Data Collection & Sampling Techniques

Section 1-4

Objectives

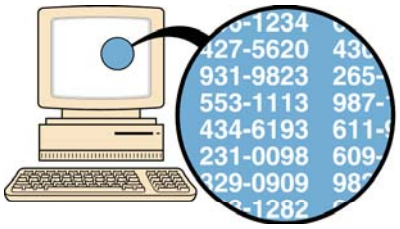
- Identify the five basic sample techniques

Data Collection

- In research, statisticians use data in many different ways.
- Data can be used to describe situations.
- Data can be collected in a variety of ways, **BUT** if the sample data is not collected in an appropriate way, the data may be so completely useless that no amount of statistical torturing can salvage them.

Basic Methods of Sampling

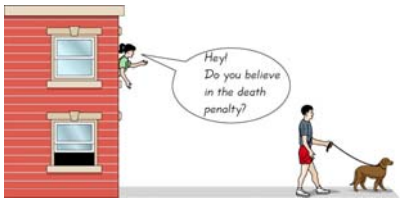
- Random Sampling
  - Selected by using chance or random numbers
  - Each individual subject (human or otherwise) has an equal chance of being selected
  - Examples:
    - Drawing names from a hat
    - Random Numbers



Basic Methods of Sampling

- Systematic Sampling
  - Select a random starting point and then select every k^{th} subject in the population
  - Simple to use so it is used often

Basic Methods of Sampling

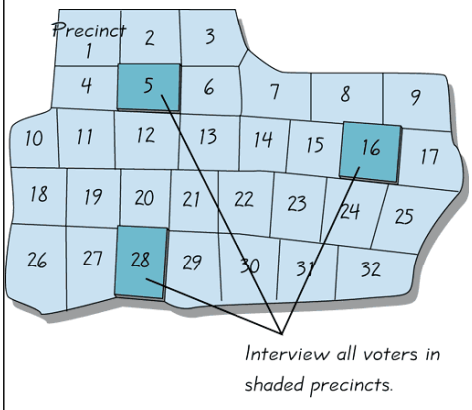


- Convenience Sampling
  - Use subjects that are easily accessible
  - Examples:
    - Using family members or students in a classroom
    - Mall shoppers

Basic Methods of Sampling

- Stratified Sampling
  - Divide the population into at least two different groups with common characteristic(s), then draw SOME subjects from each group (group is called strata or stratum)
  - Basically, randomly sample each subgroup or strata
  - Results in a more representative sample

Basic Methods of Sampling



- Cluster Sampling
  - Divide the population into groups (called clusters), randomly select some of the groups, and then collect data from ALL members of the selected groups
  - Used extensively by government and private research organizations
  - Examples:
    - Exit Polls

Observational and Experimental Studies

Section 1-5

Objectives

- Explain the difference between an observational and an experimental study

Types of Experiments

- Observational Studies
  - The researcher merely observes what is happening or what has happened in the past and tries to draw conclusions based on these observations
  - No interaction with subjects, usually
  - No modifications on subjects
  - Occur in natural settings, usually
  - Can be expensive and time consuming
  - Example:
    - Surveys---telephone, mailed questionnaire, personal interview

More on Surveys

Telephone	Mailed Questionnaire	Personal Interviews
Less costly than personal interviews	Cover a wider geographic area than telephone or pi	Provides in-depth responses
Subjects are more candid than if face to face	Less expensive than telephone or pi	Interviewers must be trained
Challenge---some subjects do not have phone, will not answer when called, or hang up (refusal to participate)	Subjects remain anonymous	Most costly of three
Tone of voice of interviewer may influence subjects' responses	Challenge –low number of subjects' respond, inappropriate answers to questions, subjects have difficulty reading/understanding the questions	Interviewer may be biased in his/her selection of subjects

Types of Experiments

- Experimental Studies
  - The researcher manipulates one of the variables and tries to determine how the manipulation influences other variables
  - Interaction with subject occurs, usually
  - Modifications on subject occurs
  - May occur in unnatural settings (labs or classrooms)
  - Example:
    - Clinical trials of new medications ,treatments, etc.

