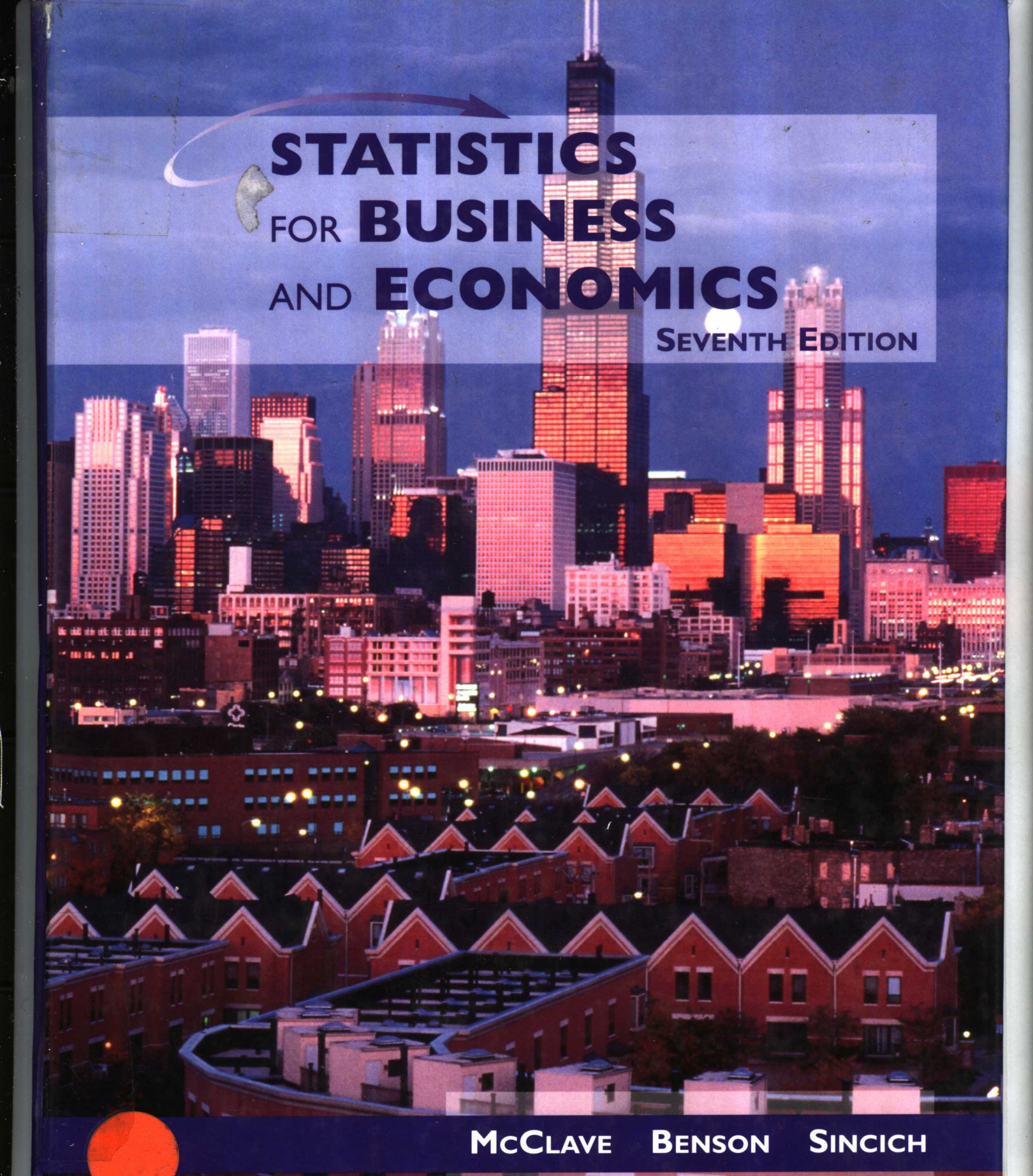
STATISTICS
FOR BUSINESS
AND ECONOMICS
SEVENTH EDITION
McCLAVE BENSON SINCICH

STATISTICS

FOR BUSINESS AND ECONOMICS

SEVENTH EDITION

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PREFACE

This seventh edition of *Statistics for Business and Economics* has been extensively revised to stress the development of statistical thinking, the assessment of credibility and value of the inferences made from data, both by those who consume and those who produce them. This is an introductory text emphasizing inference, with extensive coverage of data collection and analysis as needed to evaluate the reported results of statistical studies and make good business decisions. It assumes a mathematical background of basic algebra.

A briefer version of this book, *A First Course in Business Statistics,* is available for courses that include minimal coverage of regression analysis.

