Inferential Statistics

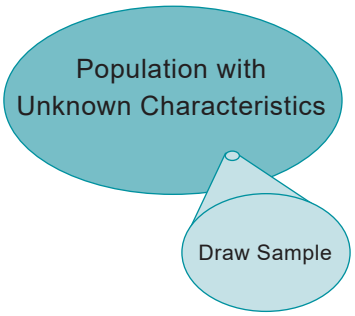
Definition

Inferential Statistics

The objective of **inferential statistics** is to make reasonable estimates about population characteristics using sample data.

It would be preferable to have measurements of the entire population, but in most cases these data are either not obtainable or would be much too costly to obtain. For example, to be absolutely certain that all car air bags will inflate in head-on collisions would require each new car to be crash tested in a head-on crash. If 100 percent inspection were a requirement, cars would be a scarce commodity. Fortunately for automobile manufacturers, statistical sampling techniques can reliably estimate, with a relatively small sample, the fraction of air bags that will inflate.

Use Sample Data to Make Inferences about Unknown Population Characteristics



Example 1.3.1

Differentiating Between Descriptive and Inferential Statistics

The Michelin tire company has a feature called "Track Connect" that will assist racecar drivers in getting the maximum performance out of their tires when on a racetrack. Michelin has an app that will give personalized advice before, during, and after a driver takes laps around a track. The app will make suggestions for optimal tire pressure and temperature so that the car is handled efficiently as they navigate the track (road track or oval). To evaluate the app, Michelin randomly collected data from 30 drivers that took laps around various track surfaces using several car models, different tires (those with and without the sensors), and under different weather conditions. Using the data from the drivers' experiences on the tracks, Michelin has concluded that the tires lasted longer (i.e., less wear) and the cars had improved gas mileage. Were the results of this experiment an example of descriptive or inferential statistics?

Source: michelinman.com/trackconnect.html

SOLUTION

The Michelin tire company has collected data on tire performance from a random sample of 30 racecar drivers who took laps around various racetracks, under various track conditions. The primary data collected from the tires were air pressure and temperature. They also collected gas mileage (miles per gallon) data for each of the racecars. Using the collected data, Michelin was able to conclude that the tires lasted longer and had better gas mileage than tires without the sensors. This is a case of inferential statistics.

1.3 Exercises

Basic Concepts

1. What is the difference between descriptive and inferential statistics?
2. Name three questions that a descriptive statistic can be used to answer.

Exercises

3. Determine whether the statement describes a descriptive or inferential statistic.

The average price of a car at the new car dealership in town is $28,200.

4. Determine whether the statement describes a descriptive or inferential statistic.

A survey of 885 people revealed that 51% have a college degree; therefore, it can be assumed that 51% of the U.S. population has a college degree.

1.4 The Value of Statistical Literacy

Part of being an intelligent human being is the desire to learn the truth about the world we live in. But as Oscar Wilde said:

"The truth is rarely pure and never simple."

—Oscar Wilde, *The Importance of Being Earnest*

Being statistically illiterate puts one (or one's organization) at a competitive disadvantage compared to companies that possess and use statistical knowledge and analytical tools. Statistics and its uses cannot be avoided. Therefore, learning and using statistical tools will give you and your organization more flexibility when making decisions.

To intelligently appreciate or produce statistical information, you must be statistically literate to defend yourself from a persuasive but fallacious statistical argument, to decrease your vulnerability to pseudo-sciences, and to diminish the chances of making poor and sometimes injurious business decisions.

A statistically literate person understands the language of statistics and understands statistical concepts and reasoning. To become statistically literate, one should be able to think "statistically". This will involve asking questions like:

- Where did the data come from?
- How was the sample taken and is the sample large enough?
- How reliable or accurate were the measures used to generate the reported data?
- Are the reported statistics appropriate for this kind of data?
- Is a graph drawn appropriately?
- How was this probabilistic statement calculated?
- Do the claims make sense?
- Should there be additional information?
- Are there alternative interpretations?

Liar or Statistician?

In his book *How to Tell the Liars from the Statisticians*, Robert Hooke sheds light on our exposure to misleading statistics in everyday life. In the preface he writes, "The science of statistics has made great progress in this century, but progress has been accompanied by a corresponding increase in the misuse of statistics. The public, whether it gets its information from television, newspapers, or news magazines, is not well prepared to defend itself against those who would manipulate it with statistical arguments. Many people either believe everything they hear or come to believe in nothing statistical, which is even worse." Throughout the remaining chapters, Hooke uses examples from politics, economics, entertainment, and the medical community to illustrate the dangers of being statistically illiterate. You might be surprised to learn the ways in which the misuse of statistics affects you every day. In order to digest the plethora of statistical information you encounter, you must first become statistically literate.

Source: Hooke, Robert. *How to Tell the Liars from the Statisticians.* New York, New York: Marcel Dekker Inc., 1983. Print.

1.4 Exercises

Basic Concepts

1. What are the consequences of being statistically illiterate? How could this put you at a disadvantage in business?

2. What kinds of questions would a statistically literate person ask?