Section 13.1 Statistics-Sampling Techniques-follow along with podcast

<u>What You Will Learn</u>

Sampling Techniques

Random Sampling

Systematic Sampling

Cluster Sampling

Stratified Sampling

Convenience Sampling

Statistics

Statistics is the art and science of gathering, analyzing, and making inferences (predictions) from numerical information, ***data***, obtained in an experiment.

Statistics is divided into two main branches.

Descriptive statistics is concerned with the collection, organization, and analysis of data.

Inferential statistics is concerned with making generalizations or predictions from the data collected.

Statisticians

A statistician's interest lies in drawing conclusions about possible outcomes through observations of only a few particular events.

The ***population*** consists of **all** items or people of interest.

The ***sample*** includes *some* of the items in the population.

When a statistician draws a conclusion from a sample, there is always the possibility that the conclusion is incorrect.

Types of Sampling

A ***random sampling*** occurs if a sample is drawn in such a way that each time an item is selected, each item has an equal chance of being drawn.

When a sample is obtained by drawing every *n*th item on a list or production line, the sample is a ***systematic sample***.

A ***cluster sample*** is sometimes referred to as an area sample because it is frequently applied on a geographical basis.

Stratified sampling involves dividing the population by characteristics called *stratifying factors* such as gender, race, religion, or income.

Convenience sampling uses data that are easily or readily obtained, and can be extremely biased.

Example 1: Identifying Sampling Techniques

Identify the sampling technique used to obtain a sample in the following. Explain your answer.

a) Every 20th soup can coming off an assembly line is checked for defects.

Solution

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b) A $50 gift certificate is given away at the Annual Bankers Convention. Tickets are placed in a bin, and the tickets are mixed up. Then the winning ticket is selected by a blindfolded person.

Solution

c) Children in a large city are classified based on the neighborhood school they attend. A random sample of five schools is selected. All the children from each selected school are included in the sample.

Solution

d) The first 50 people entering a zoo are asked if they support an increase in taxes to support a zoo expansion.

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e) Viewers of the *USA Network* are classified according to age. Random samples from each age group are selected.

Section 13.2 The Misuses of Statistics

What You Will Learn

Misuses of Statistics

What is Not Said

Vague or Ambiguous Words

Draw Irrelevant Conclusions

Charts and Graphs

Misuses of Statistics

Many individuals, businesses, and advertising firms misuse statistics to their own advantage.

When examining statistical information, consider the following:

- Was the sample used to gather the statistical data unbiased and of sufficient size?
- Is the statistical statement ambiguous, could it be interpreted in more than one way?
- What is Not Said

"Four out of five dentists recommend sugarless gum for their patients who chew gum."

What is Not Said

In this advertisement, we do not know the sample size and the number of times the experiment was performed to obtain the desired results.The advertisement does not mention that possibly only 1 out of 100 dentists recommended gum at all.

What is Not Said

In a golf ball commercial, a "type A" ball is hit and a second ball is hit in the same manner.

The type A ball travels farther.We are supposed to conclude that the type A is the better ball.

The advertisement does not mention the number of times the experiment was previously performed or the results of the earlier experiments.

Possible sources of bias include

(1) wind speed and direction,

(2) that no two swings are identical, and

(3) that the ball may land on a rough or smooth surface.

Vague or Ambiguous Words

Vague or ambiguous words also lead to statistical misuses or misinterpretations.

The word *average* is one such culprit. There are at least four different "averages," some of which are discussed later in the text(in Section 13.4).

Each is calculated differently, and each may have a different value for the same sample.

Ex)During contract negotiations, it is not uncommon for an employer to state publicly that the average salary of its employees is $45,000, whereas the employees' union states that the average is $40,000.

Who is lying?

Actually, both sides may be telling the truth. Each side will use the average that best suits its needs to present its case.

Vague or Ambiguous Words

Advertisers also use the average that most enhances their products.

Consumers often misinterpret this average as the one with which they are most familiar.

Vague or Ambiguous Words

Another vague word is *largest.*

For example, Department store "X" claims that it is the largest department store in the United States.

Does that mean largest profit, largest sales, largest building, largest staff, largest acreage, or largest number of outlets?

Draw Irrelevant Conclusions

Still another deceptive technique used in advertising is to state a claim from which the public may draw irrelevant conclusions.

For example, a disinfectant manufacturer claims that its product killed 40,760 germs in a laboratory in 5 seconds.

"To prevent colds, use disinfectant A."

It may well be that the germs killed in the laboratory were not related to any type of cold germ.

Draw Irrelevant Conclusions: ex) Company C claims that its paper towels are heavier than its competition's towels. Therefore, they will hold more water. Is weight a measure of absorbency?

A rock is heavier than a sponge, yet a sponge is more absorbent.

Draw Irrelevant Conclusions

EX) An insurance advertisement claims that in Duluth, Minnesota, 212 people switched to insurance company Z.

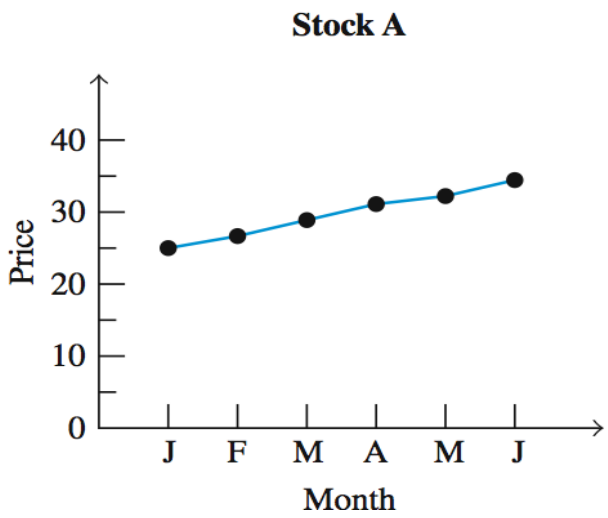
One may conclude that this company is offering something special to attract these people.

