Lesson 14.4A Drawing Conclusions from Samples, Surveys, and Data

Objectives

- Evaluate various ways of collecting data.
- Use statistical thinking to justify conclusions and explain misleading uses of data.

A **population** is a group of people or objects about which information is gathered. Usually it is too expensive or time-consuming to ask questions of each member of a population.

Information gathered may be opinions of those surveyed or specific information and facts about the demographics of the group.

Types of Samples

When a population is too large to question each member, it is common to use a smaller subset of the population, called a **sample**. There are various ways to select a sample group from a population. Four are listed below.

In a **voluntary sample**, members of a population volunteer to be in the sample.

In a **systematic sample**, a certain rule is followed when selecting the members. For example, every third person who enters a building.

In a **convenience sample**, members who are easily selected become part of the sample. For example, the first 10 people to enter a room.

In a **random sample**, each member of a population has an equal chance of being selected as a member of the sample. A random sample most closely represents the population.

Example 1 Categorizing Samples

A marketing analysis firm wants to find out the preferred type of bottled water consumers purchase at local grocery stores. Identify the types of samples described.

a. The marketing analysis firm sends out a mass email to households asking the primary shopper to complete and return the survey.

b. A surveyor stands outside of the exit of the grocery store and asks customers questions as they leave the store.

Solution

a. The marketing analysis firm cannot require the return of the survey. The sample is a self-selected sample.

b. The surveyor is at a location where he knows consumers will be. The sample is a convenience sample.

Bias

Researchers use information gained from samples of populations to draw conclusions or make predictions. Therefore, it is important to have an unbiased sample.

An **unbiased** sample is a fair representation of the population being studied. If a sample misrepresents the overall population either by overstating or understating a certain characteristic of the population, it is **biased**.

Example 2 Identifying Bias in a Sample

The nutrition department of a school district wants to know which menu items are the most popular at schools in the district. The manager decides to survey 75 of the students in the lunch line at the high school. Is this sample biased or unbiased? Explain your reasoning.

Solution

This sample is biased. The manager only surveyed students at the high school that eat lunch at the school. The manager did not include the students at the middle school or elementary school.

Ongoing Assessment

Describe another reason that the results in the survey above might show bias.

Surveys

Surveys are a popular method for collecting data. It is important to carefully word questions on a survey. Poorly-worded questions result in inaccurate results for the survey. These types of questions are biased questions.

There are several reasons questions can be biased, including questions that:

- may lead the respondent to answer in a certain way.
- are too complicated or confusing.
- the respondents do not feel comfortable answering truthfully.
- do not include enough information for respondents to form opinions.

The order the questions are asked can also influence answers given and produce biased results.

Example 3 Bias in Survey Questions

Identify the bias in the survey question and describe how it can be corrected.

> Do you agree that Superior Electronics has the best car stereo equipment?

Solution

This is an example of a leading question.

The respondent may think a "no" response to this question would be unpopular since the question is worded in a way that implies others do agree that Superior Electronics has the best stereo equipment.

A better way to ask this question is to give the respondent several brands of car stereo equipment to choose from and ask, "Which brand do you think is best?"

Misleading Data

Data published in the media can be misleading either by the way it is displayed in graphs and reports or by the way the facts are presented or interpreted. For example, the scales on a graph can be set to make the slope of a line appear less steep or the bars to appear to have greater difference.

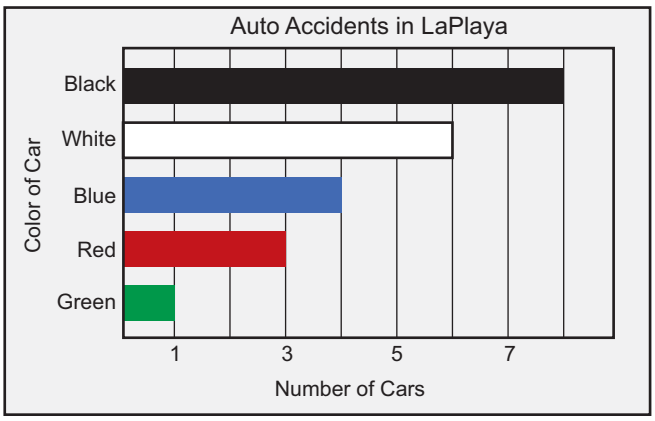
This visual change can influence readers' opinions of the data. Also, the inclusion or exclusion of certain facts in reports can lead the readers' interpretations to a certain conclusion. For this reason, it is important to understand the data itself and when analyzing a report or graph, and not rely solely on the visual representation of data or the interpretation of the person who wrote the report.

