

The book cover features a complex design with overlapping wood grain patterns. The top and left portions are dominated by light-colored wood grain with a wavy, zigzag pattern. A diagonal section on the left shows a darker, more textured wood grain. The right side of the cover is a solid, textured blue. The authors' names are printed in the top left, and the title and edition information are on the right.

JAMES T. McCLAVE
P. GEORGE BENSON

A FIRST COURSE IN BUSINESS STATISTICS

FIFTH EDITION

FIFTH EDITION

A First Course In Business Statistics

JAMES T. MCCLAVE

College of Business Administration
University of Florida

P. GEORGE BENSON

Curtis L. Carlson School of Management
University of Minnesota

DELLEN

an imprint of

MACMILLAN PUBLISHING
COMPANY

New York

MAXWELL MACMILLAN CANADA

Toronto

MAXWELL MACMILLAN INTERNATIONAL

New York Oxford Singapore Sydney

On the cover: A detail from a mixed-media, three-dimensional screen created by San Francisco designer Robert Hutchinson. The entire six-panel screen is 24 feet long and 8 feet high. It is one of many custom-made art screens created by Mr. Hutchinson.

Copyright © 1992 by Dellen, an imprint of Macmillan, Inc.

Printed in the United States of America

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the Publisher.

Macmillan Publishing Company
866 Third Avenue, New York, New York 10022

Macmillan Publishing Company is part of the Maxwell Communication Group of Companies.

Maxwell Macmillan Canada, Inc.
1200 Eglinton Avenue East
Suite 200
Don Mills, Ontario M3C 3N1

Library of Congress Cataloging in Publication Data

McClave, James T.

A first course in business statistics / James T. McClave,
P. George Benson — 5th ed.

p. cm.

Includes index.

ISBN 0-02-378571-3

1. Commercial statistics 2. Statistics—Data processing.

3. Commercial statistics—Case studies. I. Benson, P. George,
1946- II. Title.

HF1017.M358 1992

519.5—dc20

91-31604

CIP

Printing: 2 3 4 5 6 7 Year: 2 3 4 5 6 7 8

**A First
Course in
Business
Statistics**

Preface

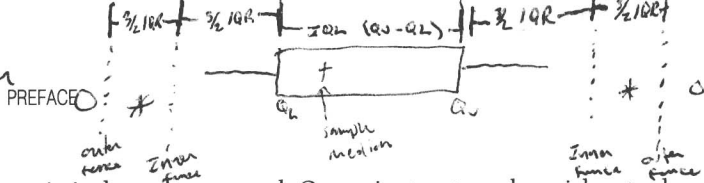
The fifth edition of *A First Course in Business Statistics* finds the authors continuing to try to walk the fine line between classical statistical inference and the “new wave” of business statistics. We note with interest the new texts that have adopted a “contemporary” approach, focused primarily on data analysis and emphasizing pre-inferential methods. Of course, something must be sacrificed in order to adopt this approach, which typically results in the delay of, and sometimes even the elimination of, the traditional inferential techniques. We continue to think it important to present inferential techniques and, in fact, to make them the theme of the text. However, we also recognize that the methods and focus of the applications of statistics in business are changing ever more rapidly. In particular, the worldwide quality movement is convincing profit and nonprofit organizations alike of the importance of applying statistical reasoning in all aspects of their operations. Thus, our objective is to achieve the appropriate blend of the contemporary and classical approaches. With that objective in mind, the following are the new features of the fifth edition:

1. **Quality Improvement.** The most important change in the fifth edition is the replacement of the Decision Analysis chapter with a new chapter on Methods for Quality Improvement (Chapter 12). In previous editions we treated the statistical aspects of quality in various case studies, examples, and exercises throughout the text. Because the issue of quality transcends statistical methods, we resisted devoting a chapter to the topic until we could develop a treatment of quality that covers more than just statistical control charts. With this edition we introduce a chapter on quality improvement, beginning with the history of the quality movement in the United States, introducing and explaining the concepts of “systems thinking” and “process management,” and finally presenting the ultimate consequence of these concepts—the statistical control of systems. This chapter is longer and more encompassing than the typical treatment of statistical quality control; we believe that this more complete treatment of quality is essential to a comprehensive understanding of the quality movement that is sweeping the business world.
2. **Processes and Measurement.** Our treatment of quality really begins in Chapter 1. We have added the concept of a dynamic process to the traditional static population, so that the instructor who wishes to focus on process improvement early in the course and/or inferences about both populations and processes can now do so. We also introduce the concept of “variables” in Chapter 1. We do this by redefining the population to consist of “units” rather than “data,” and then defining a variable to be the characteristic of these units. Data are then obtained by measuring the variable of interest. This will focus more attention on measurement and will make an easier transition to the concept of random variables and their probability distributions.

