

The Nature of Probability and Statistics

Chapter 1

Outline

- 1-1 Introduction
- 1-2 Descriptive & Inferential Statistics
- 1-3 Variables & Types of Data
- 1-4 Data Collection & Sampling Techniques
- 1-5 Observational & Experimental Studies
- 1-6 Uses & Misuses of Statistics
- 1-7 Computers & Calculators
- 1-8 Summary

Section 1-1 Introduction

- Most people become familiar with probability and statistics through various media (radio, TV, Internet, newspapers, and magazines)
 - Nearly one in seven US families are struggling with bills from medical expenses even though they have health insurance
 - About 15% of men in the US are left-handed and 9% of women are left-handed
 - The median age of couples who watch Jay Leno is 48.1 years
 - Eating 10 grams of fiber a day reduces the risk of heart attack by 14%

- Statistics is used in almost ALL fields of human endeavor.
 - Sports: a statistician may keep records of the number of yards a running back gains during the football game OR number of hits a baseball player gets in a season
 - Public Health: an administrator might be concerned with the number of residents who contract a new strain of flu virus
 - Education: a researcher might want to know if new teaching methods are better than old ones.
 - Quality Control
 - Prediction

Why Should We Study Statistics?

- To be able to read and understand various statistical studies performed in their fields—requires a knowledge of the vocabulary, symbols, concepts, and statistical procedures
- To conduct research in their fields—requires ability to design experiments which involves collection, analysis, and summary of data
- To become better consumers and citizens

In this chapter, we will introduce the basic concepts of probability and statistics by answering the following:

1. What are the branches of statistics?
2. What are data?
3. How are samples selected?

Section 1-2 Descriptive & Inferential Statistics

- Objectives
 - Demonstrate a knowledge of statistical terms
 - Differentiate between the two branches of statistics

What is Statistics?

- Statistics is much more than mere averages and colorful graphs
- In a broad sense, statistics is the science of conducting studies to collect, organize, summarize, analyze, and draw conclusions from data.

“Language of Statistics”

- **Variable:** a characteristic or attribute that can assume different values
- Variables whose values are determined by chance are called **random variables**
- **Data:** values (measurements or observations) that variables can assume
- Data is the information collected – the group of information forms a **data set**
- Each value in the set is a **data point or datum**

Two Branches of Statistics

- **Descriptive Statistics** involves the collection, organization, summarization, and presentation of data
- Chapters 2 & 3
- **Inferential Statistics** consists of generalizing from samples to populations, performing estimations, and hypothesis tests, determining relationships among variables, and making predictions
- Chapter 10

Population vs Sample

Population

- ALL subjects (human or otherwise) that are being studied
- Examples
 - All citizens of the United States
 - All students enrolled at GHC during Fall 2009
 - The governors of the 50 United States

Sample

- “Small” group of subjects (human or otherwise) selected from the population
- Examples
 - 1000 adult Americans surveyed to determine if he/she favors the legalization of marijuana
 - 21 GHC students in Mr. Griffin’s statistics class surveyed to determine height

Section 1-3 Variables & Types of Data

- Objectives:
 - Identify types of data
 - Identify the measurement level for each variable

Variable Classifications

Qualitative Variables

- Can be placed into distinct categories, according to some characteristic or attribute (typically non-numeric)
- Examples:
 - Eye Color
 - Gender
 - Religious Preference
 - Yes/No

Quantitative Variables

- Numerical
- Can be ordered or ranked
- Examples:
 - Heights
 - Weights
 - Pulse Rate
 - Age
 - Body Temperatures
 - Credit Hours

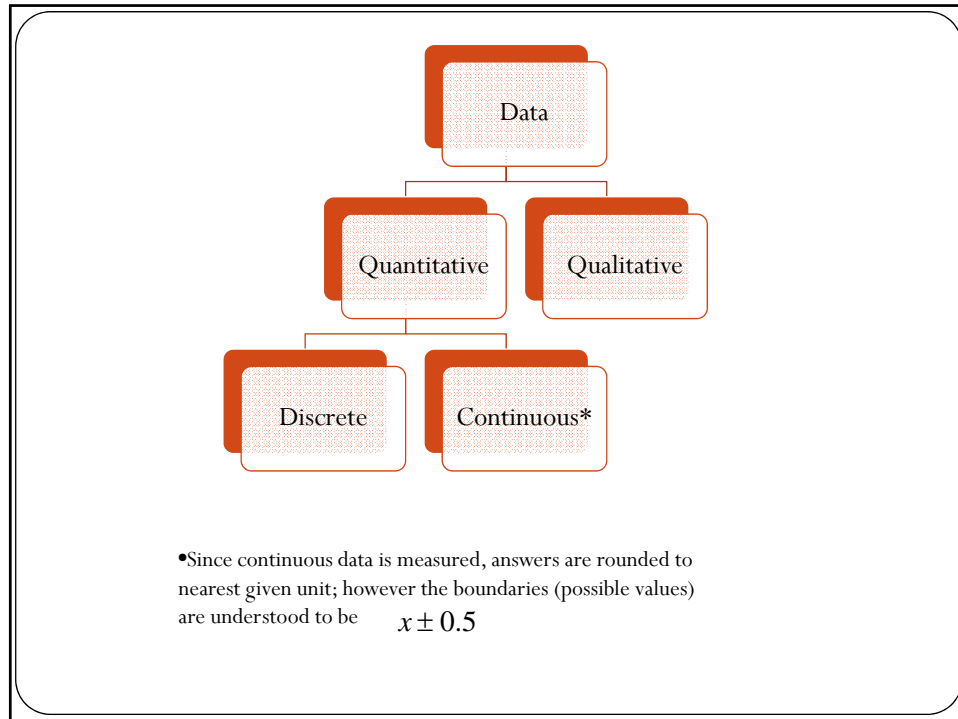
Quantitative Variables

Discrete Variables

- Can be assigned values such as 0, 1, 2, 3
- “Countable”
- Examples:
 - Number of children
 - Number of credit cards
 - Number of calls received by switchboard
 - Number of students

Continuous Variables

- Can assume an infinite number of values between any two specific values
- Obtained by measuring
- Often include fractions and decimals
- Examples:
 - Temperature
 - Height
 - Weight



Another Variable Classification

- Variables can also be classified according to how they are categorized, counted, or measured ---called measurement scales
- Examples
 - Area of residence
 - Ranks (1st, 2nd, 3rd, ...)
 - Measurements (heights, IQ, temperatures)

Measurement Scales

Nominal

- Classifies data into mutually exclusive (nonoverlapping) exhausting categories
- No order or ranking can be imposed
- Examples:
 - Gender
 - Zip Codes
 - Political Affiliation
 - Religion

Ordinal

- Classifies data into categories
- RANKING, but precise differences between ranks do not exist
- Examples:
 - Letter grades (A, B, C, D, F)
 - Judging contest (1st, 2nd, 3rd)
 - Ratings (Above Avg, Avg, Below Avg, Poor)

Measurement Scales

Interval

- Ranks data
- PRECISE DIFFERENCES between units of measure do exist
- No meaningful zero
- Examples:
 - Temperature (0° does not mean no heat at all)
 - IQ Scores (0 does not imply no intelligence)

Ratio

- Ranks data
- Precise differences exist
- TRUE ZERO exist
- Examples:
 - Height
 - Weight
 - Area
 - Number of phone calls received
 - Salary