

Math 142: Wednesday, Aug 20th, Day 2 Notes

Agenda for Wednesday, Aug 20, 2024

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Reminders

- ! Complete intro form (if haven't done so by now)



- Canvas Homeworks Section 1.1 and 1.2 will open today and be due next Wednesday

Section 1.1 Basic Definitions continued

Recall: Data, Descriptive statistics, Inferential Statistics, Population, Sample

A few more definitions:

- A Parameter
- A Statistic
- A Variable

Example 1. Determine what the key terms refer to in the following study. We want to know the average amount of money first year college students spend at CLC on school supplies that do not include books. We randomly survey 100 first year students at the college. The average first year CLC student spends \$168 on school supplies that do not include books. The average of those surveyed spend \$174.

- **Population:**
- **Sample:**
- **Parameter:**
- **Statistic:**

There are two types of variables:

- Numerical
- Categorical

Example 2. Is the variable numerical or categorical?

1. Let Y be the monthly cost to operate a business
2. Let P be a favorite pizza place
3. Let A be an Academic major

1.2 Data and Sampling

There are two types of data:

1. Qualitative
2. Quantitative

Example 3. Determine if the data is qualitative or quantitative. If the data is quantitative, determine if it is continuous or discrete.

- a) The number of smartphones in a household
- b) The type of car a person drives
- c) Where one goes on vacation
- d) The distance it is from home to the nearest gas station
- e) The tuition for a student's classes this semester
- f) Movie ratings (PG, PG-13, G, ...)
- g) Political party preferences
- h) Weights of NFL wide receivers
- i) Temperature of infants in the hospital nursery
- j) Amount of money (in dollars) won playing video poker
- k) Student ID number

Sampling Techniques

1. Simple Random Sample
2. Stratified Sample
3. Cluster Sample
4. Systematic Sample
5. Convenience Sample

Get in pairs and discuss Example 4.

Example 4. Determine the type of sampling used for the following:

Benefits package which includes health insurance, dental insurance, child care, vacation days, retirement plan, etc. You want to conduct a survey of benefits packages available in private business in the state of Illinois. You want a sample of size 200. Some sampling techniques are described below.

1. Assign each tax-id of the private business a number. Choose every 15th number to select to be included in the sample.
2. Pick a random sample of 10 zip code areas and then include all the businesses in each of the selected zip code area.
3. Assign each tax-id of the private business a number. Have a random generator select 200 the businesses to be included in the sample.
4. Group each private business into categories such as Medical, Retail, Financial, Restaurant, Hotel, Manufacturing, Education, other. Then select a random sample of 20 businesses from each type.
5. Send an online survey to each email associated with the tax ID registered to the state and choose the first 200 responses to the survey

Data Collection

The four most common ways of collecting data for a statistical study are:

- 1.
- 2.
- 3.
- 4.

Surveys are a common method of collecting data. Three methods of surveying are:

- 1.
- 2.
- 3.

Sampling Bias :

Potential Sources of Bias in Surveys:

- 1.
- 2.
- 3.
- 4.

Section 1.3 Experimental Design

Observational and Experimental Studies

- In an **observational study**, the researchers only observe the subjects and do not interfere or try to influence the outcomes.
- The researchers do not control the treatments or assign subjects to experimental groups. Instead, they observe and measure variables of interest and look for relationships between them.
- Researchers conduct observational studies when it is difficult, impossible, or unethical to assign study participants to the experimental groups randomly.
- For example: if you're studying how depression affects performance of an activity, it's impossible to assign subjects to the depression and control group randomly. However, you can have subjects with and without depression perform the activity and compare the results in an observational study.
- In an **experimental study**, treatments are variables that the researchers control. They are the primary independent variables of interest. Researchers administer the treatment to the subjects or items in the experiment and want to know whether it causes changes in the outcome.

Treatment vs. Control Groups

- **Treatment group** in an experiment is the group who receive treatment being tested.
- **Control group** is the group that does not receive treatment.

Placebo Effect:

- **Placebo** lacks the active ingredient of a treatment being test in the study. It has the appearance of the treatment.
- **Placebo effect** refers to the situation in which the subjects improve simply because they believe they are getting the treatment.

Blinding in Experiments

- An experiment is **single-blind** if the participants do not know whether they are part of the treatment group or part of the control group.
- An experiment is **double-blind** if the participants and those giving the treatment do not know if the participants are part of treatment or control group