

Bellwork:

Find the mean, median, mode, standard deviation, and quartiles for your group of 4-6 people

3.16 people

Number of people in your household

PWDKTHTCUWAN

$$\bar{x} = 6.8$$

$$s_x = 1.48$$

$$\text{Med} = 7$$

$$\text{Mode} = 7$$

$$Q_1 = 5.5$$

$$Q_3 = 8$$

$$\text{WB-2}$$

$$\bar{x} = 4.83$$

$$s_x = 1.60$$

$$\text{Med} = 5$$

$$\text{Mode} = 3, 5$$

$$Q_1 = 3$$

$$Q_3 = 6$$

McKenzie w/Strawberries

$$\bar{x} = 6.16$$

$$s_x = 1.47$$

$$\text{Med} = 5.5$$

$$\text{Mode} = 5$$

$$Q_1 = 5$$

$$Q_3 = 8$$

Lesson 9.3 Solutions

$$1. \text{ mode} = \text{ med} = 32 \quad \bar{x} = 31.28 \quad q_1 = 28.45 \quad q_3 = 33.05$$

$$\text{IQR} = 4.6 \quad S_x = 3.32$$

$$2. \text{ mode} = \text{ med} = \bar{x} = q_1 = q_3 = \text{IQR} = S_x =$$

$$3. \text{ mode} = \text{ med} = \bar{x} = q_1 = q_3 = \text{IQR} = S_x =$$

$$4. \text{ mode} = \text{ med} = \bar{x} = q_1 = q_3 = \text{IQR} = S_x =$$

$$5. \text{ mode} = \text{ med} = \bar{x} = q_1 = q_3 = \text{IQR} = S_x =$$

$$6. \text{ mode} = \text{ med} = \bar{x} = q_1 = q_3 = \text{IQR} = S_x =$$

Lesson 9.4 Objectives:

~~I can identify the difference between surveys, experiments, and observational studies.~~

I understand experimental design and the importance of randomization in statistics

Vocabulary

A **population** consists of all people or items which we wish to describe to draw conclusions about

A **sample** is a small group of people or items taken from the larger population

The **parameter** of interest is the trait we are wanting to learn about the population

It's often difficult to look at an entire population, so we use statistics, or data gathered from a sample of the population, to make an inference about the parameter of interest for the population.

Random Sampling is important to use when creating your sample. Each member of the population must have an equal chance of being picked.

Example 1:

The Utah State Legislature wants to know what percentage of teen drivers text while they drive. They decide to survey 250 randomly selected teen drivers across the state. Identify a) the population, b) the sample population, and c) the parameter of interest.

a) teen drivers

b) 250 teen drivers in Utah

c) texting while driving

Obtaining a random sample is not as simple as you might think. In fact, there are a few different methods for sampling. Some of the methods can be biased. A bias occurs when part of the population is overrepresented or underrepresented. For example, if you wanted to know how many students support the school's athletic programs, you wouldn't interview only the cheerleaders or students on a team, because they regularly attend athletic events and would be overrepresented in the study.

★ simple random sample every member of the population has an equal chance of being selected to be part of the sample group. Drawing names from a hat is an example of this type of sampling. Another example would be assigning every member of the population a number and then using a random number table or generating random numbers through technology to randomly select members. The key is that you must have a list of all the members of the population.

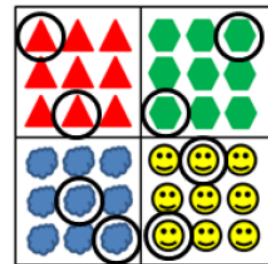
"SRS"

In a **systematic sample** it is assumed that the entire population is naturally organized in a sequential order. Using a random number generator, you select a starting point and then select every n th member to be part of the sample. For example, homes in a neighborhood are already in an order. You could randomly select a starting point and then select every third home.

In a **cluster sample** the population is divided into smaller groups that are representative of the entire population and then groups are randomly selected. For example, if you wanted to make inferences about your entire school, you could randomly select 1st periods to survey.



In a **stratified sample** members of the population that share the same characteristic are grouped together. Then, members of that subgroup are randomly selected to make up the sample group. Each member of the subgroup has an equal chance of being selected. There are times when the subgroups are not equal in size. When this happens, members are chosen in proportion to their actual percentages in the overall population. For example, if you wanted to study all high school students who are involved in extracurricular activities you would probably want to divide them into their particular extracurricular activity and then select randomly from those groups so that each extracurricular activity is represented in the sample. The football team would have more members than the basketball team so you would select more football players than basketball players to participate.