NEW IN THE SEVENTH EDITION

MAJOR CONTENT CHANGES

- Chapter 1 has been entirely rewritten to emphasize the science of statistics and its role in business decisions. Coverage of process and quality control is expanded (Section 1.4). Data collection from published sources, designed experiments, surveys, and observations are introduced in a new section (Section 1.6). Special attention is given to statistical thinking and issues of statistical ethics (Section 1.7).
- Chapter 2 now more thoroughly covers descriptive analytical tools that are useful in examining assumptions about data. A new introductory section (Section 2.1) presents both graphical and numerical methods for summarizing qualitative data. Time series plots and the graphing of bivariate data relationships are introduced in optional sections (Sections 2.3 and 2.10). There is a greater focus throughout on variability (Section 2.7). The discussion of statistical ethics is continued in Section 2.11.
- Chapter 7 has been extensively rewritten to emphasize confidence interval estimation procedures and their interpretation. The approach to small-sample confidence intervals is motivated by pharmaceutical testing requirements (Section 7.2). Two new optional sections cover the finite population correction (Section 7.5) and survey designs (Section 7.6).
- Chapter 8 features more balanced treatment of p-values and critical values in interpreting testing results (Example 8.6). New examples make greater use of computer solutions rather than formulas (Examples 8.4 and 8.6).
- Chapter 9 has been reorganized to present inference in the context of the experimental design used for data collection (Sections 9.1, 9.2, and 9.3).
- Chapter 10 includes an expanded coverage of correlation (Section 10.6), which continues the emphasis from Chapter 2 on bivariate linear relationships. Where appropriate, the emphasis has shifted from the discussion of formulas to the interpretation of computer output, including Excel spreadsheets.
- Chapter 11 has been revised to incorporate more extensive computer output, and inferences about the beta parameters include new material on confidence intervals (Section 11.4).
- Chapter 12 on model building includes a new introductory section that emphasizes the consequences of choosing the wrong model, i.e., errors in prediction. New material treats models with more than two quantitative variables.

- Chapter 15 contains a separate section on multiple comparisons with emphasis on computer output rather than formulas. Examples of both Bonferroni's and Tukey's methods are presented.

New Pedagogical Features

- **Statistics in Action**—two or three features per chapter examine high-profile business, economic, government, and entertainment issues. Questions prompt the students to form their own conclusions and to think through the statistical issues involved.
- **Examples and Exercises**—More than 60% are new or revised, featuring real business data from 1990 to 1996.
- **Quick Review**—Each chapter ends with a list of key terms and formulas, with reference to the page number where they first appear.
- **Language Lab**—Following the Quick Review is a pronunciation guide to Greek letters and other special terms. Usage notes are also provided.
- **Showcases**—Six extensive business problem-solving cases, with real data and assignments, are now included in the text. Each case serves as a good capstone and review of the material that has preceded it.
- **Internet Labs**—This is a new feature to this edition. The Labs are designed to instruct the student in retrieving and analyzing raw data downloaded from the Internet.

Traditional Strengths

We have maintained the features of *Statistics for Business and Economics* that we believe make it unique among business statistics texts. These features, which assist the student in achieving an overview of statistics and an understanding of its relevance in the business world and in everyday life, are as follows:

The Use of Examples as a Teaching Device

Almost all new ideas are introduced and illustrated by real data-based applications and examples. We believe that students better understand definitions, generalizations, and abstractions *after* seeing an application.

Many Exercises—Labeled by Type

The text includes more than 1,400 exercises illustrated by applications in almost all areas of research. Because many students have trouble learning the mechanics of statistical techniques when problems are couched in terms of realistic applications, all exercise sections are divided into two parts:

Learning the Mechanics. Designed as straightforward applications of new concepts, these exercises allow students to test their ability to comprehend a concept or a definition.

Applying the Concepts. Based on applications taken from a wide variety of journals, newspapers, and other sources, these exercises develop the student's skills at comprehending real-world problems that describe situations to which the techniques may be applied.

A Choice in Level of Coverage of Probability

One of the most troublesome aspects of an introductory statistics course is the study of probability. Probability poses a challenge for instructors because they

must decide on the level of presentation, and students find it a difficult subject to comprehend. We believe that one cause for these problems is the mixture of probability and counting rules that occurs in most introductory texts. We have included the counting rules in a separate and optional section at the end of the chapter on probability. In addition, all exercises that require the use of counting rules are marked with an asterisk (*). Thus, the instructor can control the level of coverage of probability.

Extensive Coverage of Multiple Regression Analysis and Model Building

This topic represents one of the most useful statistical tools for the solution of applied problems. Although an entire text could be devoted to regression modeling, we believe we have presented coverage that is understandable, usable, and much more comprehensive than the presentations in other introductory statistics texts. We devote three chapters to discussing the major types of inferences that can be derived from a regression analysis, showing how these results appear in computer printouts and, most important, selecting multiple regression models to be used in an analysis. Thus, the instructor has the choice of a one-chapter coverage of simple regression, a two-chapter treatment of simple and multiple regression, or a complete three-chapter coverage of simple regression, multiple regression, and model building. This extensive coverage of such useful statistical tools will provide added evidence to the student of the relevance of statistics to the solution of applied problems.

Footnotes

Although the text is designed for students with a non-calculus background, footnotes explain the role of calculus in various derivations. Footnotes are also used to inform the student about some of the theory underlying certain results. The footnotes allow additional flexibility in the mathematical and theoretical level at which the material is presented.

Supplements for the Instructor

The supplements for the seventh edition have been completely revised to reflect the extensive revisions of the text. Each element in the package has been accuracy checked to ensure adherence to the approaches presented in the main text, clarity, and freedom from computational, typographical, and statistical errors.

NEW! *Annotated Instructor's Edition* (AIE) (ISBN 0-13-840265-5)

Marginal notes placed next to discussions of essential teaching concepts include:

- Teaching Tips—suggest alternative presentations or point out common student errors
- Exercises—reference specific section and chapter exercises that reinforce the concept
- 💾—identify data sets and file name of material found on the data disks.
- Short Answers—section and chapter exercise answers are provided next to the selected exercises.

