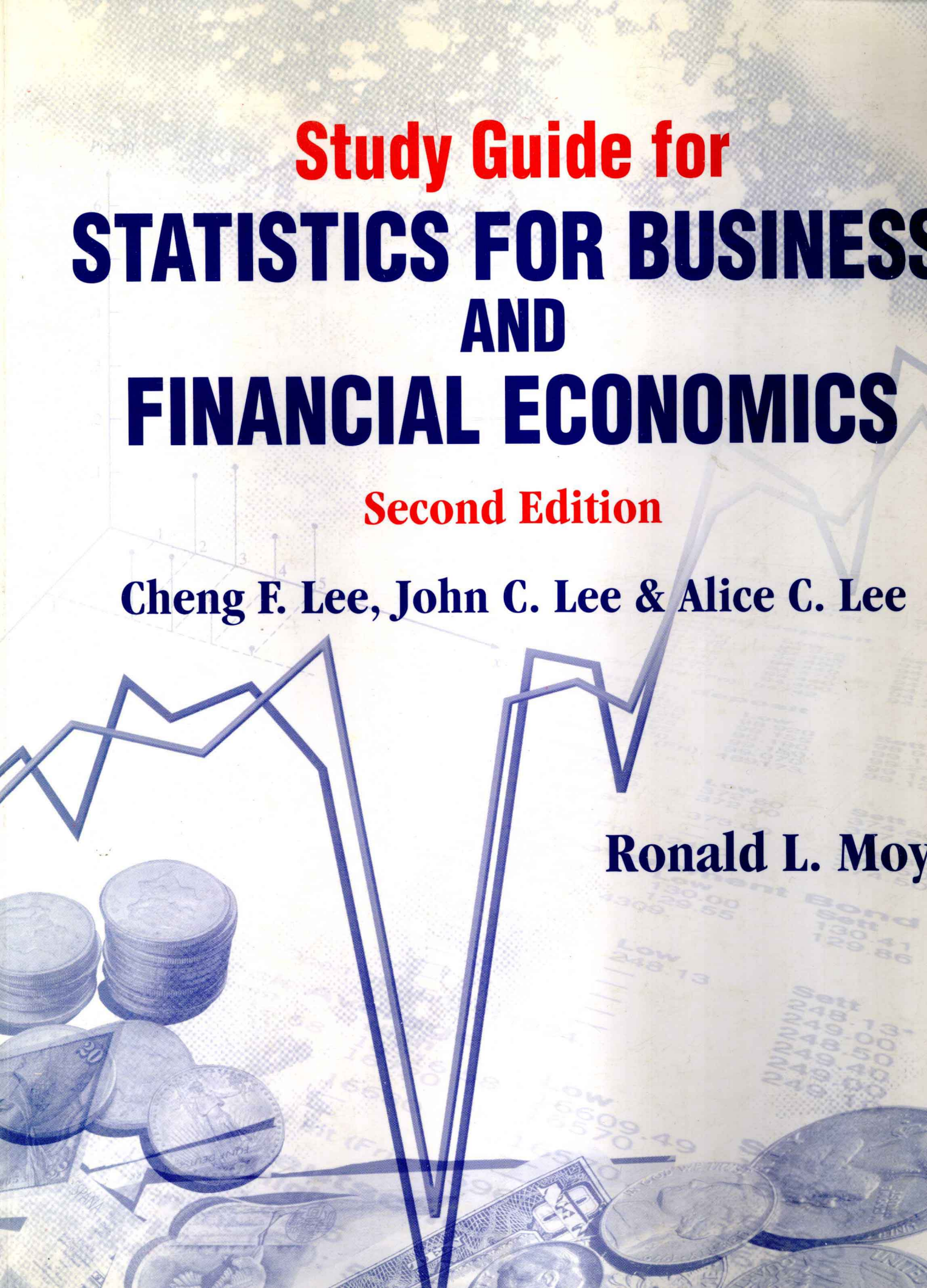
Study Guide for

STATISTICS FOR BUSINESS AND FINANCIAL ECONOMICS

Second Edition

Cheng F. Lee, John C. Lee & Alice C. Lee

Ronald L. Moy



Study Guide for
STATISTICS FOR BUSINESS AND FINANCIAL ECONOMICS

Second Edition

Cheng F. Lee, John C. Lee & Alice C. Lee

Ronald L. Moy
St. John's University, New York

World Scientific
Singapore • New Jersey • London • Hong Kong

Published by

World Scientific Publishing Co. Pte. Ltd.
P O Box 128, Farrer Road, Singapore 912805
USA office: Suite 1B, 1060 Main Street, River Edge, NJ 07661
UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

STUDY GUIDE FOR STATISTICS FOR BUSINESS AND FINANCIAL ECONOMICS (Second Edition)

ISBN 981-02-3831-2 (pbk)

Printed in Singapore by Uto-Print

PREFACE

Nearly all students in business and economics regard a course in statistics as a "necessary evil" required for graduation. I have known of students who postponed taking the required course in statistics until the final semester of their senior year in hope that they will receive sympathy from the instructor simply because they are graduating.

While many students suffer from this anxiety, I believe that much of their fear is unwarranted. Aside from providing important skills used in business decision making, the use of statistics can actually be fun. Sports fans, for instance, constantly deal with statistics, from the average yards a running back gains every time he carries the ball, to the percentage of first serves that are good for a tennis player, to the batting average of a baseball player. Those of you who are not sports fans also deal with statistics in your everyday life. For example, the television ratings provided by A. C. Nielsen and Company, the polls that predict the winners of elections, and the probability of snow from a weather forecast all represent statistics. The person who has a basic understanding of statistics will have a great advantage throughout life. You can be sure that when the time comes for contract negotiations, actor Tom Hanks and baseball player Mark McGuire know statistics.

To reflect the many uses of statistics, I have used examples and problems from all walks of life, including sports, politics, and entertainment as well as business and economics.