Uses and Misuses of Statistics

Section 1-6

Objectives

- Explain how statistics can be used and misused

Uses of Statistics

- Describe data
- Compare two or more data sets
- Determine if a relationship exists between variables
- Test hypothesis (educated guess)
- Make estimates about population characteristics
- Predict past or future behavior of data

Use of statistics can be impressive to employers.

- Almost all fields of human endeavor benefit from the application of statistical method; however, the misuses of statistics are just as abundant, if not more so!

- "There are three types of lies---lies, damn lies, and statistics" Benjamin Disraeli
- "Figures don't lie, but liars figure"
- "Statistics can be used to support anything ---especially statisticians" Franklin P. Jones

Sources of Misuse

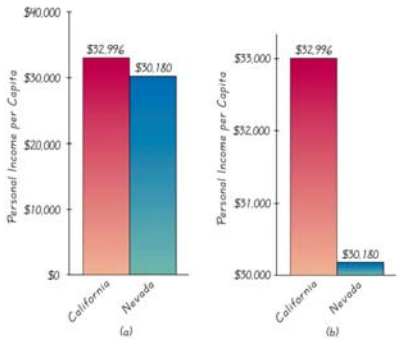
- There are two main sources of misuse of statistics:
  - An agenda on the part of a dishonest researcher
  - Unintentional errors on part of a researcher
    - Basically, good old fashioned mistakes

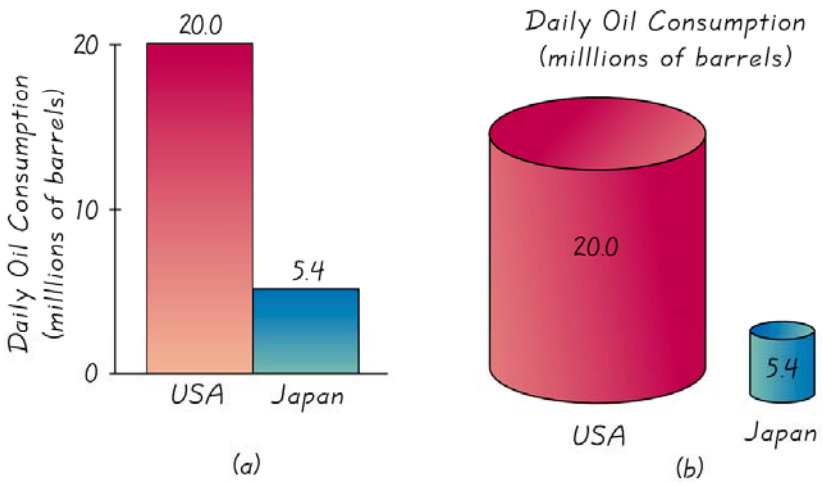
Misuses of Statistics

- Samples
  - Voluntary-response sample (or self-selected sample)
    - One in which the subjects themselves decide whether to be included---creates built-in bias
      - Telephone call-in polls (radio)
      - Mail-in polls
      - Internet polls
  - Small Samples
    - Too few subjects used
  - Convenience
    - Not representative since subjects can be easily accessed

Misuses of Statistics

- Graphs
  - Can be drawn inappropriately leading to false conclusions
    - Watch the "scales"
    - Omission of labels or units on the axes
    - Exaggeration of one-dimensional increase by using a two-dimensional graph





Misuses of Statistics

- Survey Questions
  - Loaded Questions---unintentional wording to elicit a desired response
  - Order of Questions
  - Nonresponse (Refusal)—subject refuses to answer questions
  - Self-Interest ---Sponsor of the survey could enjoy monetary gains from the results

Misuses of Statistics

- Missing Data (Partial Pictures)
  - Detached Statistics ---no comparison is made
  - Percentages --
- Precise Numbers
  - People believe this implies accuracy
- Implied Connections
  - Correlation and Causality –when we find a statistical association between two variables, we cannot conclude that one of the variables is the cause of (or directly affects) the other variable