

# Tuesday, October 30, 2018

## • Warm-up

- We need to survey a random sample of the 300 passengers on a flight. Name each sampling method described below.

*Systematic*

- Generate a random number between 1 and 10, start with that person then choose every 10<sup>th</sup> passenger after that as people board the plane

- From the boarding list, randomly choose 5 people flying in first class and 25 other passengers.

- Randomly generate 30 seat numbers and survey the passengers who sit there.

- Randomly select a seat position (right window, etc.) and survey all passengers sitting in those seats.

*Stratified*

*SRS*

*Cluster*

## Sampling Methods:

- Convenience
- SRS
- Systematic
- Stratified
- Cluster

## • More Sampling & sample statistics

## • Experimental Vocabulary

Social  
Objective: I  
will  
participate  
in the class  
activities.

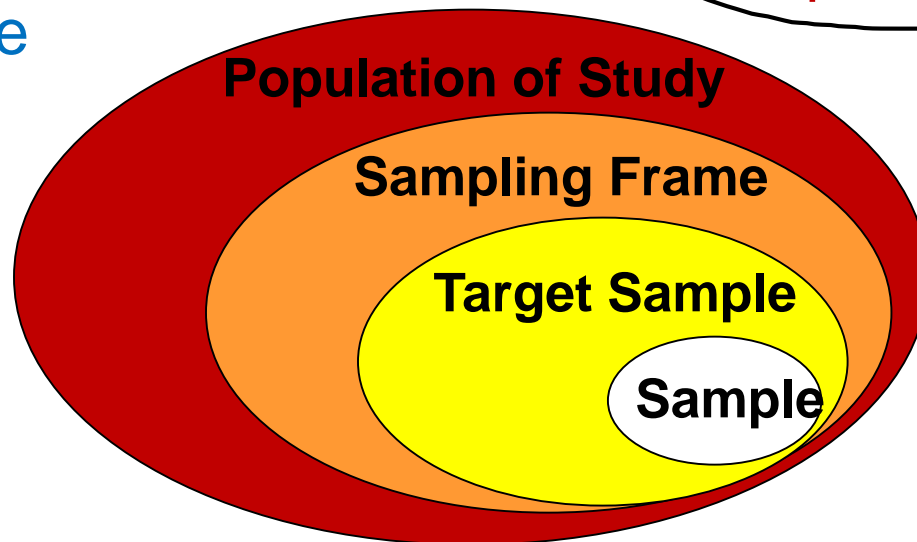
Content  
Objective:  
I will apply  
different  
types of  
random  
sampling  
to my  
class.

Language  
Objective: I  
will describe  
the types of  
random  
sampling  
clearly both  
verbally and  
in writing (in  
my notes).

A uniformed policeman interviews a group of college freshmen by choosing the first 50 he finds having lunch in the cafeteria. He asks each one his or her name and then if he or she has used an illegal drug in the last month.

- SRS
- Stratified
- Cluster
- Systematic
- Convenience
- Multistage

- Undercoverage
- Voluntary Response Bias
- Nonresponse Bias
- Response Bias



Past FRAPPY



# How (not) to Survey



# Observational Studies

- In an ***observational study***, researchers don't ***assign choices; they simply observe them.***
- No “treatment” is assigned – just observing what is already happening
- Examples?

# Observational Studies

- In a **retrospective study**, subjects are selected and their previous conditions or behaviors are studied.
- When the researchers identify subjects in advance and collected data as events unfold, it is a **prospective study**
- Other Examples?



# Observational Studies

- Observational studies are valuable for discovering trends and possible relationships.
- However, it is not possible for observational studies, whether prospective or retrospective, to demonstrate a causal relationship.





# Randomized, Comparative Experiments

- An **experiment** is a study design that allows us to prove a cause-and-effect relationship.
- In an experiment, the experimenter must identify at least **one explanatory variable, called a factor, to manipulate and at least one response variable to measure.**
- An experiment:
  - **Manipulates** factor levels to create treatments.
  - **Randomly assigns** subjects to these treatment levels.
  - **Compares** the responses of the subject groups across treatment levels.

# Randomized, Comparative Experiments

- In an experiment, the experimenter actively and deliberately manipulates the factors to control the details of the possible treatments, and assigns the subjects to those treatments *at random*. “RANDOM ASSIGNMENT”
- The experimenter then *observes* the response variable and *compares* responses for different groups of subjects who have been treated differently.



# Randomized, Comparative Experiments

- In general, *the individuals on whom or which we experiment are called **experimental units**.*
  - *When humans are involved, they are commonly called **subjects** or **participants**.*
- *The specific values that the experimenter chooses for a factor are called the **levels** of the factor.*
- *A **treatment** is a combination of specific levels from all the factors that an experimental unit receives.*

# The Four Principles of Experimental Design

## 1. Control:

- We control sources of variation other than the factors we are testing by making conditions as similar as possible for all treatment groups.

## 2. Randomize:

- **Randomization** allows us to equalize the effects of unknown or uncontrollable sources of variation.
  - It does not eliminate the effects of these sources, but it spreads them out across the treatment levels so that we can see past them.
- Without randomization, you do not have a valid experiment and cannot draw valid conclusions from your study.



# The Four Principles of Experimental Design

## 3. Replicate:

- Repeat the experiment, applying the treatments to a number of subjects.
- The outcome of an experiment on a single subject is an anecdote, not data.
- When the experimental group is not a representative sample of the population of interest, we might want to replicate an entire experiment for different groups, in different situations, etc.
- Replication of an entire experiment with the controlled sources of variation at different levels is an essential step in science.

# The Four Principles of Experimental Design

## 4. Block:

- Sometimes, attributes of the experimental units that we are not studying and that we can't control may nevertheless affect the outcomes of an experiment.

- If ***we group similar individuals together*** and then randomize within each of these **blocks**, we can remove much of the variability due to the difference among the blocks.

Note: Blocking is an important compromise between randomization and control, but, unlike the first three principles, is ***not required in an experimental design.***

# Homework

Pg 289 (23-26)

Pg 313 (1-4)

← check  
on  
Friday