DEFINITION OF STATISTICS

- The term STATISTICS refers to a set of mathematical procedures for organizing, summarizing, and interpreing information.

- Statistics serve two general purposed:
    1. Organize and summarize the information
    2. Help the researcher to answer the general questions that initiated the research

Population and Sample

- **Population** refers to the set of all the individuals of interest in a particular study.
  - Populations vary in size
  - The size of population is identified by the researcher
  - The population need not consist of people.
- **Sample** is a set of individuals selected from a population, usually intended to represent the population.
  - Samples can vary in size

Parameters and Statistics

- A **Parameter** is a value that describes a population

- A **Statistic** is a value that describes a sample.

Descriptive and Inferential Statistical Methods

- Descriptive Statistics are used to summarize, organize, and simplify data.
  - Tables & Graphs
  - Computing average
- Inferential Statistics are used to make general statements about a population by studying samples.
  - We draw conclusions about population parameters on the basis of sample statistics
  - However, there is usually a discrepany between a sample statistic and a population parameter.
  - It is known as sampling error.

DATA STRUCTURES, RESEARCH METHODS, AND STATISTICS

- A **VARIABLE** is a characteristic or condition that changes or has different values for different individuals. For instance height, weight, gender, SES, and so on.

- A **constant** is a characteristic or condition that does not vary but is the same for every individual

Relationships Between Variables

- Most research are conducted to examine the relationship between variables.

- In order to indicate the relationship between variable, researchers must measure the variables

The Correlational Method

- Two variables are observed to determine whether there is a relationship between them
- In correlation method, we observe two variables as they exist naturally for a set of individuals.

Experimental & Nonexperimental Methods

- Experimental method aims to indicate a cause-and-effect relationship between two variables

- Two characteristics differentiate experiments from other types of research studies:

    1. Manipulation
    2. Control

Experimental & Nonexperimental Methods

- A researcher must eliminate the confounding variables that may affect dependent variable.
- Two general categories of variables that researchers must consider:

  1. Participant Variables such as age,   gender and so on

  2. Enviromental Variables such as temperature, the time of the day etc.

Experimental & Nonexperimental Methods

- In experimental method, one variable is manipulated while other variable is observed and measured. In order to establish a cause-and-effect relationship between the two variables, the researcher try to control all other variables that may be influential on the results.

Terminology in the Experimental Method

- Independent Variable is the variable that is manipulated by the researcher.
  - It can be identified as the treatment conditions to which subjects are assigned
- Dependent Variable is the variable that is observed to assess a possible effect of the manipulation
  - In psychological research, DV is typially a measurement or score obtained for each subject.

Terminology in the Experimental Method

- An experiment often includes a condition in which the subjects do not receive any treatment. It is known as CONTROL CONDITION.

- The conndition in which the participants do receive the experimental treatment is known as EXPERIMENTAL CONDITION.

THE NONEXPERIMENTAL AND QUASI-EXPERIMENTAL METHODS

- These are not true experiments but still examine the relationship between variables by comparing groups of scores.

- Many research studies compares groups that were not created by manipulating an IV.

- In these nonexperimental studies, the variable that determines the groups is known as a **quasi-independent variable.**

VARIABLES AND MEASUREMENT

- In behavioral science research, many variables are actually hypothetical and cannot be observed directly.

- However, it is possible to observe and measure behaviors that are representative of the construct.

- External behaviors can be used to create an operational definition for the variable.

VARIABLES AND MEASUREMENT

- **Operational Definition** identifies a measurement procedure for measuring an external behavior and uses the resulting measurements as a definition and measurement of a hypothetical construct.

VARIABLES AND MEASUREMENT

- The variables in a study can be characterized by the type of values.

- **A Discrete Variables** consists of separate, indivisible categories. No values can exist between two neighboring categories. For instance, the number of legs of an animal, the number of heads, gender,

- **A Continuous Variable** consist of an infinite number of possible values fall between any two observed values. For instance, time, height, weight.

VARIABLES AND MEASUREMENT

- There are two factors regarding to continuous variables:
  - 1. When measuring a continous variable, it is very rare to obtain the identical scores for two different individuals.
  - 2. When measuring a continuous variable, each measurement category is actually an **interval** that must be defined by boundaries. These boundaries are called as **real limits.**

SCALES OF MEASUREMENT

- Several types of scales are associated with measurements.

- Distinction among the scales are important because some statistical procedures are appropriate for data collected on some scales but not on others.

- Four different scales of measurement will be examined:
  - The Nominal
  - The Ordinal
  - The Interval
  - The Ratio

SCALES OF MEASUREMENT

- A **nominal scale** incolves a set of categories that have different names. Categories are not related to each other in any systematic way. For example, academic majors, race, gender.

- It allows us to determine whether two individuals are different, but they do not identify the size and direction of the difference.

SCALES OF MEASUREMENT

- **An ordinal scale** consists of a set of categories that are organized in an ordered sequence.

- With ordinal measurements, you can determine the **direction** of difference between two individuals. However, it does **not** allow us to determine the **magnitude** of the difference between two individuals.

SCALES OF MEASUREMENT

- **An interval scale** involves ordered categories that are all intervals of exactly **the same size.** For instance, temperature in celcius.
  - With interval scale, equal differences between numbers on the scale reflect equal differences in magnitude. However, ratios of magnitudes are not meaningful.
- **An ratio scale** is an interval scale with an absolute zero.
  - **A ratio scale** has a zero point that is not arbitrary but rather is a meaningful value representing none of the variable being measured.

Statistical Notation

- Order of Mathematical Operations
  - Any calculation contained within parentheses is done first
  - Squaring (or raising to other exponents) is done second
  - Multiplying and/ or dividing is done third. A series of multiplication and/or division operations should be done in order from left to right
  - Summation using the $\sum$ notation is done next.
  - Finally any other addition and/or substraction is done.