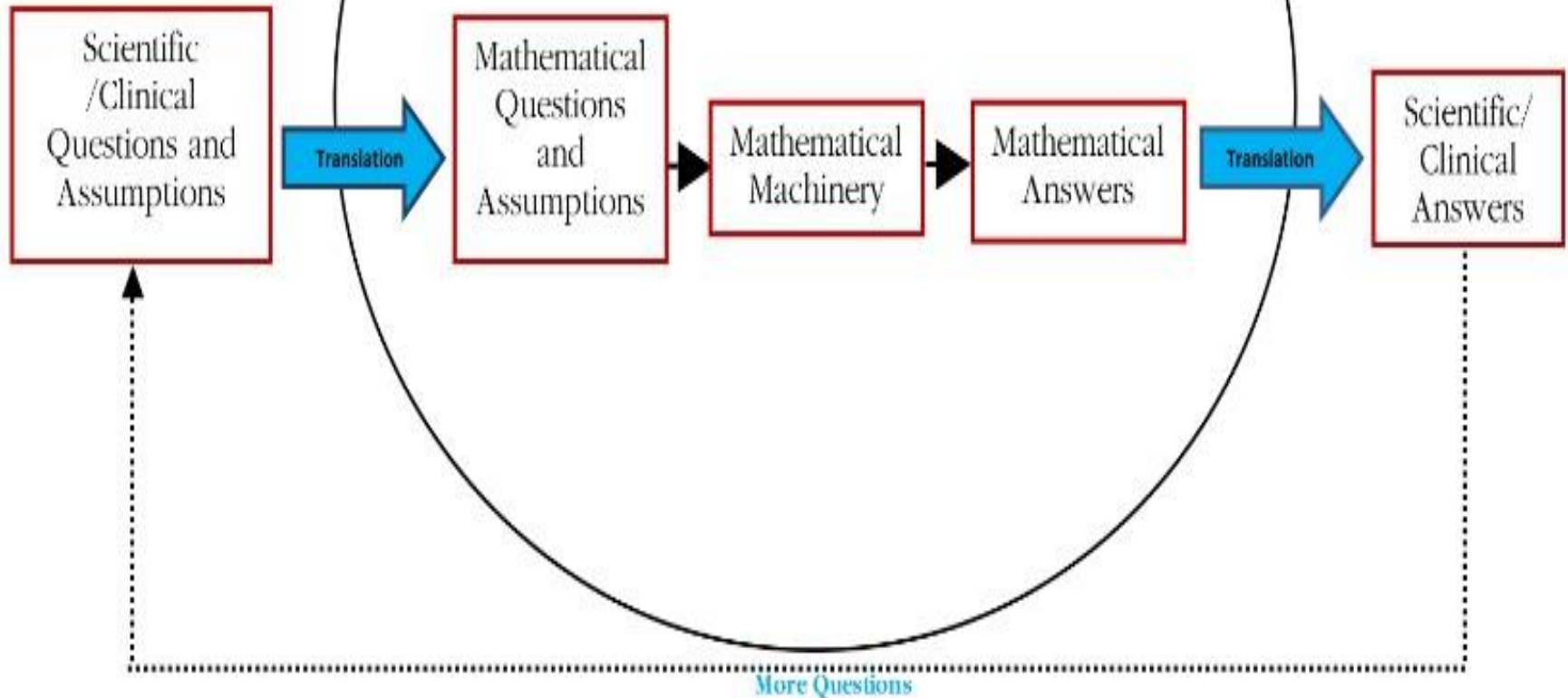
Biostatistics is a growing field with applications in many areas including epidemiology, medical sciences, health sciences, educational research and environmental sciences.

Bridging the sciences

BIOSTATISTICS

Concerns of Biostatistics

Biostatistics is concerned with:

a. Collection, organization and summarization of data (descriptive statistics). For example:
- ❖ Tables & Graphs
- ❖ Measures of Central Tendency
- ❖ Measures of Variability

Average rainfall in Hilla last year
Number of car thefts in last year

b. Drawing inferences about a body of data when only a part of the data is observed.(inferential statistics).
- ❖ Data from sample used to draw inferences about population

Data are numbers which can be measurements or can be obtained by counting.