The organization of this study guide closely parallels that of Cheng F. Lee's *Statistics for Business and Financial Economics*, providing a comprehensive treatment of every chapter. As an educator, I realize that there are many ways to present a topic. What works for one student may not work for another. To give students the best opportunity to understand the material, I try to present the text material in a slightly different although complementary way. For each chapter, the study guide provides:

- ***Chapter Intuition***. Each chapter begins with an intuitive verbal explanation of the chapter's central message. Essentially, I try to provide some sense of why this chapter is important and where it is headed.

- ***Chapter Review***. Rather than just giving a simple outline of the chapter, all the key concepts in the chapter are presented in a simple, easy-to-follow narrative.

- ***Useful Formulas***. When appropriate, a list of useful formulas from the chapter is presented so that you will not need to search through the text to find formulas necessary for solving the problems.

- ***Example Problems and Solutions***. Here, sample problems similar to the problems in the text are presented, along with a step-by-step solution. To provide you with a guide to solving the problems, each example states the topic that the problem presents.

- ***Supplementary Exercises***. Once you have studied the example problems, you can begin to put your skills to work by solving problems. A variety of exercise types is offered to accommodate various learning styles.

I hope that this study guide will make your study of statistics easier, and more interesting, and perhaps even fun. Good luck.

I would like to thank C. F. Lee for giving me the opportunity to work on this project.

R. L. M.

CONTENTS

CHAPTER 1

INTRODUCTION

Chapter Intuition

Throughout our day-to-day activities, we are constantly bombarded with numbers. Whether we are checking out the results from last night's baseball game or reading the financial pages in the newspaper, we must deal with numbers. One problem with simply looking at a large amount of numbers is that it can be difficult to interpret what they mean. One way to deal with these numbers is to find a method for organizing them so they can be easily understood.

