Review

• Observational study and Experiment
• Individuals, population and sample
• Sample survey and Census
Review

• Observational Study
  – Observes individuals and measures variables of interest but does not attempt to influence the responses.

• Experiment
  – imposes some treatment on individuals in order to observe their responses and Studies whether the treatment causes change in the response.
Review

- **Individuals**
  - Objects described by a set of data.

- **Variable**
  - Any characteristic of an individual.

- **Population**
  - Entire group of individuals.

- **Sample**
  - The part of the population from which we actually collect information.
Review

• Sample Survey
  – An observational study, choose a sample from a specific population and uses the sample to get information about the entire population.

• Census
  – Attempts to measure every individual in a population
Chapter 2

Samples, Good and Bad
Write-in interview

Popular magazines often contain surveys that ask their readers to answer questions about hot topics in the news.

Do you think the responses the magazines receive are representative of public opinion? Explain why or why not.
Call-in interview

Cable News Network (CNN) often asks its viewers to call the network with their opinions on certain political issues, like whether or not they favor current foreign policy.

Do you think the results of these polls represent the feelings of the general population? Do you think they represent the feelings of all those watching CNN at the time? Explain.
Interview at the mall

Manufacturers and advertising agencies often use interviews at shopping malls to gather information about the habits of consumers and the effectiveness of ads. A sample of mall shoppers is fast and cheap.

Do you think the results represent the whole U.S. population? Explain.
Bad Sampling Plans

• The design of a statistical study is biased if it systematically favors certain outcomes.
• Selection of whichever individuals are easiest to reach is called convenience sampling.
• A voluntary response sample chooses itself by responding to a general appeal. Write-in or call-in opinion polls are examples of voluntary response samples.
• Convenience samples and voluntary response samples are often biased.
Bad Sampling Plans

• Convenience sampling
  – selecting individuals who are easiest to reach

• Voluntary response sampling
  – allowing individuals to choose to be in the sample

❖ Both of these techniques are biased
  – systematically favor certain outcomes
Convenience Sampling

• Sampling mice from a large cage to study how a drug affects physical activity
  – lab assistant reaches into the cage to select the mice one at a time until 10 are chosen

• Which mice will likely be chosen?
  – could this sample yield biased results?
Voluntary Response

• Ann Landers once asked the readers of her advice column, “If you had it to do over again, would you have children?” Out of nearly 10,000 responses almost 70% said “NO!”.

• Can it be true that 70% of parents regret having children? Of course, not!

• It is most likely that people feeling strongly about an issue will take the trouble to respond.
Simple Random Sampling

• Each individual in the population has the same chance of being chosen for the sample
• Each group of individuals in the population of the required size \( (n) \) has the same chance of being the sample actually selected

• Random selection:
  – “drawing names out of a hat”
  – random number table (see Table A on pg.597 of textbook)
  – computer software
Simple Random Sampling

• John’s small accounting firm serves 30 business clients. John wants to interview a sample of 5 clients to find ways to improve client satisfaction. To avoid bias, he chooses an SRS of size 5.
• **Step 1: Label** Give each client a numerical label, using as few digits as possible.

  01, 02, 03, ..., 28, 29, 30
Step 2: Table: Enter Table A anywhere and read two-digit groups. Suppose we enter at line 130, which is

69051  64817  87174  09517  84534  06489  87201  97245

The first 10 two-digit groups in this line are

69  05  16  48  17  87  17  40  95  17
We ignore all two digit groups greater than 30

\[05 \ 16 \ 17 \ 17 \ 17\]

The clients labeled 05, 16, and 17 go into the sample.
But we need two more! Write 10 more two-digit groups from line 130

\[84 \ 53 \ 40 \ 64 \ 89 \ 87 \ 20 \ 19 \ 72 \ 45\]

Disregard the numbers greater than 30, leaving us with

\[2019\]

So clients 20 and 19 go into the sample as well.
Hence, the sample consists of clients labeled 05, 16, 17, 19, and 20:

Bailey Trucking
JL Records
Johnson Commodities
MagicTan
Liu’s Chinese Restaurant
Simple Random Sample (SRS)

• Step 1
  – **Label.** Assign a numerical label to every individual in the population. Be sure that all labels have the same number of digits if you plan to use a table of random digits.

• Step 2
  – **Software of table.** Use random digits to select labels at random.
A Gallup Poll

A Gallup Poll on sex and violence on TV began with the question "In your view, does the entertainment industry need to make a serious effort to reduce the amount of sex and violence in its movies, TV shows and so on, or don’t you think they need to do this?"

The press release reported that the poll found “75% of Americans saying the industry”
A Gallup Poll

The press release reported that the poll found “75% of Americans saying the entertainment industry should make a serious effort to reduce the amount of sex and violence”

These results are based on telephone interviews with a randomly selected national sample of 1008 adults, 18 years and older, conducted 6/8/2004.

Can we trust this result?
Key Concepts

• Bias
• Convenience Sampling
• Voluntary Response Sampling
• Simple Random Sampling
Exercise 2.1

Letters to the editor. You work for a local newspaper that has recently reported on a bill that would make it easier to create charter schools in the state. You report to the editor that 201 letters have been received on the issue, of which 171 oppose the legislation.

“I’m surprised that most of our readers oppose the bill. I thought it would be quite popular,” says the editor.

Are you convinced that a majority of the readers oppose the bill? How would you explain the statistical issue to the editor?
Exercise 2.7

• Design your own bad sample. Your college wants to gather student opinion about parking for students on campus. It isn’t practical to contact all students.

a) Give an example of a way to choose a sample of students that is poor practice because it depends on voluntary response.

b) Give another example of a bad way to choose a sample because that doesn’t use voluntary response.
Exercise 2.12

• An election day sample. You want to choose an SRS of 20 of a city’s 480 voting precincts for special voting-fraud surveillance on election day.

a) Explain clearly how you would label the 480 precincts. How many digits make up each of your labels? What is the greatest number of precincts you could label using this number of digits?

b) Use Table A to choose the SRS, and list the labels of the precincts you selected. Enter Table A at line 107.
Exercise 2.16

• How do random digits behave. Which of the following statements are true of a table of random digits, and which are false?

a) Each pair of digits has chance 1/100 of being 33.

b) There are exactly four 4s in each row of 40 digits.

c) The digits 99999 can never appear as a group, because this pattern is not random.
Exercise 2.19

- **Racial profiling and traffic stops.** The Denver Police Department wants to know if Hispanic residents of Denver believe that the police use racial profiling when making traffic stops. A sociologist prepares several questions about the police. The police department chooses and SRS of 200 mailing addresses in predominantly Hispanic neighborhoods and sends a uniformed Hispanic police officer to each address to ask the questions to an adult living there.

a) What are the population and the sample?

b) Why are the results likely to be biased even though the sample is an SRS?
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