Biostatistics is concerned with the interpretation of the data and the communication of information about the data.

Concerns of Biostatistics

- Biostatistics is concerned with collection, organization, summarization and analysis of *data*.

- We seek to draw *inferences* about a body of data when only a part of the data is observed.

Role of statisticians

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

2. To analyze data using proper statistical procedures and techniques.

3. To present and interpret the results to researchers and other decision makers.

Sources of data

Data are obtained from:

1. Analysis of records.

2. Surveys.

3. Counting.

4. Experiments.

5. Reports.

Research Process

Research question

Hypothesis

Identify research design

Data collection

Presentation of data

Data analysis

Interpretation of data
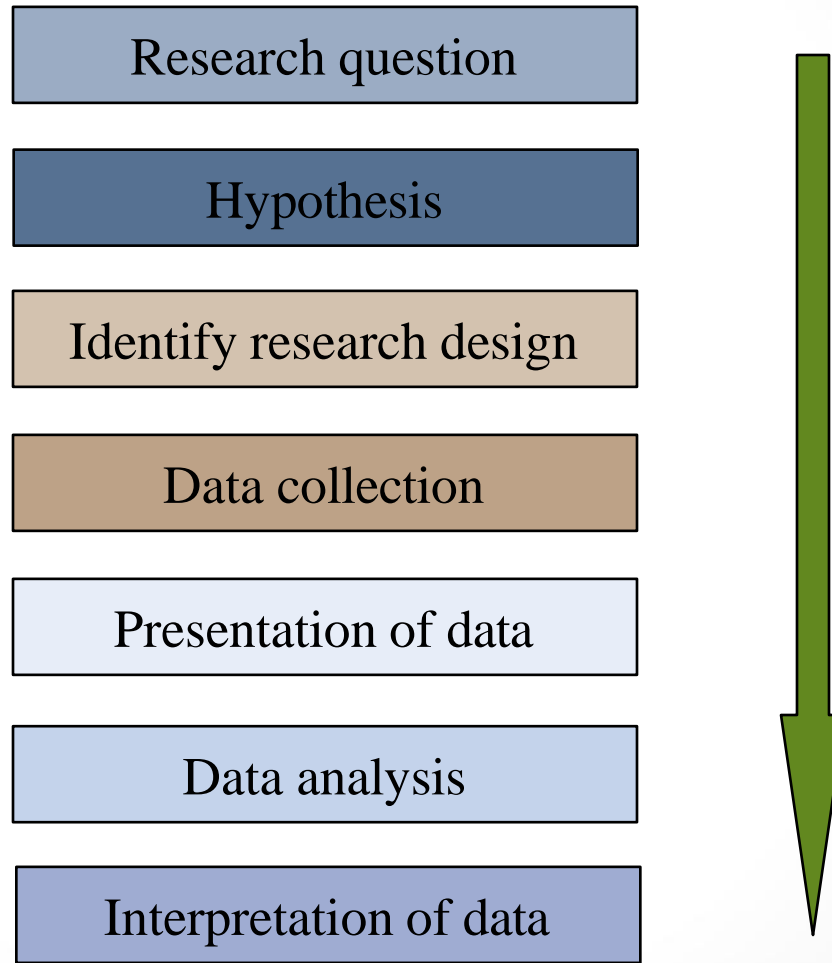
What is a Variable?
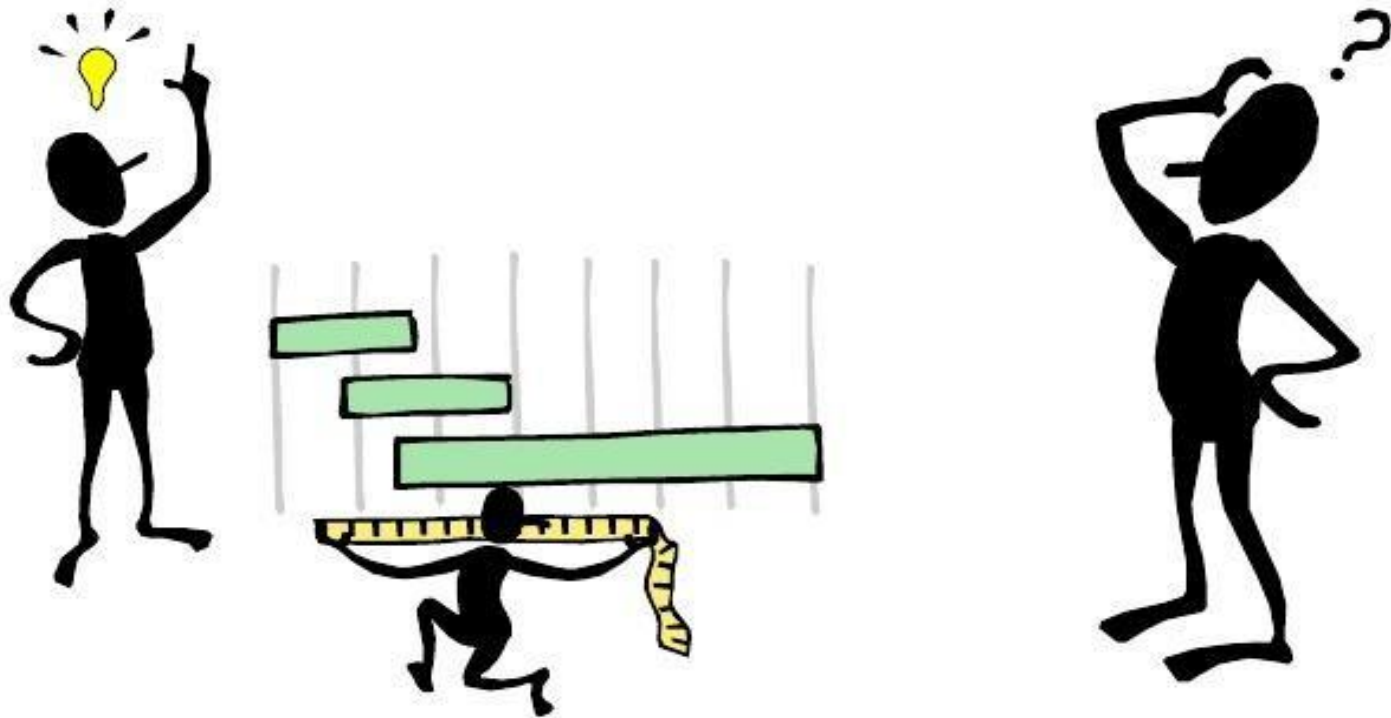
Variables

