Unit 1: Introduction

Statistics 571: Statistical Methods
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What is Statistics?

• Statistics
  – Science of collecting and analyzing data for the purpose of drawing conclusions and making decisions
  – Provides data collection methods to reduce biases, and analysis methods to identify patterns and draw inference from noisy data

• Statistical tasks
  – Collecting data
  – Summarizing and exploring data
  – Drawing conclusions and making decisions based on data
Statistical Concepts and Terms

• Observational studies such as surveys
• Experimental studies
• Descriptive statistics or exploratory data analysis
  – Summarizes data
• Inferential statistics or confirmatory data analysis
  – Fitting models to data
  – Drawing conclusions and making decisions
• A population is a collection of all units of interest
• A sample is a subset of a population that is actually observed
• A variable is a measurable property or attribute associated with each unit of a population
Statistical Concepts and Terms

- A *parameter* is a numerical characteristic of a population defined for each variable of interest.
- A *statistic* is a numerical characteristic of a sample defined for each variable of interest.
- Statistics are used to infer the values of parameters.
- A *random sample* gives an equal chance to every group of unit of the population to enter the sample.
  - One form of unbiased sample.
- In probability we assume that the population and its parameters are known and compute the probability of drawing a particular sample.
- In statistics we assume that population parameters are unknown and use a sample to infer their value.
Statistical Concepts and Terms

- Different samples give different estimates of population parameters (called *sampling variability*).
- Sampling variability leads to sampling error.
- One goal of statistic is to quantify sampling error.
- Probability is deductive.
- Statistics is inductive.

*Figure 1.1* Relationship between Probability and Statistics*