3. **Types of Data.** In the same vein, we have added more on the concept of measuring different types of variables in Chapter 2, introducing and defining the four types of data: nominal, ordinal, interval, and ratio. Also, Pareto analysis is introduced and a new section on time series plots has been added to Chapter 2.
4. **Random Variables.** The two chapters on discrete and continuous random variables have been streamlined into a single chapter (Chapter 5). This provides for a quicker transition from probability to statistical inference.
5. **Estimation and Hypothesis Tests.** The introduction to the classical inferential techniques of estimation and tests of hypotheses had made for a very long Chapter 8 in the fourth edition, especially with the (optional) material on Type II errors. In the fifth edition we have separated single-sample inference into two chapters: one on estimation (Chapter 7) and the second on tests of hypotheses (Chapter 8).
6. **Multinomial Distribution.** A chi-square test for probabilities from a multinomial distribution has been added to the chapter on comparing two or more proportions (Chapter 10).
7. **Regression.** Optional sections on multiple regression models and residual analysis have been added to Chapter 11, which included only material for simple linear regression analysis in the previous edition.
8. **Exercises.** New exercises have been added throughout, this time concentrating on new and better mechanical exercises in the Learning the Mechanics sections at the beginning of most exercise sets. Some new applied exercises have been added as well, especially accompanying the new material. We continue to introduce business terminology in the prologues of a portion of our Applying the Concepts exercises.
9. **Data Sets on Disk.** We have placed all of the large exercise data sets on a computer disk. The List of Exercise Data Sets (page xix) lists these data sets, indicates the exercise number, the page number, and the file names of the data sets. Instructors who adopt the text may obtain the disk by writing to Dellen Publishing Company, 400 Pacific Avenue, San Francisco, California 94133, or by calling 415-433-9900.

The fifth edition of *A First Course in Business Statistics* maintains the same objectives as the earlier editions. It is constructed to provide greater flexibility in designing a one- or two-course introductory sequence. This text contains the material that is usually presented in a one-quarter or one-semester introductory course in statistics. It is intended for use in the traditional one-quarter or one-semester business statistics course that is offered in many two-year colleges. It may also be used in a single introductory business college course that stresses the understanding and application of concepts along with the ability to apply some of the basic statistical methods for analyzing data. For example, instructors who would like to emphasize processes and process improvement might cover all of Chapter 1, followed immediately by the first four sections of Chapter 12, Methods for Quality Improvement. Then later, after covering the relevant sections of Chapter 6–10, return to Chapter 12 and cover the last four sections on

$K=1 \rightarrow 0$ because things 10 from M
 $K=2 \rightarrow 3/4$ because things 20 from M
 $K=3 \rightarrow 3/4$ because things 30 from M



$\frac{n+1}{4} = \text{est. } 25^{\text{th}}$
 $\frac{n+1}{4} = \text{est. } 75^{\text{th}}$
 $\frac{n+1}{4} = \text{est. } 75^{\text{th}}$

Range measure variability of a data set

$\frac{\text{sum of var}}{n}$ = sample mean, which is more accurate than group average

Comb notation

$$\binom{23,188,100}{100} = \frac{23,188,100!}{100! (23,188,100 - 100)!}$$

Sample Ave

$$\frac{1+1+1}{3} = 1$$

Sample median

$$1+5+7 = 5$$

Sample Stand Dev

$$s = \sqrt{S^2}$$

Sample Var

$$\frac{(\text{sum of squares of samp. mean}) - \frac{(\text{sum of sums})^2}{n}}{n-1}$$

Sample Mean

$$\frac{5+6+7}{3} = \frac{18}{3} = 6$$

Z-scores (normal shaped)

- 68% (-1, 1)
- 95% (-2, 2)
- 99% (-3, 3)

statistical process control. Or, an instructor who wishes to devote significant time to exploratory data analysis might cover all topics in Chapters 2 and 3 and omit either the regression chapter (Chapter 11) or the quality chapter (Chapter 12).