Statistics is an approach that allows us to systematically organize, present and analyze data. There are two basic uses of statistics: to compare or describe data and to make inferences about uncertain events. When statistics is used to describe or compare, we call it ***descriptive statistics***. Most of us have seen a wide variety of descriptive statistics. Sports enthusiasts are especially bombarded with descriptive statistics. Average points per game for a basketball player, average yards rushing for a football player, and batting averages in baseball all represent descriptive statistics. Those of you who are not interested in sports also deal frequently with descriptive statistics such as your grade point average, and the average salary a graduating senior receives. Descriptive statistics is important because it allows us to summarize a series of numbers such as the grades you received in all your courses into a single number, your grade point average. Also, descriptive statistics enables us to make comparisons. For example, if you received a score of 80 on your statistics midterm, it would be difficult for you to know how well you did without knowing how other students in the class performed. By looking at the class average, you can compare your score to the performance of the rest of the class.

When we use statistics to make guesses about uncertain things, we are using an approach known as ***inferential statistics***, because it allows us to infer something that is not yet known. For example, polls that predict the outcome of elections use inferential statistics. Inferential statistics is an approach to making educated guesses about what an entire population (for example, all voters) would do based on a smaller sample (for example, a selection of 1,000

voters). Inferential statistics is especially important when it is too costly or time consuming to survey the entire population.

Chapter Review

1. ***Statistics*** is a course of study devoted to the collection, organization and analysis of data.
2. The entire group we are interested in studying is called the ***population***. A ***sample*** is a subset of the population.
3. ***Descriptive statistics*** allows us to compare different things. For example, we can use a descriptive statistic like the mean (or average) to compare the height of the Boston Celtics to that of the Los Angeles Lakers. Descriptive statistics can be used for comparisons between different groups as in the previous example or it can be used to measure performance such as the return of AT&T's stock, or the average yards Eric Dickerson gains every time he carries the ball, or the average SAT score for students entering Stanford University or the average performance of a statistics class on the midterm exam. Whether we realize it or not, all of us have dealt with descriptive statistics in our lives. The first part of the text is devoted to descriptive statistics.
4. In many cases, we are interested in going beyond simply describing a set of data. ***Inferential statistics*** allows us to draw conclusions about an entire population using only a smaller subset of the population. For example, inferential statistics lets us draw conclusions about how all voters will vote in the presidential election by looking at how only a few will vote. The benefit of using inferential statistics is that it enables us to draw reasonably accurate conclusions inexpensively and efficiently. Imagine the time, money and energy that would be necessary to survey all registered voters in the U.S. about their preferences for the various presidential candidates. The second half of the book is devoted to inferential statistics.
5. ***Deductive statistics*** draws conclusions about specific cases using general information.
6. ***Inductive statistics*** draws general conclusions based on specific information.

Example Problems

Example 1 **Descriptive vs. Inferential Statistics**

Explain whether each of the following is a descriptive or inferential statistic:

a. The average earnings per share for AT&T over the last 5 years.
b. The number of people who will vote for the Democratic candidate for senator in the upcoming election in California using a sample of 200 potential voters.
c. The number of people who would favor a constitutional amendment requiring Congress to balance the budget, based on a survey of registered voters.
d. The average number of yards a rookie running back is expected to gain, based on a sample of rookie running backs.

Solution:

a. Because averages are used to summarize or describe past data, they are descriptive statistics. So the average EPS is a descriptive statistic.
b. When we use a small subset of data to guess or infer the behavior of an entire population, we are using inferential statistics.
c. Inferential statistic
d. Inferential statistic

Example 2 **Using Descriptive Statistics**

Briefly explain how the agent for Greg Maddox of the Atlanta Braves could have used statistics to negotiate a contract similar to that of the Los Angeles Dodgers Kevin Brown in 1998.

Solution: For Maddox's agent to negotiate a contract similar to the one Kevin Brown signed in early 1998, he could have shown that the pitching performance of the

two players was similar. To do this, he could have used statistics such as the earned run average of each pitcher (the average number of runs given up per 9 innings pitched), the winning percentages of each player, average strikeouts per year, and so on.

Example 3 **Using Descriptive Statistics**

Suppose you are graduating this semester. What statistics might be useful in helping you negotiate a fair salary?

