Simple Random Sampling

Lecture 7
Section 2.5

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Outline

Review Quiz

Example (Review Quiz)

1. Researchers select all the patients that are suffering from depression at a large hospital for their study.

   This could be an example of

   (a) Selection bias.
   (b) Non-response bias.
   (c) Response bias.
   (d) Experimenter bias.

Review Quiz

Example (Review Quiz)

2. Patients agree (or disagree) to be a part of a study to test the effectiveness of a new treatment.

   This could be an example of

   (a) Selection bias.
   (b) Non-response bias.
   (c) Response bias.
   (d) Experimenter bias.

Review Quiz

Example (Review Quiz)

3. Patients join either a treatment group that receives the new treatment and a control group that does not receive the treatment.

   This could be an example of

   (a) Selection bias.
   (b) Non-response bias.
   (c) Response bias.
   (d) Experimenter bias.

Review Quiz

Example (Review Quiz)

4. After two weeks, the researchers check each patient to see how well they are doing.

   This could be an example of

   (a) Selection bias.
   (b) Non-response bias.
   (c) Response bias.
   (d) Experimenter bias.

Review Quiz Answers

Example (Review Quiz Answers)

1. (a) Selection bias.
2. (b) Non-response bias.
3. (c) Response bias.
4. (d) Experimenter bias.

Outline

Introduction

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- Is the sample a random sample?
- Is this a good method?

Outline

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 {Armstrong, Bean, Craycroft, Davis, Freston, Garner}.
- The possible samples of size 3 are

{A, B, C}	{A, C, D}	{A, D, G}	{B, C, G}	{C, D, F}
{A, B, D}	{A, C, F}	{A, F, G}	{B, D, F}	{C, D, G}
{A, B, F}	{A, C, G}	{B, C, D}	{B, D, G}	{C, F, G}
{A, B, G}	{A, D, F}	{B, C, F}	{B, F, G}	{D, F, G}

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

Outline

Simple Random Sample

- For larger populations, the previous method is not practical.
- For example, if $N = 100$ and $n = 6$, then there are 1,192,052,400 different possible samples.
- However, 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.

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.

Outline

TI-83: Selecting a Sample

TI-83: Selecting a Sample

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.

Outline

TI-83: Setting the Seed

TI-83: Setting the Seed

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.

Outline

Simple Random Sample

Example (Simple Random Sample)

- 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.
- For example, suppose we toss a coin to choose one of the following samples.

{A, B, C} {D, F, G}

Simple Random Sample

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What is each person's chance of being in the sample?

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What is the probability of getting the sample {A,B,C}?

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What is the probability of getting the sample {A,B,C}?

What is the probability of getting the sample {A,B,D}?

Outline

Assignment

Homework

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