Alternatively, this text is designed for a first course in a two-course sequence where the instructor desires the freedom to devise a second course of his or her choosing. Since most phenomena in business and economics are described by multivariable statistical models, a prime candidate for a (nonsurvey) second course in business statistics is one that provides coverage of model building and multiple regression analysis. Consequently, we are simultaneously publishing the fourth edition of *A Second Course in Business Statistics: Regression Analysis*, by William Mendenhall and Terry Sincich. This text provides in-depth coverage of regression analysis, analysis of variance, and time series and is intended for the second course in the sequence.

We have maintained the features of this text that we believe make it unique among introductory statistics texts for business courses. These features, which assist the student in achieving an overview of statistics and an understanding of its relevance in the solution of business problems, are as follows:

1. Case Studies. (See the list of case studies on page xvii.) Many important concepts are emphasized by the inclusion of case studies, which consist of brief summaries of actual business applications of the concepts and are often drawn directly from the business literature. These case studies allow the student to see business applications of important statistical concepts immediately after the introduction of the concepts. The case studies also help to answer by example the often asked questions, "Why should I study statistics? Of what relevance is statistics to business?" Finally, the case studies constantly remind the student that each concept is related to the dominant theme—statistical inference.
2. Where We've Been . . . Where We're Going . . . The first page of each chapter is a "unification" page. Our purpose is to allow the student to see how the chapter fits into the scheme of statistical inference. First, we briefly show how the material presented in previous chapters helps us to achieve our goal (Where We've Been). Then, we indicate what the next chapter (or chapters) contributes to the overall objective (Where We're Going). This feature allows us to point out that we are constructing the foundation block by block, with each chapter an important component in the structure of statistical inference. Furthermore, this feature provides a series of brief résumés of the material covered as well as glimpses of future topics.
3. Many Examples and Exercises. We believe that most students learn by doing. The text contains many worked examples to demonstrate how to solve various types of problems. We then provide the student with a large number (more than 700) of exercises. The answers for odd-numbered exercises are included at the end of the text. The exercises are of two types:
 - a. Learning the Mechanics. These exercises are intended to be straightforward applications of the new concepts. They are introduced in a few words and are unhampered by a barrage of background information designed to

Drug test declares 2% of drug free people to be drug users.

a) What is the prob that from 6 randoms, at least one will be called a user?

- ⊙ $P(X \geq 1) = 1 - P(X=0)$
- ⊙ $\binom{6}{0} (.02)^0 (.98)^6$
- ⊙ $\frac{6!}{0!6!} (1) (.98)^6$
- ⊙ $(1) (1) (.98)^6 = .886$
- ⊙ $1 - .886 = \boxed{.114}$ is prob that at least 1 will be called a user

b) If 60 people are chosen, what is the prob that no mistakes will be made?

- ⊙ $\binom{60}{0} (.02)^0 (.98)^{60}$
- ⊙ $(1) (1) (.98)^{60}$
- ⊙ $P(X=0) = \boxed{.298}$

guide) that allow the student to check mastery of the material in each section.

c. **Minitab Supplement** (by Ruth K. Meyer and David D. Krueger). The Minitab computer supplement was developed to be used with Minitab Release 7.0, a general-purpose statistical computing system. The supplement, which was written especially for the student with no previous experience with computers, provides step-by-step descriptions of how to use Minitab effectively as an aid in data analysis. Each chapter begins with a list of new commands introduced in the chapter. Brief examples are then given to explain new commands, followed by examples from the text illustrating the new and previously learned commands. Where appropriate, simulation examples are included. Exercises, many of which are drawn from the text, conclude each chapter.

A special feature of the supplement is a chapter describing a survey sampling project. The objectives of the project are to illustrate the evaluation of a questionnaire, provide a review of statistical techniques, and illustrate the use of Minitab for questionnaire evaluation.

d. **DellenStat** (by Michael Conlon). DellenStat is an integrated statistics package consisting of a workbook and an IBM PC floppy diskette with software and example sets of data. The system contains a file creation and management facility, a statistics facility, and a presentation facility. The software is menu-driven and has an extensive help facility. It is completely compatible with the text.