Solution: A good starting point for your negotiations would be the average starting salary for other students in your major. However, other statistics could be useful too. First, if you have a very good grade point average, you could argue that you deserve an above average starting salary simply because you are well above average. Another useful statistic would be the starting salaries for other fields of study in which you have taken courses. For example, you are graduating with a major in economics and a minor in computer science. If the starting salary for economics majors is $35,000 and the starting salary for computer science majors is $42,000, you may be able to argue that your computer science background entitles you to be paid more in line with computer science majors rather than being paid as an economics major.

Supplementary Exercises

Multiple Choice

1. Statistics is a
   a. method for organizing and analyzing data.
   b. method for describing data.
   c. method for making educated guesses based on limited data.
   d. method for summarizing data.
   e. all of the above.

2. Descriptive statistics can be used to
   a. compare different sets of data.
   b. compare one observation to a set of data.
   c. make inferences about unknown events.
   d. make guesses about a population using a sample.
   e. both a and b.

3. The average points per game for a basketball player represents
   a. a descriptive statistic.
   b. an inferential statistic.
   c. a deductive statistic.
   d. an inductive statistic.
   e. a sample.

4. Using the Nielsen television ratings to estimate the number of television viewers represents
   a. descriptive statistics.
   b. inferential statistics.
   c. deductive statistics.
   d. inductive statistics.
   e. a population.

5. Using the Gallup election poll to predict the outcome of an election represents
   a. descriptive statistics.
   b. inferential statistics.
   c. deductive statistics.
   d. inductive statistics.
   e. a population.

6. Your grade point average is
   a. descriptive statistics.
   b. inferential statistics.
   c. deductive statistics.
   d. inductive statistics.
   e. a sample.

7. When you are interested in comparing data you would use
   a. descriptive statistics.
   b. inferential statistics.
   c. deductive statistics.
   d. inductive statistics.
   e. a census.

8. Business people use
   a. descriptive statistics.
   b. inferential statistics.
   c. deductive statistics.
   d. inductive statistics.
   e. all of the above.

9. If you were interested in predicting the outcome of the presidential election, you would use
   a. descriptive statistics.
   b. inferential statistics.
   c. deductive statistics.
   d. inductive statistics.
   e. a census.

10. If a business is interested in predicting which flavor mouthwash will be favored by all consumers based on a sample of 500 people they should use
    a. descriptive statistics.
    b. inferential statistics.
    c. deductive statistics.
    d. inductive statistics.
    e. a census.

True/False (If false, explain why)

1. When we use the Nielsen television ratings are used to estimate the number of television viewers, we are using descriptive statistics.
2. The average salary for a graduating senior majoring in finance is a descriptive statistic.
3. Descriptive statistics can be useful in contract negotiations.
4. Inferential statistics can be used to compare two sets of data.
5. Descriptive statistics is used to make educated guesses about unknown events.
6. Statistics can be useful in organizing and presenting data.
7. Deductive statistics draws general conclusions based on specific information.
8. Inductive statistics draws specific conclusions based on general information.
9. Descriptive statistics is frequently used in court cases to make comparisons.
10. The true average salary a graduating senior receives, based on a sample of 100 graduating seniors, is a descriptive statistic.

Questions and Problems

1. List three descriptive statistics commonly encountered in college.
2. List four descriptive statistics in baseball.
3. List four descriptive statistics commonly used in business.
4. Name two well-known sources of inferential statistics.

5. If you were interested in knowing what percentage of the 12 students in your art class will be attending the Picasso exhibit, would it be better to use a sample or a census? Why?
6. If you were interested in knowing what percentage of the 2,000 students in your school will be attending the Picasso exhibit, would it be better to use a sample or a census? Why?