Example 4 Published Data

Determine if the conclusion published below is an accurate analysis of the data. Describe how a retailer might use this information to lead consumers to make a buying decision.

Car Color Affects Likelihood of Being in an Accident

Recent accident reports show that drivers should consider the facts about dangerous colors before buying a new car.



Solution

This conclusion is not accurate because it uses the accident statistics from a single city to make general statements about the most dangerous color of vehicles.

A car dealer that has an overstock of green cars might use this data to lead consumers to think that green-colored cars are safer, therefore making more people want to buy a green car.

Lesson Assessment

Think and Discuss

see margin

1. Explain why a random sample is preferred over the other types of samples.
2. Choose another type of sample and give an example of how it may affect the results of a survey.
3. Write an example of a survey question which is biased and explain why the question is biased.

Practice and Problem Solving

Identify the type of sample described.

4. The owner of a jewelry store wants to determine what shoppers like most about shopping in his store. He decides to survey every tenth customer that arrives at the store.

5. Rebecca needs to survey people about their jobs for an economics class. She asks the adults in her neighborhood to participate.

6. Martin is writing an article about high school students perspectives on standardized testing. He gets a list of all the students in the school and assigns each a number. He then uses his graphing calculator to randomly generate 75 numbers. He uses those numbers to choose which students to survey.

7. An online vendor wants to gather information about its customers. The vendor offes the opportunity to complete a survey to each person who visits the company's website.

Identify each sample as biased or unbiased. Explain your reasoning.

8. A polling service calls 10% of all registered Democrats to ask how they plan to vote on issues for the next election.

9. A customer service organization conducts a phone questionnaire with every 25th customer who calls.

10. A toy company offers a free toy truck to the first 100 children that complete a survey.

Identify the bias in the survey question and describe how it can be corrected.

11. In a taped interview, respondents are asked, "How accurate is your tax return?"

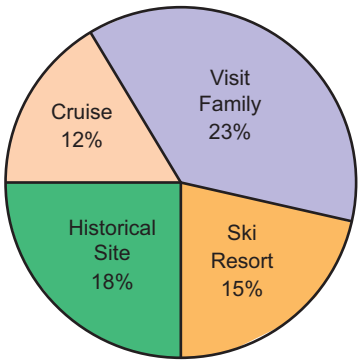
12. A survey asks respondents, "Do you agree with the newly-adopted school dress code?"

13. A record store has a survey which asks, "Paul Gorham and the famous Bart Evans will each be performing concerts this winter. Which would you most like to see?"

Use the data below to answer Questions 14 and 15.

Types of Vacations

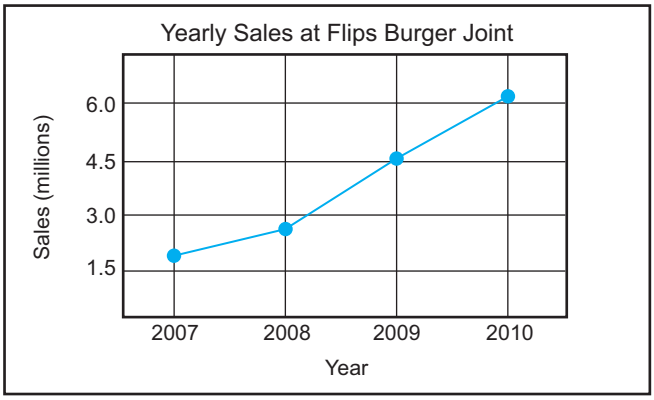
A recent survey revealed that people take vacations to the homes of family members in other cities.



14. Does the circle graph shown support the claim? Explain.

15. Is the graph accurate? If the graph is inaccurate, explain what is wrong and how the error might lead to a wrong conclusion.

Use the data below to answer Questions 16 and 17.



Americans are eating out an alarming rate.
Sales at fast food restaurants continue to rise from year to year.

16. Is the conclusion an accurate analysis of the data? Explain.

17. Describe how this information is used to mislead consumers.