

# Stat 104 – Lecture 10

## Simple Random Sample

- Assign each person a unique number.
- Use a random number table to select 400 random numbers.
- The random numbers selected identify the persons in the sample.

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## Simple Random Sample

- Enter the names into a JMP data table.
- Use Tables – Subset – Random
- Enter 400 for the sample size.

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## Simple Random Sample

- If one were to do this more than once
  - Different random numbers will give different samples of 400 students.
  - We have introduced variability by sampling!

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## Margin of Error

- The variability introduced by random sampling can be quantified by the margin of error.
- Approximate margin of error

$$\frac{1}{\sqrt{n}} \times 100\%$$

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**Population** – all items of interest.  
Example: Adults in the U.S.

Between **35%** and **41%** of the **population** would say that the earth is getting warmer mostly because of human activity.



Margin of error of  $\pm 3$ .

**Sample** – a few items from the population.  
Example: 2,011 U.S. adults.

**38%** of the **sample** think that the earth is getting warmer mostly because of human activity.

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## Types of Bias

- Sampling bias
- Non-response bias
- Response bias

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## Other Sampling Plans

- **Systematic**
  - Select in a systematic way from the sampling frame.
  - Select every 60<sup>th</sup> student on the list from the Registrar.
  - Caution the list should be in random order and the starting point should be selected at random.

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## Other Sampling Plans

- **Stratified Random**
  - Divide population into strata (subpopulations that contain similar items) and select a SRS from each strata.
  - Divide ISU students into colleges and select a SRS from each college.

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## Other Sampling Plans

- **Cluster**
  - Divide population into clusters, each cluster having a mix of items representative of the population, and select clusters at random as your sample.
  - Use classes as clusters.

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## Observational Studies

- Simply observing what happens
  - A sample survey is an observational study.
  - There are other observational studies that are not surveys.

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## Tanning and Skin Cancer

- This observational study involved 1,500 people.
- Found people who had skin cancer and other people who did not have skin cancer.
- Asked all participants whether they used tanning beds.

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## Diet and Blood Pressure

- Enroll 100 individuals in the study.
- Give each a diet diary. Everything eaten each day is recorded. From the diary entries the amount of sodium in the diet is calculated.
- Measure blood pressure.

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## Differences

- Retrospective – look at past records and historical data.
  - Tanning and Skin Cancer
- Prospective – identify subjects and collect data as events unfold.
  - Diet and Blood Pressure

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## Experiments

- Explanatory variable – Factor.
- Treatments.
- Response variable.
- Subjects – Participants – Experimental Units.

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## Experiments

- The experimenter must actively and deliberately manipulate the factor(s) to establish the method of treatment.
- Experimental units are assigned to the treatments.

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