Answers to Supplementary Exercises

Multiple Choice

1.	e	6.	a
2.	e	7.	a
3.	a	8.	e
4.	b	9.	b
5.	b	10.	b

True/False

1. False. Using the Nielsen television ratings to predict the number of television viewers represents inferential statistics.
2. True
3. True
4. False. Descriptive statistics is used to compare two sets of data.
5. False. Inferential statistics is used to make educated guesses.
6. True
7. False. Inductive statistics draws general conclusions based on specific information.
8. False. Deductive statistics draws specific conclusions based on general information.
9. True
10. False. Inferential statistics.

Questions and Problems

1. There are many descriptive statistics you may encounter in college including: grade point average, mean SAT score of all freshmen, average high school class rank, average starting salary for graduating seniors, percentage of female students, percentage of minorities, and average GMAT score.
2. Again, there are many descriptive statistics including: batting average, slugging percentage, earned run average, average strikeouts per nine innings pitched, and stolen base percentage.
3. In the business world, descriptive statistics might include: average advertising dollars, average sales per month, average revenues per month, average salary of employees, and average bonus per employee.
4. Probably the two most widely recognized sources of inferential statistics are the Nielsen television ratings, and the Gallup polls on voting preferences.
5. Because the size of the population is small, it is probably easier to use a census and simply ask all 12 people whether they are going to the exhibit or not.
6. Because the size of the population is relatively large, it may be better to use a sample of students and use inferential statistics to determine the percentage of all students who will be attending the exhibit.

CHAPTER 2

DATA COLLECTION AND PRESENTATION

Chapter Intuition

The say a "picture is worth a thousand words," and no where is this more true than when you are dealing with statistics. Once the data have been collected, they need to be organized and presented so they can be easily understood. For example, when your professor grades the midterm exam, she will have one score for each student. If the class is extremely large, it will be difficult for her to draw any conclusions about the class's performance by simply looking at a bunch of scores. However, by organizing the data into tables or graphs, she can much more easily determine how the class performed and how to assign grades. This chapter discusses how to collect and present data in an orderly manner so that it can be easily analyzed.

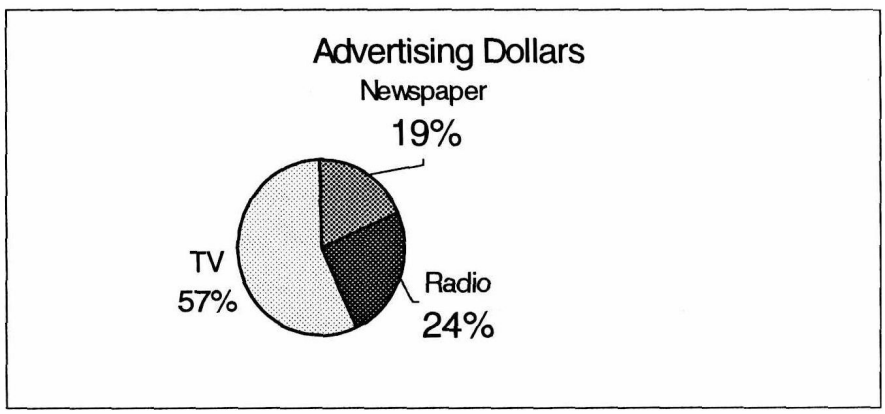
Chapter Review

1. Data can come from either a ***primary source***, which means it is collected specifically for the study, or from a ***secondary source***, which means that the data were originally collected for some other purpose.
2. Before collecting the data, the researcher must decide whether to take a ***sample*** or a ***census***. In a census, all members of the population of interest are surveyed. A census is most practical when the population is small. For example, when trying to decide which movie to see, a family of five would find little difficulty in surveying all five members. However, when the population of interest is very large, it may be infeasible to survey every member. In this case, it may be more desirable to take a sample of the entire population. In a sample, a subset of the population is used to evaluate the views of the entire population. For example, if we are interested in the views of all the men and women in the U.S. concerning a national health care policy, it would not be feasible to survey every single man and woman. Instead, we choose to examine the views of a

