Simple Random Samples
Section 8.3
Lecture 17

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Outline

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Simple Random Samples

Definition

A simple random sample of size n is a sample that is chosen in such a way that every *set* of n individuals in the population has the same chance of being chosen.

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A simple random sample of size n is a sample that is chosen in such a way that every *set* of n individuals in the population has the same chance of being chosen.

- In a simple random sample, it turns out that all individuals have the same chance of being in the selected sample.
- However, a method that simple guarantees all *individuals* the same chance of being selected does not necessarily produce a simple random sample.

example

Example (Is this a simple random sample?)

- I want to take a sample of 10 people from a group of 20 people.

example

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- I want to take a sample of 10 people from a group of 20 people.
- I divide the 20 people into two groups of 10 and label them Group A and Group B.

example

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- I want to take a sample of 10 people from a group of 20 people.
- I divide the 20 people into two groups of 10 and label them Group A and Group B.
- I toss a coin.

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- I want to take a sample of 10 people from a group of 20 people.
- I divide the 20 people into two groups of 10 and label them Group A and Group B.
- I toss a coin.
  - If it lands heads, I choose Group A.

example

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example

Example (Is this a simple random sample?)

- I want to take a sample of 10 people from a group of 20 people.
- I divide the 20 people into two groups of 10 and label them Group A and Group B.
- I toss a coin.
  - If it lands heads, I choose Group A.
  - If it lands tails, I choose Group B.
- Do all individuals have the same chance of being in the sample?

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Example (Is this a simple random sample?)

- I want to take a sample of 10 people from a group of 20 people.
- I divide the 20 people into two groups of 10 and label them Group A and Group B.
- I toss a coin.
  - If it lands heads, I choose Group A.
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- Do all individuals have the same chance of being in the sample?
- Is this a simple random sample?

example

Example (Is this a simple random sample?)

- I want to take a sample of 10 people from a group of 20 people.
- I divide the 20 people into two groups of 10 and label them Group A and Group B.
- I toss a coin.
  - If it lands heads, I choose Group A.
  - If it lands tails, I choose Group B.
- Do all individuals have the same chance of being in the sample?
- Is this a simple random sample?
- Why not?

Simple Random Sample

Example (Simple Random Sample)

- Let the population be $\{A, B, C, D, E, F\}$ (size 6).

Simple Random Sample

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- Let the population be $\{A, B, C, D, E, F\}$ (size 6).
- I want a simple random sample of size 3.

Simple Random Sample

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- Let the population be $\{A, B, C, D, E, F\}$ (size 6).
- I want a simple random sample of size 3.
- The possible samples of size 3 are

$\{A, B, C\}$	$\{A, C, D\}$	$\{A, D, F\}$	$\{B, C, F\}$	$\{C, D, E\}$
$\{A, B, D\}$	$\{A, C, E\}$	$\{A, E, F\}$	$\{B, D, E\}$	$\{C, D, F\}$
$\{A, B, E\}$	$\{A, C, F\}$	$\{B, C, D\}$	$\{B, D, F\}$	$\{C, E, F\}$
$\{A, B, F\}$	$\{A, D, E\}$	$\{B, C, E\}$	$\{B, E, F\}$	$\{D, E, F\}$

Simple Random Sample

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$\{A, B, D\}$	$\{A, C, E\}$	$\{A, E, F\}$	$\{B, D, E\}$	$\{C, D, F\}$
$\{A, B, E\}$	$\{A, C, F\}$	$\{B, C, D\}$	$\{B, D, F\}$	$\{C, E, F\}$
$\{A, B, F\}$	$\{A, D, E\}$	$\{B, C, E\}$	$\{B, E, F\}$	$\{D, E, F\}$

- Choose one of the above samples at random.

Simple Random Sample

Example (Simple Random Sample)

- Let the population be $\{A, B, C, D, E, F\}$ (size 6).
- I want a simple random sample of size 3.
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$\{A, B, D\}$	$\{A, C, E\}$	$\{A, E, F\}$	$\{B, D, E\}$	$\{C, D, F\}$
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$\{A, B, F\}$	$\{A, D, E\}$	$\{B, C, E\}$	$\{B, E, F\}$	$\{D, E, F\}$

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

Outline

Selecting a 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 a class of 20 students.
- Then $N = 20$.
- Number the members 1 - 20 in alphabetical order (or any order).
- We will choose a sample of size $n = 6$.
- What is each individual's chance of being in the sample?

Practice

- Use `randInt(1,20)` 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 20, enter `randInt(1,20,6)`.
- 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 the class of 20.

Outline

Assignment

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- Read Sections 8.1, 8.2, 8.3.
- Apply Your Knowledge: 1, 3, 4, 5.
- Check Your Skills: 17, 18, 20.
- Exercises 26, 27, 29 (use the TI-83).