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5 Assignment
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.
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.
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.
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.
Example (Review Quiz Answers)

1. (a) Selection bias.
2. (b) Non-response bias.
3. (c) Response bias.
4. (d) Experimenter bias.
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5. Assignment
Suppose I wanted to select a random sample of 4 students from this class.
Suppose I wanted to select a random sample of 4 students from this class.

I start in the front left corner and toss a coin.
- Heads, that student is selected.
- Tails, he is not selected.
Suppose I wanted to select a random sample of 4 students from this class.

I start in the front left corner and toss a coin.
  - Heads, that student is selected.
  - Tails, he is not selected.

I move on to the next student behind him and use the same rule.
Suppose I wanted to select a random sample of 4 students from this class.

I start in the front left corner and toss a coin.
- Heads, that student is selected.
- Tails, he is not selected.

I move on to the next student behind him and use the same rule.

I continue in this manner, row by row, until I have 4 students.
Suppose I wanted to select a random sample of 4 students from this class.

I start in the front left corner and toss a coin.
- Heads, that student is selected.
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I move on to the next student behind him and use the same rule.
I continue in this manner, row by row, until I have 4 students.
Is the sample a random sample?
Suppose I wanted to select a random sample of 4 students from this class.
I start in the front left corner and toss a coin.
  - Heads, that student is selected.
  - Tails, he is not selected.
I move on to the next student behind him and use the same rule.
I continue in this manner, row by row, until I have 4 students.
Is the sample a random sample?
Is this a good method?
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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.
A consequence of this is that all individuals in the population have the same chance of being selected for the 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?
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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 $N$. 
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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Robb T. Koether (Hampden-Sydney College) Simple Random Sampling Mon, Jan 30, 2012 18 / 28
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 \texttt{randInt(1, 18)} to select 6 students.
To get several random integers at once, possibly with repetitions, use \texttt{randInt} with a third parameter, representing the sample size.

For example, to get 6 random integers from 1 to 18, enter \texttt{randInt(1,18,6)}.

However, this may include repetitions.
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TI-83: Setting the Seed

1. Enter a seed (choose any number whatsoever).
2. Press \texttt{STO}. An arrow appears in the display.
3. Press \texttt{MATH}, highlight \texttt{PRB}, select \texttt{rand} (item #1).
4. Press \texttt{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

- 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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**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\}
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\}

What is each person’s chance of being in the 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\}

What is each person’s chance of being in the sample?
What is the probability of getting the sample \{A,B,C\}?
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\} \quad \{D, F, G\}

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

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

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