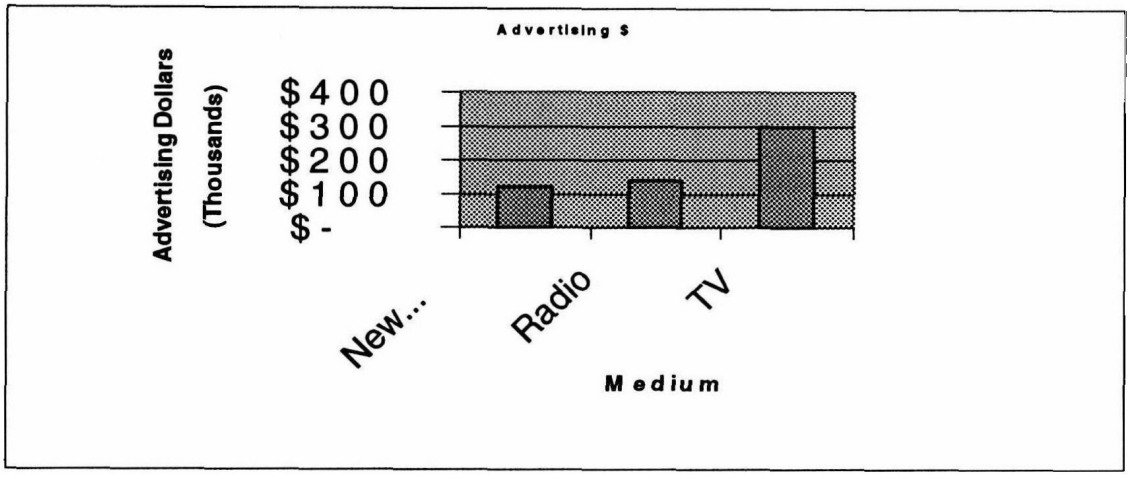
smaller number of men and women and attempt to make inferences about the entire population based on this sample.

3. There are two types of errors that are associated with primary and secondary data. ***Random error*** is the difference between the value obtained by taking a random sample and the value obtained by taking a census. ***Systematic error*** results when there are problems in measurement.
4. One way to organize data is to place them into groups, or classes, and then to present the data using tables.
5. Charts and graphs are another way for presenting data.

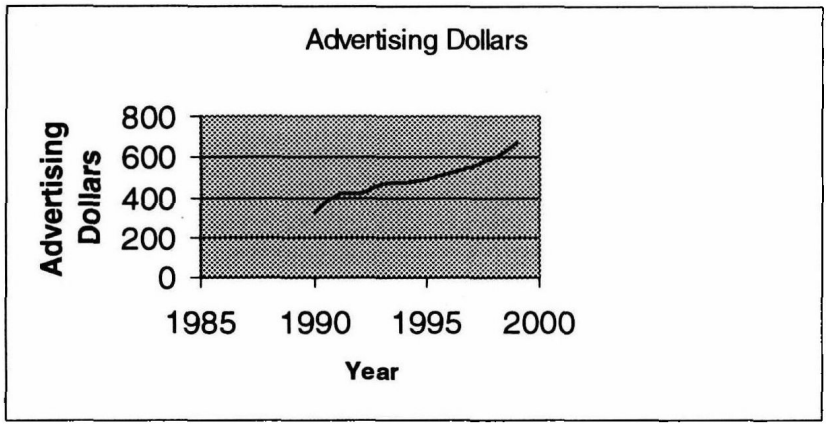
   a. A ***pie chart*** shows how the "whole," the pie, is divided into different pieces, the pieces of the pie. For example, a company could see how its advertising dollars are divided among television, radio, and newspapers by looking at a chart like the one below:



b. A ***bar chart*** can also be used to display data. The company in part (a), might use a bar graph to see how its advertising dollars are spent on television, radio, and newspapers. Each bar represents the amount spent on advertising for each medium.



c. A ***line chart*** can be used to show the relationship between two different variables or how one variable changes over time. For example, the company in part (a) might be interested in seeing how its advertising expenditures have changed over time.



d. A ***time series graph*** is a line graph in which the variable on the X-axis represents time, such as the year or month of the data. The line graph shown for part (c) is also a time series graph.