Section 10-1 Designing Experiments/Collecting Data

Data are measurements or observations that are gathered for a study.

Statistics is the branch of mathematics that deals with collecting, organizing, analyzing and interpreting data as well as drawing conclusions based on the data.

A population consists of all objects being studied.

A sample is a representative subgroup of the population.

There are 2 main branches of statistics:

1. Descriptive statistics - collect, organize, and report data without using the data to draw wide-ranging conclusions.

2. Inferential statistics - study characteristics of a sample and use them to draw conclusions about the population.

In an experiment, the researcher typically manipulates 1 or more variables to see any differences in outcomes.

Much of the study of statistics deals with variability of data, that is, the amount by which the pieces of data in a data set differ.

ex 1 If students are measuring a cup of milk using a standard measuring cup, what might cause a difference in measurements by individual students?

1. slight variation in cup size/shape
2. slosh some out
3. some will overfill & some will underfill

ex 2 Determine the population in each survey & whether the sample is representative of that population.

a) You ask 50 soccer fans sitting in seat numbers randomly chosen by a computer to rate the new stadium lights.
population = soccer fans
Sample is randomly generated & is representative of the population

b) To find the average distance students have to travel to get to school, you survey the first 75 students coming through the main gate one morning
population = students
not a good sample since students who live farther may not be the first ones to arrive at school

c) To find the average number of bicycles owned by a typical household in your town, you poll every student at your school.
population = people in your town
This sample does not account for people who don't have kids at that school

In order to evaluate statistical claims, students must be able to:

1. formulate statistical questions (with no bias)
2. collect data
3. analyze & display data
4. interpret the results

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1. Formulate Statistical Questions

When choosing statistical questions, you should avoid questions that have an inherent bias.

ex 3 Label each as fair or biased

a) Do you prefer sweet dogs or demon cats? biased

b) What is your favorite shampoo? fair

c) Did you enjoy the amazing presentation? biased

d) Should concerned dog owners vaccinate their pets? biased

e) How many hours of sleep do you get on an average weeknight? fair

2. Collecting Data

Much like formulating a question, you should avoid bias when collecting data. You want a sample that is representative of the population with data that was collected in an unbiased way.

For ex: If you are conducting an exit poll of voters and you are wearing a "Biden / Harris" shirt, the data you collect will be biased. People may lie to you about who they voted for to avoid a confrontation or judgement.

3. Analyzing Data

Once data is collected, we must decide how to display and summarize the data. This is discussed more in sections 10-2 and 10-3.

4. Interpreting Results
Some data have clear results. Other data are more open to interpretation. This step is often where misuses of statistics occur.

When you see a result like:

"95% of people voted for Trump"

You need information to go along with this result.

1. What question was asked?
2. How many people were polled?
3. Where / how were they polled?
4. How many people responded to the poll?
5. How were the people chosen?

* It is common for companies / news outlets to use misleading statistics to sell products or push an agenda. Don't be afraid to question statistical results.

end 10-1