Instructor's Notes by Mark Dummeldinger (ISBN 0-13-891243-2)

This new printed resource contains suggestions for using the questions at the end of the Statistics in Action boxes as the basis for class discussion on statistical ethics and other current issues, solutions to the Showcases, a complete short answer book

with letter of permission to duplicate for student use, and many of the exercises and solutions that were removed from the sixth edition of this text.

***Instructor's Solutions Manual* by Nancy S. Boudreau (ISBN 0-13-840307-4)**
Solutions to all of the even-numbered exercises are given in this manual. Careful attention has been paid to ensure that all methods of solution and notation are consistent with those used in the core text. Solutions to the odd-numbered exercises are found in the *Student's Solution's Manual.*

***Test Bank* by Mark Dummeldinger (ISBN 0-13-840356-2)**
Entirely rewritten, the *Test Bank* now includes more than 1,000 problems that correlate to problems presented in the text.

Windows PH Custom Test (ISBN 0-13-621152-6)
Mac PH Custom Test (ISBN 0-13-621103-8)
Incorporates three levels of test creation: (1) selection of questions from a test bank; (2) addition of new questions with the ability to import test and graphics files from WordPerfect, Microsoft Word, and Wordstar; and (3) inclusion of algorithmic capabilities. PH Custom Test has a full-featured graphics editor supporting the complex formulas and graphics required by the statistics discipline.

PowerPoint Presentation Disk (ISBN 0-13-61116-2)
This versatile Windows-based tool may be used by professors in a number of different ways:

- Slide show in an electronic classroom
- Printed and used as transparency masters
- Printed copies may be distributed to students as a convenient note-taking device.

Included on the software disk are learning objectives, thinking challenges, concept presentation slides, and examples with worked-out solutions. The PowerPoint Presentation disk may be downloaded from the FTP site found at the McClave Web site.

Data Disk (ISBN 0-13-840380-5)
The data sets described in Appendix B and the data for all exercises containing 20 or more observations are available on a 3½" diskette in ASCII format. When a given data set is referenced, a disk symbol and the file name will appear in the text near the exercise.

***New York Times Supplement* (ISBN 0-13-261367-8)**
Copies of this supplement may be requested from Prentice Hall by instructors for distribution in their classes. This supplement contains high interest articles published recently in *The New York Times* that relate to topics covered in the text.

McClave Internet Site (http://www.prenhall.com/mcclave)
This site is a work in progress that will be updated throughout the year as new information, tools, and applications become available. The site will contain information about the book and its supplements as well as FTP sites for downloading the Powerpoint Presentation Disk and the Data Files. Teaching tips and student help will be provided as well as links to useful sources of data and information such as the Chance Database, the STEPS project (interactive tutorials developed by the University of Glasgow), and a site designed to help faculty establish and manage course home pages.

Supplements Available for Purchase by Students

Student's Solutions Manual by Nancy S. Boudreau (ISBN 0-13-625260-5)

Fully worked-out solutions to all of the odd-numbered exercises are provided in this manual. Careful attention has been paid to ensure that all methods of solution and notation are consistent with those used in the core text.

Student Versions of SPSS and SYSTAT

Student versions of SPSS, the award-winning and market-leading commercial data analysis package, and SYSTAT are available for student purchase. Details on all current products are available from Prentice Hall or via the SPSS website at http://www.spss.com.

Learning Business Statistics with Microsoft® Excel by John L. Neufeld (ISBN 0-13-234097-6)

The use of Excel as a data analysis and computational package for statistics is explained in clear, easy-to-follow steps in this self-contained paperback text.

A MINITAB Guide to Statistics by Ruth Meyer and David Krueger (ISBN 0-13-784232-5)

This manual assumes no prior knowledge of MINITAB. Organized to correspond to the table of contents of most statistics texts, this manual provides step-by-step instruction to using MINITAB for statistical analysis.

ConStatS by Tufts University (ISBN 0-13-502600-8)

ConStatS is a set of Microsoft Windows based programs designed to help college students understand concepts taught in a first-semester course on probability and statistics. ConStatS helps improve students' conceptual understanding of statistics by engaging them in an active, experimental style of learning. A companion ConStatS workbook (ISBN 0-13-522848-4) that guides students through the labs and ensures they gain the maximum benefit is also available.

Acknowledgments

This book reflects the efforts of a great many people over a number of years. First we would like to thank the following professors, whose reviews and feedback on organization and coverage, contributed to the seventh and previous editions of the book.