A variable is an object ,characteristic or property that can have different values.

A quantitative variable can be measured in some way. (eg. height and weight), it is called (Numerical data).

A qualitative variable is characterized by its inability to be measured but it can be sorted into categories. (eg. person belong to certain ethnic group).(Non numerical data or categorical).

Quantitative variable include :

*A discrete variable : discrete variable has gaps or interruptions in the values that it can assume. (eg. number of daily admissions to hospital which either 0,1,2,3…..etc).
*A continuous variable : a continuous variable does not have gaps in the values it can assume. Its properties are like the real numbers.(eg. height, weight and skull circumference).

Types of variables

Quantitative variables

Quantitative continuous

Quantitative discrete

Qualitative variables

Qualitative nominal

Qualitative ordinal

Independent and dependent variables

- In scientific research, we often want to study the effect of one variable on another one. For example, you might want to test whether students who spend more time studying get better exam scores.

- The variables in a study of a cause-and-effect relationship are called the independent and dependent variables.

- The independent variable is the cause. Its value is independent of other variables in your study.

- The dependent variable is the effect. Its value depends on changes in the independent variable.
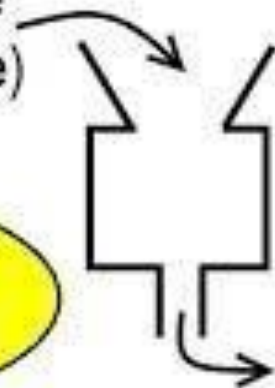
Dependent vs Independent Variable

independent variable → input variable
dependent variable → output variable
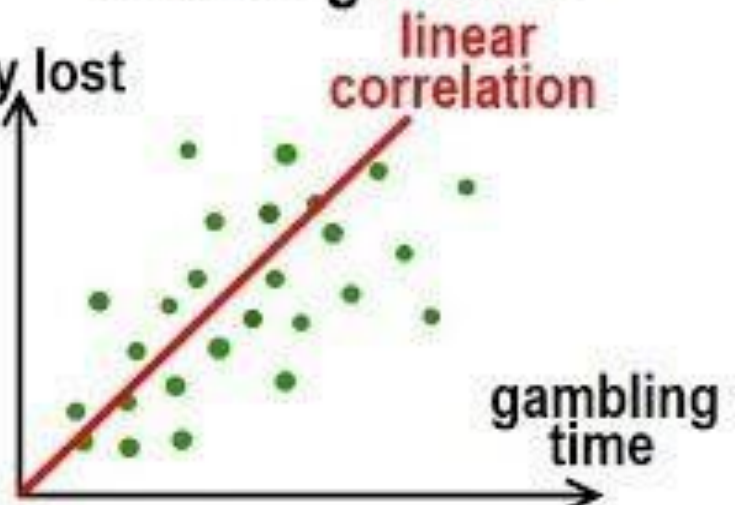
money lost compared to time gambled

gambling time = independent variable
money lost = output variable.

input variable
(gambling time)

one is the cause
the other is the effect

money lost

linear correlation

gambling time

money is lost as a result of the amount to the time gambling
output variable(money lost)

Populations and Samples

A population is the collection or set of all of the values that a variable may have.
A sample is a part of a population.

Statistics and Parameters

A statistic is a descriptive measure computed from the data of the sample.
A parameter is a descriptive measure computed from the data of the population

