Simple Random Sampling

Lecture 7
Section 2.5

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Mon, Sep 5, 2011

Outline

1. Homework Review
2. Introduction
3. Simple Random Samples
4. Selecting Samples
   - On the TI-83
   - Setting the Seed
5. Assignment
6. Answers to Even-numbered Problems

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Homework Review

Exercise 7, p. 97

To estimate the average age of all adult members of a club, a researcher randomly selects 100 adult members of the club, contacts them, and asks for their age. The average of the reported ages was 34 years.

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- Is 34 the value of a parameter or a statistic?

Homework Review

Exercise 7, p. 97

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- Is 34 the value of a parameter or a statistic?

  It is a statistic.

Homework Review

Solution

- Examining the recorded ages from this survey the researcher found that there were a large number of adults reporting ages of 29, 35, and 39 years old and only a very few reporting an age of 30 or 40. Suppose that the reported 39-year-olds have been “39” for a good many years. This would be an example of what type of bias?

Homework Review

Solution

- Examining the recorded ages from this survey the researcher found that there were a large number of adults reporting ages of 29, 35, and 39 years old and only a very few reporting an age of 30 or 40. Suppose that the reported 39-year-olds have been “39” for a good many years. This would be an example of what type of bias?

  Response bias.

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Introduction

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- By this method, do all *individuals* have equal chances?
- Do all *samples* of size 3 have equal chances?

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Simple Random Sample

Definition (Simple random sample)

A simple random sample of size n is a random sample that is selected in such a way that all *samples* of size n have the same chance of being selected.

Simple Random Sample

- A consequence of this is that all individuals in the population have the same chance of being selected for the sample.

Simple Random Sample

Example (Simple Random Sample)

- For example, let the population be {Alex, Bryan, Craig, Matt, Spencer, Zach}.
- The possible samples of size 3 are

{A, B, C}	{A, C, M}	{A, M, Z}	{B, C, Z}	{C, M, S}
{A, B, M}	{A, C, S}	{A, S, Z}	{B, M, S}	{C, M, Z}
{A, B, S}	{A, C, Z}	{B, C, M}	{B, M, Z}	{C, S, Z}
{A, B, Z}	{A, M, S}	{B, C, S}	{B, S, Z}	{M, S, Z}

- Choose one of the above samples at random.
- What is each person's chance of being in the sample?

Simple Random Sample

- However, that does not work the other way around.
- Just because a sampling method guarantees that all individuals in the population have the same chance of being in the sample, it does not mean that the sample is a simple random sample.

Simple Random Sample

Example (Simple Random Sample)

- Toss a coin to choose one of the following samples.
- What is each person's chance of being in the sample?

{A, B, C} {M, S, Z}

Simple Random Sample

Example (Simple Random Sample)

- Toss a coin to choose one of the following samples.
- What is each person's chance of being in the sample?
- What is the probability of getting the sample {A,C,Z}?

{A, B, C} {M, S, Z}

Simple Random Sample

- It turns out that if we select individuals one at a time, *with all individuals equally likely at each step*, then all samples are equally likely.
- Thus, our sample will be a simple random sample.

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Selecting a Simple Random Sample

Select a Sample of Size n

- Given a population of size N,
  - Number the members of the population from 1 to N.
  - Use a random number generator (such as on a calculator) to generate n random integers from 1 to N.

Sampling With or Without Replacement

Definition (Sampling with replacement)

When we sample with replacement, a selected item may be selected again. That is, repetitions are allowed.

Definition (Sampling without replacement)

When we sample without replacement, a selected item may not be selected again. That is, repetitions are not allowed.

- Sampling may be done with or without replacement.

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TI-83: Selecting a Sample

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1. Press `MATH`.
2. Use the arrow keys to highlight the `PRB` menu title.
3. Press 5 to select `randInt` (item #5).
4. Enter `randInt(1,100)`. (E.g., if $N = 100$.)
5. Press `ENTER`. A random number appears.
6. Press `ENTER` repeatedly for more random numbers.

- If the sampling is done without replacement, then repetitions should be discarded.

Example

- Let the population be the students in this class.
- Then $N = 18$.
- Number the members 1 - 18 in alphabetical order.
- We will choose a sample of size $n = 6$.
- What is each individual's chance of being in the sample?

Practice

- Use `randInt(1,18)` to select 6 students.

TI-83: Getting a Set of Random Numbers

- To get several random integers at once, possibly with repetitions, use `randInt` with a third parameter, representing the sample size.
- For example, to get 6 random integers from 1 to 18, enter `randInt(1,18,6)`.
- However, this may include repetitions.

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TI-83: Setting the Seed

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1. Enter a seed (choose any number whatsoever).
2. Press `STO`. An arrow appears in the display.
3. Press `MATH`, highlight `PRB`, select `rand` (item #1).
4. Press `ENTER`. The seed is now set.

- In general practice, this is not done.
- We do it only to "synchronize" our calculators so that we will all get the same answer.

Practice

Practice

- Set the seed to 157 (an arbitrary choice).
- Then select a random sample of size 6 from the population of the students in this class.

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Assignment

Homework

- Read Section 2.5, pages 98 - 106.
- Let's Do It! 2.4.
- Page 107, exercises 13, 15 - 18.

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Answers to Even-numbered Problems

Page 107, Problems 16, 18

2.16 (a) $\frac{12}{100}$.
(b) $77, 51, 72, 40, 71, 42, 17, 34, 62, 23, 35, 12$.

2.18 Label the sites 1 through 80. The sites selected at random are $50, 66, 43, 49, 74$.