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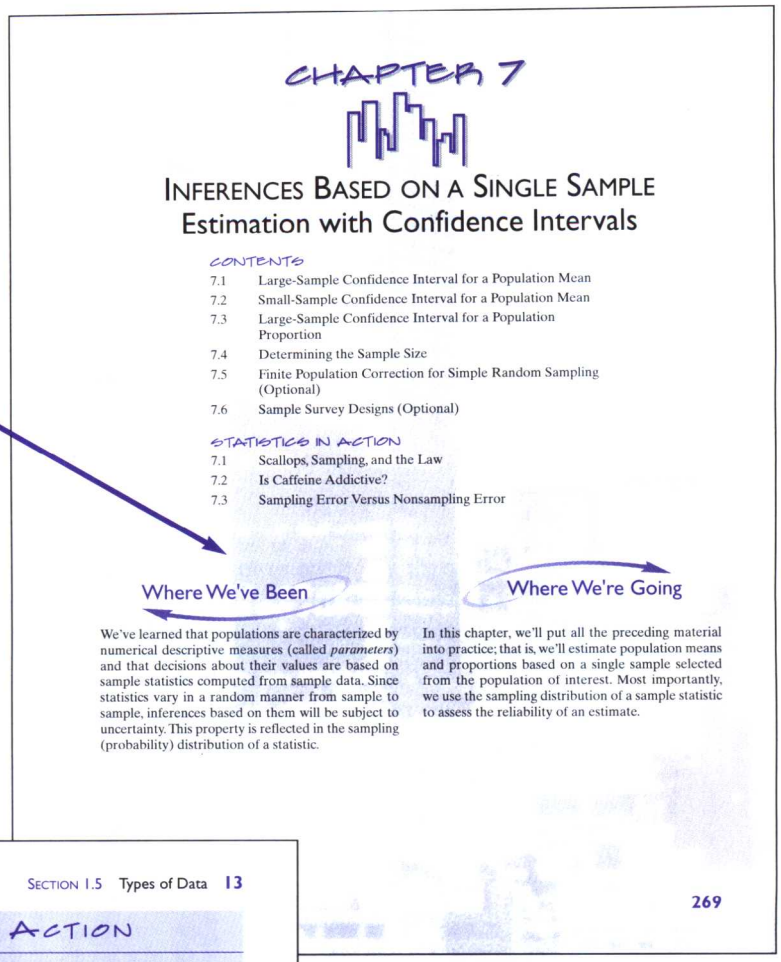
How to Use This Book

To the Student

The following four pages will demonstrate how to use this text in the most effective way—to make studying easier and to understand the connection between statistics and your world.

Chapter Openers Provide a Road Map

- **Where We've Been** quickly reviews how information learned previously applies to the chapter at hand.
- **Where We're Going** highlights how the chapter topics fit into your growing understanding of statistical inference.



CHAPTER 7

INFERENCES BASED ON A SINGLE SAMPLE
Estimation with Confidence Intervals

CONTENTS

STATISTICS IN ACTION

Where We've Been

We've learned that populations are characterized by numerical descriptive measures (called *parameters*) and that decisions about their values are based on sample statistics computed from sample data. Since statistics vary in a random manner from sample to sample, inferences based on them will be subject to uncertainty. This property is reflected in the sampling (probability) distribution of a statistic.

Where We're Going

In this chapter, we'll put all the preceding material into practice; that is, we'll estimate population means and proportions based on a single sample selected from the population of interest. Most importantly, we use the sampling distribution of a sample statistic to assess the reliability of an estimate.

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STATISTICS IN ACTION

1.1 QUALITY IMPROVEMENT: U.S. FIRMS RESPOND TO THE CHALLENGE FROM JAPAN

Over the last two decades, U.S. firms have been seriously challenged by products of superior quality from overseas. For example, from 1984 to 1991, imported cars and light trucks steadily increased their share of the U.S. market from 22% to 30%. As a second example, consider the television and VCR markets. Both products were invented in the United States, but as of 1995 not a single U.S. firm manufactures either. Both are produced exclusively by Pacific Rim countries, primarily Japan.

To meet this competitive challenge, more and more U.S. firms—both manufacturing and service firms—have begun quality-improvement initiatives of their own. Many of these firms now stress the management of quality in all phases and aspects of their business, from the design of their products to production, distribution, sales, and service.

Broadly speaking, quality-improvement programs are concerned with (1) finding out what the customer wants, (2) translating those wants into a product design, and (3) producing and delivering a product or service that meets or exceeds the specifications of the product design. In all these areas, but particularly in the third, *improvement of quality requires improvement of processes*—including production processes, distribution processes, and service processes.

But what does it mean to say that a process has been improved? Generally speaking, it means that the customer of the process (i.e., the user of the output) indicates a greater satisfaction with the output. Frequently, such increases in satisfaction require a reduction in the variation of one or more process variables. That is, a reduction in the variation of the output stream of the proc[illegible] is needed.

produced by a given machine are the same; no two transactions performed by a given bank teller are the same. He also recognized that variation could be understood, monitored, and controlled using statistical methods. He developed a simple graphical technique—called a **control chart**—for determining whether product variation is within acceptable limits. This method provides guidance for when to adjust or change a production process and when to leave it alone. It can be used at the end of the production process or, most significantly, at different points within the process. We discuss control charts and other tools for improving processes in Chapter 13.

In the last decade, largely as a result of the Japanese challenge to the supremacy of U.S. products, control charts and other statistical tools have gained widespread use in the United States. As evidence for the claim that U.S. firms are responding well to Japan's competitive challenge, consider this: The most prestigious quality-improvement prize in the world that a firm can win is the Deming Prize. It has been awarded by the Japanese since the 1950s. In 1989 it was won for the first time by an American company—Florida Power and Light Company. Other evidence of the resurgence of U.S. competitiveness includes a turnaround in market share for U.S. automakers: imports' share of the U.S. market decreased from a high of 30% in 1991 to 25% in 1995.

Focus

a. Identify two processes that are of interest to you.

