Mrs. Singleton
Math 1342 Statistics
1/24/20

Today

Statistics terms and definitions needed going forward
MATH 1342

Mrs. Singleton

1.1 – 1.8 Introduction to Statistical Thinking
2.1 The Lords of Data

WHAT IS DATA?
STATISTICS!

The collection, organization, displaying, analysis, interpretation and presentation of data

POPULATION VS. SAMPLE

POPULATION
The group we are interested in studying
* Can be broad or specific

SAMPLE
A subset of the population
POPULATION VS. SAMPLE

POPULATION
All College Students
All LU students taking MATH 1342

SAMPLE
3000 college students
Students in this course

PARAMETERS VS. STATISTICS

PARAMETER
A value that describes the population
- Exact Value
- Can be unknown or difficult to determine

STATISTIC
Fact or characteristic that describes the sample
- Varies from sample to sample
- Estimate parameters
- The number of students that attend Lamar University parameter.

- 60% of US residents agree with the latest health care proposal statistic.

- 40% of 1,211 students at a particular elementary school got below a 3 on a standardized test parameter.

- A survey of 1817 people in the U.S. revealed that 75% of those surveyed eat while they drive. statistic.

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**IDENTIFY THE PARAMETER AND THE STATISTIC**

- A researcher wants to estimate the average height of women aged 20 years or older. From a simple random sample of 45 women, the researcher obtains a sample mean height of 63.9 inches.

- A researcher wants to estimate the average farm size in Kansas. From a simple random sample of 40 farms, the researcher obtains a sample mean farm size of 731 acres.
Slide 7

- The number of students attending Lamar should be known so it's a parameter.
- There is no way they could have gotten all US residents' opinions so it should have come from a sample so it's a statistic.
- The test scores from a school should be recorded so they can know the true percentage of scores below a 3 so it's a parameter.
- There was a survey which implies a sample so it's a statistic.

Slide 8

- The statistic from the first bullet point is that the average height of women aged 20 years or older is 63.9 inches. That is because this measurement came from a sample. The parameter is the unknown true average height.

- The statistic from the second bullet point is that the average farm size in Kansas is 731 acres, because the measurement came from a sample. The parameter is the unknown true average.
DESCRIPTIVE VS. INFERENTIAL STATISTICS

DESCRIPTIVE STATISTICS
- Describes data
- No uncertainty
- Finding the mean, median, mode, and/or range of a sample or population
- Charts or graphs to depict data

INFERENTIAL STATISTICS
- Making predictions about a population using sample data
- Possible error
- Confidence intervals and hypothesis testing

DESCRIPTIVE VS. INFERENTIAL STATISTICS EXAMPLE

Suppose we want to determine the best study spots on campus.

You survey 100 students.

- Descriptive Statistics
  - Making a bar chart to show the frequency of preferred study spots
  - Finding the mode (most popular study spot)

- Inferential Statistics
  - Using your results to reason that 60% of students prefer the Library
The average price of a car at the new car dealership in town is $28,600

A survey of 1547 people in the US revealed that 51% smoke cigarettes; therefore, we assume that 51% of the US population smokes.

The average SAT score for freshman admitted to LU in the Fall semester.

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TWO MAIN WAYS TO COLLECT DATA

- OBSERVATION
- EXPERIMENT
- The average price can be calculated exactly so it describes something so it's a descriptive statistic.

- They took a survey then using those results made an assumption about the population the sample was taken from. They are assuming, also known as inferring, something about a population; therefore it is an inferential statistic.

- Lamar should have record of all the SAT scores of incoming freshman thus the exact value can be calculated. Therefore this is a descriptive statistic.
EXPERIMENTS

A controlled experiment is a scientific test done under controlled conditions.

Control Group
- Does not receive treatment
- May get a placebo

Experimental Group
- Receives a treatment

EXAMPLE

Suppose we are testing a new headache medication.

One group of participants will be given the new medication.

The other group will be given a sugar pill.

Who is the control group?

The experimental group?
SINGLE- VS. DOUBLE-BLIND STUDIES

**SINGLE-BLIND STUDY**
The participants do not know if they are receiving a placebo or a treatment

**DOUBLE-BLIND STUDY**
The participants and the scientists do not know who is receiving a placebo or a treatment

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VARIABLES IN AN EXPERIMENT

**Response Variable**
The focus of a question in a study or experiment

**Explanatory Variable**
Explains changes in the response variable

**Confounding Variables**
A variable that unknowingly influences an experiment
BACK TO OUR EXAMPLE WITH THE HEADACHE MEDICATION...

WHAT IS THE RESPONSE VARIABLE?  THE EXPLANATORY VARIABLE?  ANY CONFOUNDING VARIABLES?

BIAS

- Bias is the tendency to over- or underestimate the value of a parameter
- Controlling the variable: removing the effect of the confounding variable
- The response variable would be how well the medicine reduces headaches.

- The explanatory variable would be whether or not someone actually received medicine or the placebo.

- Confounding variables could be things like age, medical history, or receptiveness to medication. All of these things could affect how the medication affects you.
SOME EXAMPLES OF BIAS

- Selection Bias
  - Surveying only female students about their favorite places to study
- Surveys and questionnaires
  - Leading questions
  - Assumptive questions
  - Accidental error in data collection

CONTROLLING THE VARIABLE

In our headache medication example, we could:

- Prescribe a specific dose at onset of headache
- Find participants with a similar medical history
- What else?
OBSERVATIONAL DATA

Measuring "what is"
No control/treatment groups
More susceptible to confounding variables

Examples:
- Stock, bond, currency data
- Federal and state government data
- Sports data
- YouTube viewing data
- Surveys

DO WE OBSERVE OR EXPERIMENT?

A gift shop owner wants to study if her customer base is shrinking

A coffee shop manager wants to find out if using a new cleaning product will reduce staffing costs

A deli cart entrepreneur wants to find out if a need for additional staffing exists
To see if a customer base is shrinking, all we would need to do is monitor how many customers come in and look for changes over time. Thus, this is observational data.

The manager could easily make an experiment by trying the new product over a time and compare it to the previous costs. Thus, this is experimental data.

He simply needs to observe his costs and issues to determine if additional staff would help. Thus, this is observational data.
WRAP-UP

1.1 – 1.8 and 2.1 Hawkes Learning Homework
Due Weds, Jan 29

Take Intro Survey, available on BB
Due Mon, Jan 27