Statistical inference

Statistical inference is the procedure used to reach a conclusion about a population based on the information derived from a sample that has been drawn from that population.
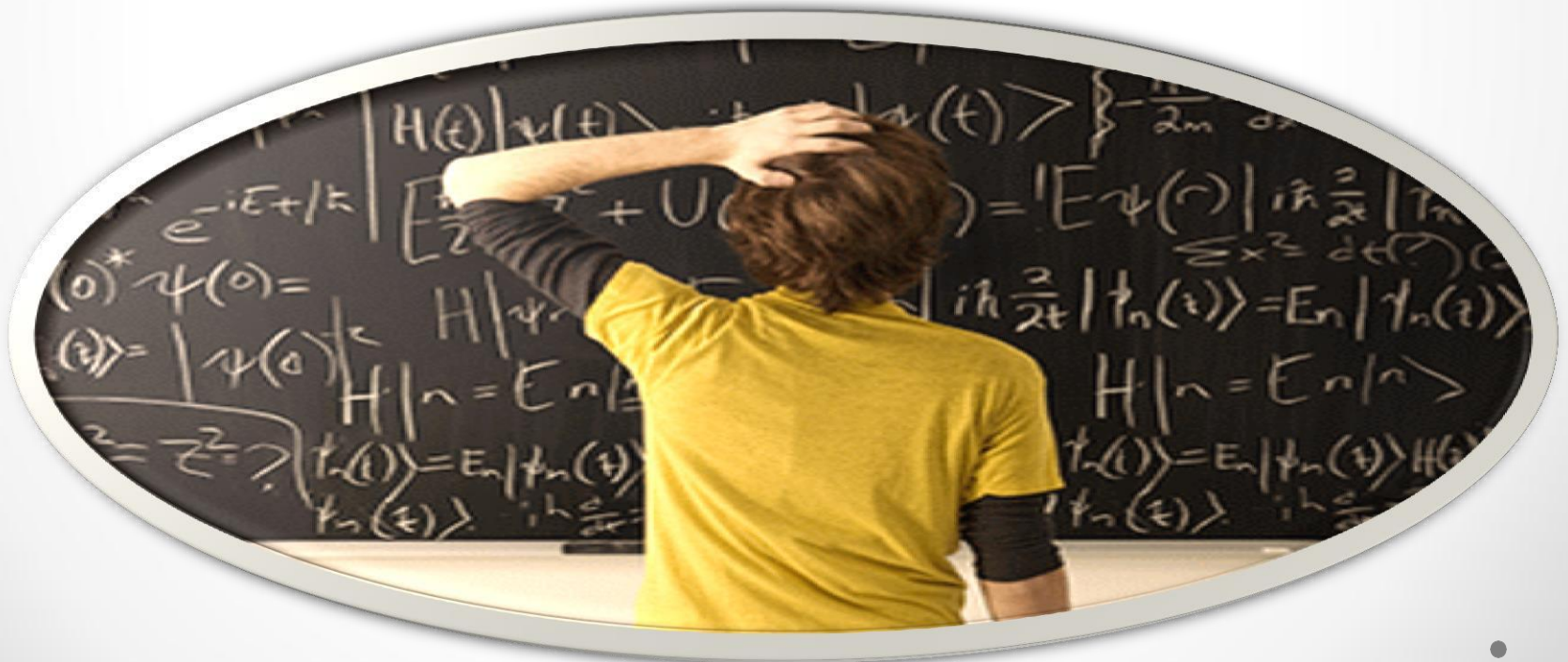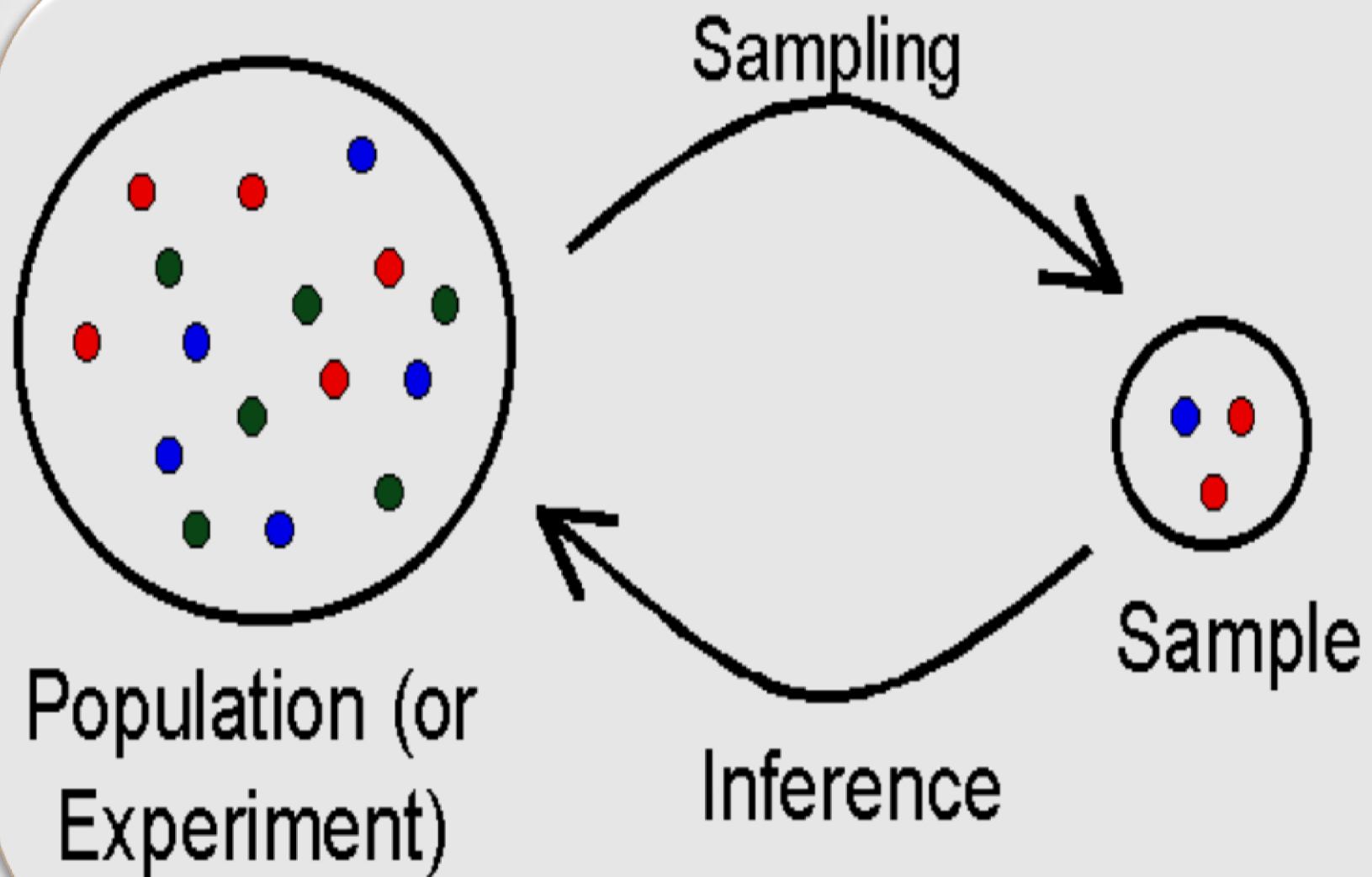
Statistical scales