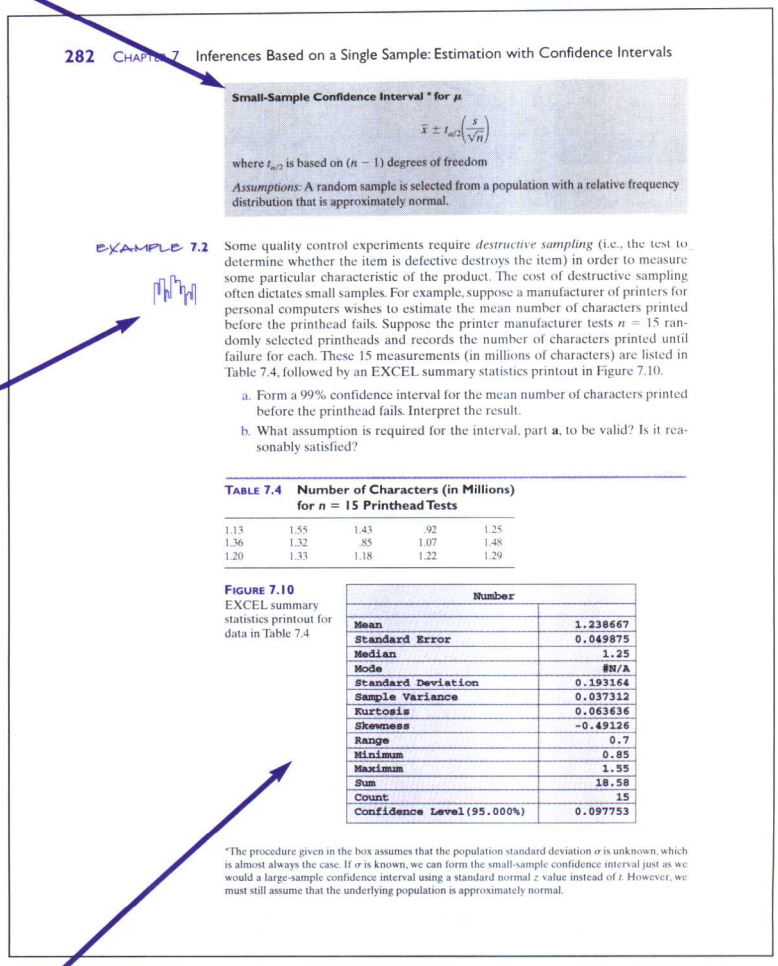
b. For each process, part **a**, identify a variable that could be used to monitor the quality of the output

"Statistics in Action" Boxes Explore High-Interest Issues

- Highlight controversial, contemporary issues that involve statistics.
- Work through the **"Focus"** questions to help you evaluate the findings.

Shaded Boxes Highlight Important Information

- Definitions, Strategies, Key Formulas, and other important information are highlighted.
- Prepare for quizzes and tests by reviewing the highlighted information.



282 CHAPTER 7 Inferences Based on a Single Sample: Estimation with Confidence Intervals

Small-Sample Confidence Interval * for μ

$$\bar{x} \pm t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$$

where $t_{\alpha/2}$ is based on $(n-1)$ degrees of freedom

Assumptions: A random sample is selected from a population with a relative frequency distribution that is approximately normal.

EXAMPLE 7.2

Some quality control experiments require *destructive sampling* (i.e., the test to determine whether the item is defective destroys the item) in order to measure some particular characteristic of the product. The cost of destructive sampling often dictates small samples. For example, suppose a manufacturer of printers for personal computers wishes to estimate the mean number of characters printed before the printhead fails. Suppose the printer manufacturer tests $n = 15$ randomly selected printheads and records the number of characters printed until failure for each. These 15 measurements (in millions of characters) are listed in Table 7.4, followed by an EXCEL summary statistics printout in Figure 7.10.

a. Form a 99% confidence interval for the mean number of characters printed before the printhead fails. Interpret the result.

b. What assumption is required for the interval, part **a**, to be valid? Is it reasonably satisfied?

TABLE 7.4 Number of Characters (in Millions) for $n = 15$ Printhead Tests

1.13	1.55	1.43	.92	1.25
1.36	1.32	.85	1.07	1.48
1.20	1.33	1.18	1.22	1.29

FIGURE 7.10 EXCEL summary statistics printout for data in Table 7.4

	Number
Mean	1.238667
Standard Error	0.049875
Median	1.25
Mode	#N/A
Standard Deviation	0.193164
Sample Variance	0.037312
Kurtosis	0.063636
Skewness	-0.49126
Range	0.7
Minimum	0.85
Maximum	1.55
Sum	18.58
Count	15
Confidence Level(95.000%)	0.097753

*The procedure given in the box assumes that the population standard deviation σ is unknown, which is almost always the case. If σ is known, we can form the small-sample confidence interval just as we would a large-sample confidence interval using a standard normal z value instead of t. However, we must still assume that the underlying population is approximately normal.

