Chapter One

The Nature of Probability and Statistics

1-1 Introduction

- Statistics is used in almost all fields of human endeavor, such as sports, public health, and education. Furthermore, it is used for analyzing and as a tool in a scientific research. Other uses of it include operation research, quality control, estimation and prediction.
- The applications of statistics are many and varied. People encounter them in everyday life, such as in reading newspapers or magazines, listening to the radio, or watching television.

1-1 Introduction

- <u>Statistics</u> is the science of conducting studies to collect, organizes, summarize, analyze, and draw conclusions from data.
- **<u>Probability</u>** is the chance of an event occurring.
- A **population** consists of all subjects that are being studied.
- A **<u>sample</u>** is a group of subjects selected from a population.
- <u>Random variables</u> have values that are determined by chance.

1-2 Descriptive and Inferential Statistics

- <u>Descriptive statistics</u> consists of the collection, organization, summarization, and presentation of data.
- Inferential statistics consists of generalizing from samples to populations, performing estimations and hypothesis testing, determining relationships among variables, and making predictions.

- Qualitative variables: are categories or numerical data that has no measure unit e.g., flight classes, departments, gender, color, student ID number, phone numbers,
- Quantitative variables: are numerical that has measure unit can be ordered or ranked, e.g., number of passengers, weight, age, temperature, number of children,

Quantitative variables can be classified into two groups:

- <u>Discrete variables</u>: values that can be counted and cannot be decimals or fractions, e.g., number of rooms in a building, number of students in Stat 110, number of children in a family,
- <u>Continuous variables</u>: values between any two specific values and can be decimals or fractions, e.g., heights, weights, temperature,

- Level of measurements can be classified into two groups:
 - <u>Nominal</u>: categories data that cannot be ordered or ranked, e.g., gender, color, departments, phone numbers....
 - <u>Ordinal</u>: categories data that can be ordered or ranked, e.g., flight classes, ranking, grade letters,



1-4 Data Collection

- There is a variety of ways to to collect data and the use of surveys is one of the most common ways which can be done by using a variety of methods. Three of the most common methods are:
 - Telephone surveys
 - Mailed questionnaire surveys
 - Personal interviews

1-5 Sampling Techniques

- Selecting <u>Random samples</u> by using chance methods or random methods.
- Researchers obtain <u>systematic samples</u> by numbering each subject of the populations and then selecting every kth number.
- Researchers select <u>stratified samples</u> by dividing the population into groups called strata according to some characteristic that is important to the study, then taking sample from each group (within groups).
- Researchers select <u>cluster samples</u> by dividing the population into groups called cluster according to some characteristic that is important to the study, then taking samples of the groups (between groups).

1-6 Observational and Experimental Studies

- In an <u>observational study</u>, the researcher observes what is happening or what has happened and tries to draw conclusions based on these observations.
- In an <u>experimental study</u>, the researcher manipulates one of the variables and tries to determine how that influences other variables.

1-6 Observational and Experimental Studies

- Statistical studies usually include one or more independent variables and one dependent variable.
 - The <u>independent variable</u> is the one that is being manipulated by the researcher.
 - The **dependent variable** is the resultant variable.