In a **convenience sample** members are randomly selected from a population that is readily available. For example if you wanted to ask shoppers what they think of a local store, you would survey every 5th person who exits the store on a given day. This method of sampling has a bias because people who like to shop at this particular store are more likely to be at the store that day.

In a **volunteer sample** members of the population self-select to be included in the sample. Filling out a survey and returning it is an example of a volunteer sample. This is prone to bias because generally people who respond have strong opinions about the topic while others who are more neutral may not respond at all. An example of a volunteer sample is when you buy a pair of shoes at your favorite shoe store and the cashier asks you to complete an online survey about your experience that day. You decide whether or not you want to complete the survey.

Example 2:

The school newspaper wants to know the percentage of students who drive to school each day. For each method described below, determine what type of sampling method it is and justify whether or not the method is biased.

- a. The newspaper staff posts signs all over the school asking students to take a short survey online. *volunteer sample - pretty unbiased/biased*
- b. The newspaper staff interviews every fifth person who walks into the school cafeteria.
- c. The newspaper staff randomly selects 20 fifth periods to survey. *convenience sample -*

*cluster sample - unbiased
both drivers & non-drivers
have 5th period*

*biased because
people that drive
can go off
campus*

*because
drivers are
excited.*

Example 3:

You want to know if students at your school prefer fast food or sit-down restaurants. What would your survey question look like to eliminate any bias? Explain the sampling method you would use and why?

VOCABULARY

When conducting a **survey** every member in the sample answers a set of questions.

Experiments require at least two groups. One group receives the trial treatment, while the other, sometimes called the control group, does not receive the treatment. At the end of an allotted period of time, the two groups are compared to determine if the treatment had an effect.

Observational studies require you to observe outcomes without interacting with any members of the sample.

Sample Surveys

The purpose of a sample survey is to gather information about the sample by means of a survey. There are several advantages to using a survey. Surveys are inexpensive and can collect a large amount of data representative of the population. They can be done in a variety of forms and about a variety of topics. Surveys also have the ability to focus only on the necessary information. However, surveys are flawed by non-responders since a survey is generally voluntary; people have the option not to participate. Additionally, people in a survey know that they are being studied and they may not be as honest in their responses as they would be if they were not being studied. Surveys are also open to interpretation and bias. Surveys can be written in a way that biases the responders. Also questions can be interpreted differently than intended by those responding to the survey.

Surveys can be administered with randomization methods, such as simple random sampling, cluster sampling, multistage sampling, stratified sampling, or systematic sampling all of which would ensure that the sample is random and representative of the overall population.

Experiments

The purpose of an experiment is to assign a treatment, using control over some of the conditions in order to gather data about the treatment's effectiveness. An experiment is the only way to establish causation. When an experiment is designed, all of the variables are controlled. This allows the experimenter to demonstrate that a change in one variable causes the change in another variable. There are drawbacks to experiments. They can be very expensive and time consuming. Ethics may be questioned especially if animals or people are used in the experiment. Experiments must not intentionally harm any of the subjects. The attitude and behavior of those conducting the experiment can also affect the results.

It is imperative that randomization is used when assigning subjects to their treatment groups. Each group needs to be representative of the overall population.

Observational Studies

The purpose of an observational study is to observe subjects in their natural environment without their knowledge and without assigning treatments to the subjects. There are some advantages to using an observational study. It is simple and inexpensive to conduct. It provides deeper and richer information than a survey because the observer is seeing behavior firsthand and is able to observe the process not just the result. There are also some disadvantages. The results cannot prove causation nor can they be applied to the general population. It is only representative of those being studied. The results are subjective and open to interpretation by the observer. There may also be a question of ethics, especially if people are involved. People have a right to privacy and the observational study must not infringe upon the rights and expectations of people.

If you are doing the study in the present, you can randomize the individuals involved. If you are gathering data from past records, there is no chance for randomization.

Example 1:

Which type of study method is described in each situation? Should the sample statistics be used to make a general conclusion about the population?

- a. Researchers randomly choose two groups from 20 volunteers. Over a period of 6 weeks, one group works on a computer for an hour right before going to sleep, and the other does not. Volunteers wear monitoring devices while sleeping, and researchers record their quality of sleep.
- b. Students in an elementary class observe the growth of some newly hatched chickens.
- c. Market researchers want to know if people like the new store at the local mall. They ask every fourth person who enters the mall if they like the new store.