Interesting Examples with Solutions

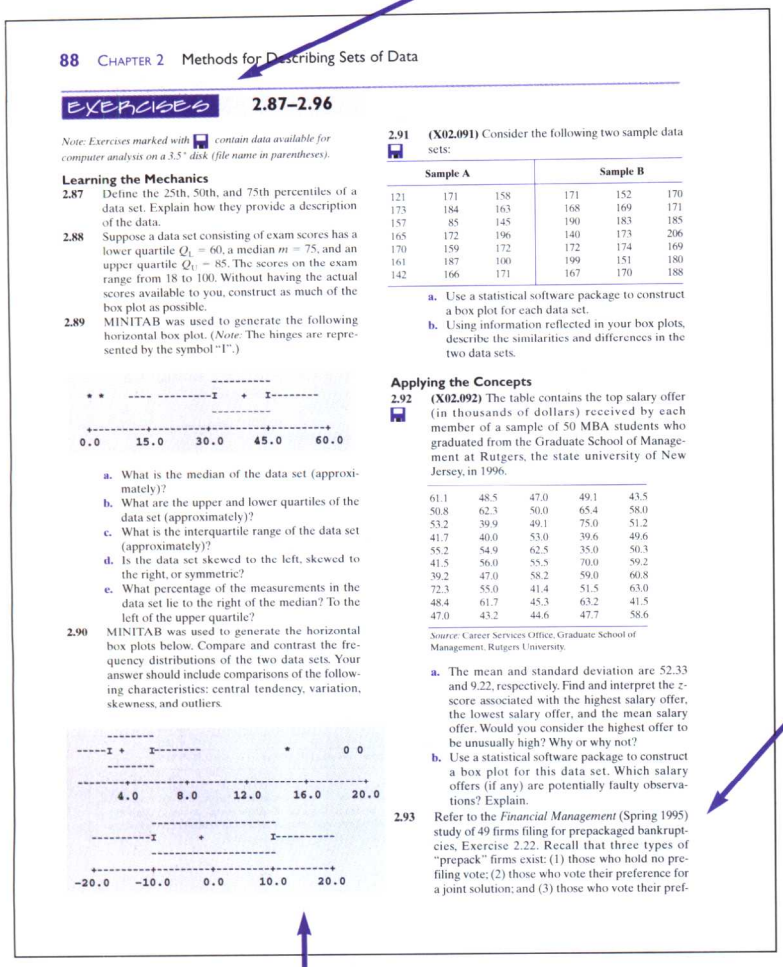
- Examples, with complete solutions and explanations, illustrate every concept and are numbered for easy reference.
- Work through the solution carefully to prepare for the section exercise set.
- The end of the solution is clearly marked with a ■ symbol.

Computer Output Integrated Throughout

- Statistical software packages such as SPSS, MINITAB, SAS, and the spreadsheet package, EXCEL, crunch data quickly so you can spend time analyzing the results. Learning how to interpret statistical output will prove helpful in future classes or on the job.
- When computer output appears in examples, the solution explains how to read and interpret the output.

Lots of Exercises for Practice

- Every section in the book is followed by an Exercise Set divided into two parts.
- **Learning the Mechanics** has straightforward applications of new concepts. Test your mastery of definitions, concepts, and basic computation. Make sure you can answer all of these questions before moving on.
- **Applying the Concepts** tests your understanding of concepts and requires you to apply statistical techniques in solving real-world problems.



88 CHAPTER 2 Methods for Describing Sets of Data

EXERCISES 2.87–2.96

Note: Exercises marked with 💾 *contain data available for computer analysis on a 3.5" disk (file name in parentheses).*

Learning the Mechanics

2.87 Define the 25th, 50th, and 75th percentiles of a data set. Explain how they provide a description of the data.

2.88 Suppose a data set consisting of exam scores has a lower quartile $Q_L = 60$, a median $m = 75$, and an upper quartile $Q_U = 85$. The scores on the exam range from 18 to 100. Without having the actual scores available to you, construct as much of the box plot as possible.

2.89 MINITAB was used to generate the following horizontal box plot. (*Note:* The hinges are represented by the symbol "I".)

```
                    ----------
  * *    ---- ---------I   +   I--------
                    ----------
  +---------+---------+---------+---------+
  0.0       15.0      30.0      45.0      60.0
```

a. What is the median of the data set (approximately)?
b. What are the upper and lower quartiles of the data set (approximately)?
c. What is the interquartile range of the data set (approximately)?
d. Is the data set skewed to the left, skewed to the right, or symmetric?
e. What percentage of the measurements in the data set lie to the right of the median? To the left of the upper quartile?

2.90 MINITAB was used to generate the horizontal box plots below. Compare and contrast the frequency distributions of the two data sets. Your answer should include comparisons of the following characteristics: central tendency, variation, skewness, and outliers.

```
        --------
  -----I +   I--------                *      0 0
        --------
  +---------+---------+---------+---------+---------+
            4.0       8.0      12.0      16.0      20.0

                 ----------------------
  ----------I    +                   I----------
                 ----------------------
  +---------+---------+---------+---------+---------+
  -20.0     -10.0      0.0      10.0      20.0
```

2.91 **(X02.091)** Consider the following two sample data sets:

Sample A			Sample B		
121	171	158	171	152	170
173	184	163	168	169	171
157	85	145	190	183	185
165	172	196	140	173	206
170	159	172	172	174	169
161	187	100	199	151	180
142	166	171	167	170	188

a. Use a statistical software package to construct a box plot for each data set.
b. Using information reflected in your box plots, describe the similarities and differences in the two data sets.

Applying the Concepts

2.92 **(X02.092)** The table contains the top salary offer (in thousands of dollars) received by each member of a sample of 50 MBA students who graduated from the Graduate School of Management at Rutgers, the state university of New Jersey, in 1996.