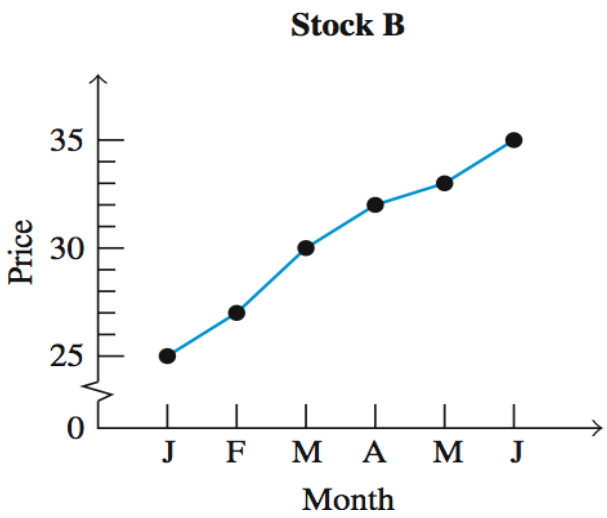
What may have been omitted from the advertisement is that 415 people in Duluth, Minnesota, dropped insurance company Z during the same period.

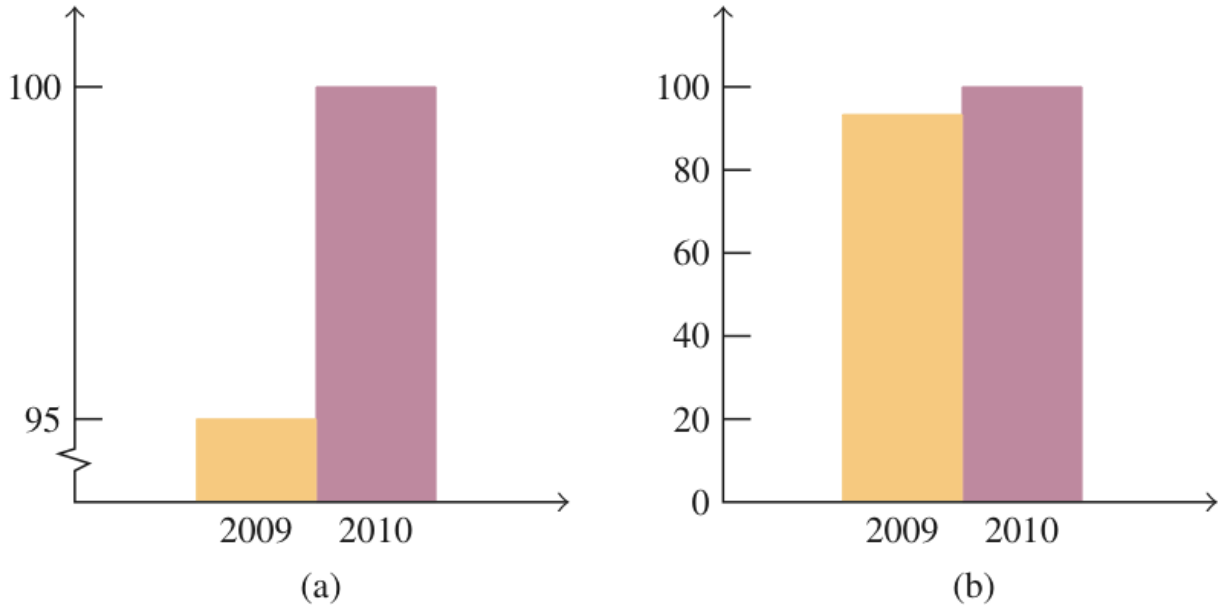
Charts and Graphs

Charts and graphs can also be misleading.

Even though the data is displayed correctly, adjusting the vertical scale of a graph can give a different impression.





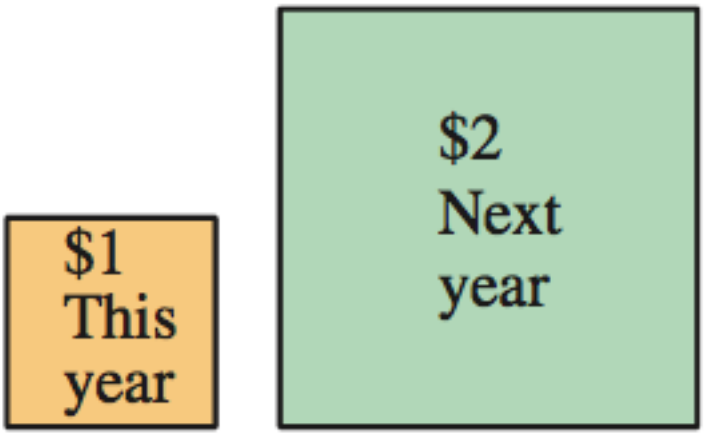


While each graph presents identical information, the vertical scales have been altered.

The graph in part (a) appears to show a greater increase than the graph in part (b), again because of a different scale.

Charts and Graphs

Consider a claim that if you invest $1, by next year you will have $2. This type of claim is sometimes misrepresented. Actually, your investment has only doubled, but the area of the square on the right is four times that of the square on the left.



Charts and Graphs

Despite the examples presented in this section, you should not be left with the impression that statistics is used solely for the purpose of misleading or cheating the consumer.

As stated earlier, there are many important and necessary uses of statistics.

Most statistical reports are accurate and useful.

You should realize, however, the importance of being an aware consumer.

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