The following scales used to measures statistical data:

For quantitative data	For qualitative data
a. Interval scale	a. Nominal scale
b. Ratio scale	b. Ordinal scale
	c. Dichotomous scale

Nominal scale :
Data are divided into qualitative groups such as (male/female and urban /rural areas).

Ordinal scale :
Data placed into categories that can be rank ordered (eg. grade A,B,C).

Dichotomous scale:
Type of nominal scale take only two groups (eg died/alive and failed/passed).

Interval scale:
Interval scale data are like ordinal data in that they can be placed in a meaningful order in addition they have meaningful intervals between items which can be measured.
Interval scale don't have an absolute or true zero point.(eg temperature when zero don't indicate absence of heat).

Ratio scale:
Like interval scale but have an absolute or true zero (eg. weight and blood pressure).

Differences between measurements, true zero exists	**Ratio Data**	
	↑	Quantitative Data
Differences between measurements but no true zero	**Interval Data**	
	↑	
Ordered Categories (rankings, order, or scaling)	**Ordinal Data**	
	↑	Qualitative Data
Categories (no ordering or direction)	**Nominal Data**	

Table 1.1 Examples of types of data	
Quantitative	
Continuous	**Discrete**
Blood pressure, height, weight, age	Number of children Number of attacks of asthma per week
Categorical	
Ordinal (Ordered categories)	**Nominal (Unordered categories)**
Grade of breast cancer Better, same, worse Disagree, neutral, agree	Sex (male/female) Alive or dead Blood group O, A, B, AB

Accuracy Vs Precision

Accuracy and precision
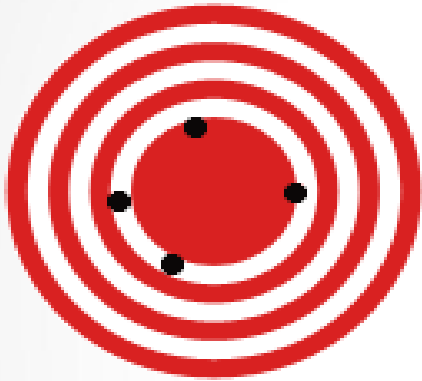
❖ <u>Accuracy</u>
   is the degree of conformity of a measured or calculated quantity to its actual (true) value.

❖ <u>Precision (reproducibility or repeatability)</u>
   is the degree to which further measurements or calculations will show the same or similar results.

Accuracy and precision

High accuracy but low precision

High precision but low accuracy

Thank you