61.1	48.5	47.0	49.1	43.5
50.8	62.3	50.0	65.4	58.0
53.2	39.9	49.1	75.0	51.2
41.7	40.0	53.0	39.6	49.6
55.2	54.9	62.5	35.0	50.3
41.5	56.0	55.5	70.0	59.2
39.2	47.0	58.2	59.0	60.8
72.3	55.0	41.4	51.5	63.0
48.4	61.7	45.3	63.2	41.5
47.0	43.2	44.6	47.7	58.6

Source: Career Services Office, Graduate School of Management, Rutgers University.

a. The mean and standard deviation are 52.33 and 9.22, respectively. Find and interpret the z-score associated with the highest salary offer, the lowest salary offer, and the mean salary offer. Would you consider the highest offer to be unusually high? Why or why not?
b. Use a statistical software package to construct a box plot for this data set. Which salary offers (if any) are potentially faulty observations? Explain.

2.93 Refer to the *Financial Management* (Spring 1995) study of 49 firms filing for prepackaged bankruptcies, Exercise 2.22. Recall that three types of "prepack" firms exist: (1) those who hold no pre-filing vote; (2) those who vote their preference for a joint solution; and (3) those who vote their pref-

Real Data

- Most of the exercises contain data or information taken from newspaper articles, magazines, and journals published since 1990. Statistics are all around you.

Computer Output

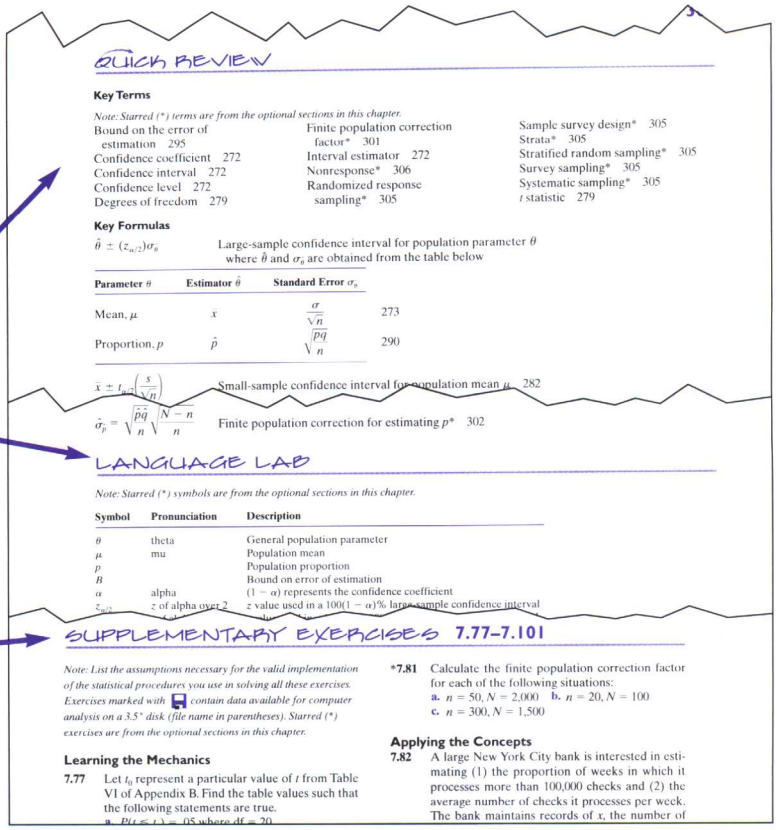
- Computer output screens appear in the exercise sets to give you practice in interpretation.

End of Chapter Review

- Each chapter ends with information designed to help you check your understanding of the material, study for tests, and expand your knowledge of statistics.
- **Quick Review** provides a list of key terms and formulas with page number references.
- **Language Lab** helps you learn the language of statistics through pronunciation guides, descriptions of symbols, names, etc.
- **Supplementary Exercises** review all of the important topics covered in the chapter.

Exercises marked with 💾 require a computer for solution.

Data sets for use with the 💾 problems are available on disk.



QUICK REVIEW

Key Terms

Note: Starred (*) terms are from the optional sections in this chapter.

Bound on the error of estimation 295
Confidence coefficient 272
Confidence interval 272
Confidence level 272
Degrees of freedom 279
Finite population correction factor* 301
Interval estimator 272
Nonresponse* 306
Randomized response sampling* 305
Sample survey design* 305
Strata* 305
Stratified random sampling* 305
Survey sampling* 305
Systematic sampling* 305
t statistic 279

Key Formulas

$\hat{\theta} \pm (z_{\alpha/2})\sigma_{\hat{\theta}}$ Large-sample confidence interval for population parameter θ where $\hat{\theta}$ and $\sigma_{\hat{\theta}}$ are obtained from the table below

Parameter θ	Estimator $\hat{\theta}$	Standard Error $\sigma_{\hat{\theta}}$	
Mean, μ	$\bar{x}$	$\frac{\sigma}{\sqrt{n}}$	273
Proportion, p	$\hat{p}$	$\sqrt{\frac{pq}{n}}$	290

$\bar{x} \pm t_{\alpha/2}\left(\frac{s}{\sqrt{n}}\right)$ Small-sample confidence interval for population mean μ 282

$\hat{\sigma}_{\hat{p}} = \sqrt{\frac{\hat{p}\hat{q}}{n}}\sqrt{\frac{N-n}{n}}$ Finite population correction for estimating p* 302

LANGUAGE LAB

Note: Starred (*) symbols are from the optional sections in this chapter.

Symbol	Pronunciation	Description
θ	theta	General population parameter
μ	mu	Population mean
p		Population proportion
B		Bound on error of estimation
α	alpha	$(1-\alpha)$ represents the confidence coefficient
$z_{\alpha/2}$	z of alpha over 2	z value used in a $100(1-\alpha)\%$ large-sample confidence interval

SUPPLEMENTARY EXERCISES 7.77–7.101

Note: List the assumptions necessary for the valid implementation of the statistical procedures you use in solving all these exercises. Exercises marked with 💾 contain data available for computer analysis on a 3.5" disk (file name in parentheses). Starred (*) exercises are from the optional sections in this chapter.

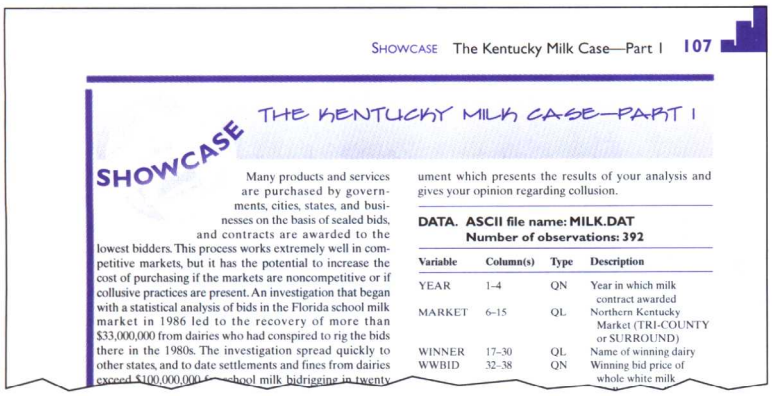
Learning the Mechanics

7.77 Let t_0 represent a particular value of t from Table VI of Appendix B. Find the table values such that the following statements are true.
a. $P(t \leq t_0) = .05$ where $df = 20$

***7.81** Calculate the finite population correction factor for each of the following situations:
a. $n = 50, N = 2,000$ b. $n = 20, N = 100$
c. $n = 300, N = 1,500$

Applying the Concepts

7.82 A large New York City bank is interested in estimating (1) the proportion of weeks in which it processes more than 100,000 checks and (2) the average number of checks it processes per week. The bank maintains records of *x*, the number of



SHOWCASE The Kentucky Milk Case—Part I 107

SHOWCASE THE KENTUCKY MILK CASE—PART I

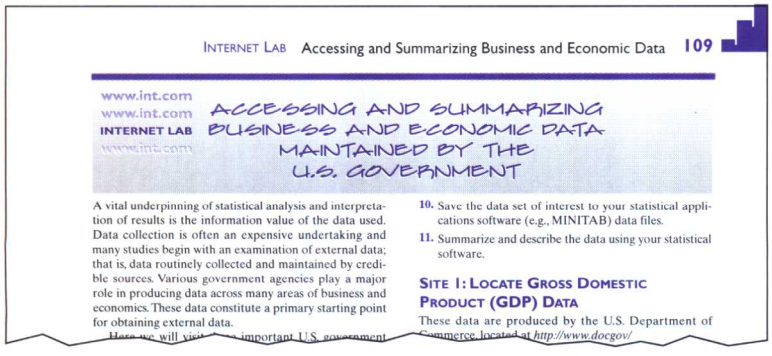
Many products and services are purchased by governments, cities, states, and businesses on the basis of sealed bids, and contracts are awarded to the lowest bidders. This process works extremely well in competitive markets, but it has the potential to increase the cost of purchasing if the markets are noncompetitive or if collusive practices are present. An investigation that began with a statistical analysis of bids in the Florida school milk market in 1986 led to the recovery of more than $33,000,000 from dairies who had conspired to rig the bids there in the 1980s. The investigation spread quickly to other states, and to date settlements and fines from dairies exceed $100,000,000 for school milk bidrigging in twenty

ument which presents the results of your analysis and gives your opinion regarding collusion.

DATA. ASCII file name: MILK.DAT
Number of observations: 392

Variable	Column(s)	Type	Description
YEAR	1–4	QN	Year in which milk contract awarded
MARKET	6–15	QL	Northern Kentucky Market (TRI-COUNTY or SURROUND)
WINNER	17–30	QL	Name of winning dairy
WWBID	32–38	QN	Winning bid price of whole white milk

- **Showcase** Six real-business cases put you in the position of the business decision maker or consultant. Use the data provided and the information you have learned in preceding chapters to reach a decision and support your arguments about the questions being asked.



INTERNET LAB Accessing and Summarizing Business and Economic Data 109

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ACCESSING AND SUMMARIZING BUSINESS AND ECONOMIC DATA MAINTAINED BY THE U.S. GOVERNMENT

A vital underpinning of statistical analysis and interpretation of results is the information value of the data used. Data collection is often an expensive undertaking and many studies begin with an examination of external data; that is, data routinely collected and maintained by credible sources. Various government agencies play a major role in producing data across many areas of business and economics. These data constitute a primary starting point for obtaining external data.

Here we will visit some important U.S. government

10. Save the data set of interest to your statistical applications software (e.g., MINITAB) data files.
11. Summarize and describe the data using your statistical software.

SITE 1: LOCATE GROSS DOMESTIC PRODUCT (GDP) DATA

These data are produced by the U.S. Department of Commerce located at *http://www.docgov/*

- **Internet Labs** follow the Showcase and are designed to help you retrieve and download raw data from the Internet for analysis. Knowing how to mine the Internet for reliable data, analyze it appropriately, and draw useful conclusions are important job skills for the 21st century.

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