The DellenStat workbook describes the operation of the software and uses examples from the text. After an introductory chapter for new computer users, the remaining chapters follow the outline of the text. Additional chapters show how to create new sets of data. Technical appendices cover material for advanced users and programmers.

DellenStat runs on any IBM PC or close compatible with at least 256K of memory and at least one floppy disk drive.

e. **DellenTest**. This unique computer-generated random test system is available to instructors without cost. Utilizing an IBM PC computer and a number of commonly used dot-matrix printers, the system will generate an almost unlimited number of quizzes, chapter tests, final examinations, and drill exercises. At the same time, the system produces an answer key and student worksheet with an answer column that exactly matches the column on the answer key.

f. **Data Base**. A demographic data set was assembled based on a systematic random sample of 1,000 U.S. zip codes. Demographic data for each zip code area selected were supplied by CACI, an international demographic and market information firm. Fifteen demographic measurements (including population, number of households, median age, median household income, variables related to the cost of housing, educational levels, the work force, and purchasing potential indexes based on the Bureau of the Census Consumer Expenditure Surveys) are presented for each zip code area.

Some of the data are referenced in the "Using the Computer" sections. The objectives are to enable the student to analyze real data in a relatively large sample using the computer, and to gain experience using the statistical techniques and concepts on real data.

Acknowledgments

We owe thanks to the many people who assisted in reviewing and preparing this textbook. Their names are listed below. We particularly acknowledge the editorial assistance of Susan L. Reiland, the administrative support of Jane Oas Benson, and the typing and assistance of Brenda Dobson and Karen Lundquist. Without these four, we never could have completed this work. We are also indebted to Professor Richard W. Andrews of the University of Michigan and his teaching assistants for using and critiquing a preliminary version of our new chapter on Methods for Quality Improvement (Chapter 12). Their comments and suggestions resulted in numerous improvements to the chapter.

Gordon J. Alexander University of Minnesota	Michael S. Broida Miami University of Ohio
Larry M. Austin Texas Tech University	Glenn J. Browne University of Minnesota
Donald W. Bartlett University of Minnesota	Edward Carlstein University of North Carolina at Chapel Hill
Clarence Bayne Concordia University	John M. Charnes University of Miami
Carl Bedell Philadelphia College of Textiles and Science	Chih-Hsu Cheng University of Minnesota
David M. Bergman University of Minnesota	Larry Claypool Oklahoma State University
William H. Beyer University of Akron	Edward R. Clayton Virginia Polytechnic Institute and State University
Atul Bhatia University of Minnesota	Ronald L. Coccari Cleveland State University
Jim Branscome University of Texas at Arlington	Ken Constantine University of New Hampshire
Francis J. Brewerton Middle Tennessee State University	Jim Daly California State Polytechnic Institute
Daniel Brick Kean College	Dileep Dhavale University of Northern Iowa
Robert W. Brobst University of Texas at Arlington	

- Mark Eakin
 University of Texas at Arlington
 Carol Eger
 Stanford University
 Robert Elrod
 Georgia State University
 Douglas A. Elvers
 University of North Carolina at
 Chapel Hill
 Iris B. Fetta
 Clemson University
 Susan Flach
 General Mills, Inc.
 Alan E. Gelfand
 University of Connecticut
 Joseph Glaz
 University of Connecticut at Storrs
 Paul W. Guy
 California State University, Chico
 Michael E. Hanna
 University of Texas at Arlington
 Don Holbert
 Oklahoma State University
 James Holstein
 University of Missouri
 Warren M. Holt
 Southeastern Massachusetts
 University
 Steve Hora
 University of Hawaii, Hilo
 Iris B. Ibrahim
 Clemson University
 Marius Janson
 University of Missouri
 Ross H. Johnson
 Madison College
 Timothy J. Killeen
 University of Connecticut
 David D. Krueger
 St. Cloud State University
 Richard W. Kulp
 Wright-Patterson AFB, Air Force
 Institute of Technology
 Martin Labbe
 State University of New York College
 at New Paltz
 James Lackritz
 California State University at
 San Diego
 Donald R. LaTorre
 Clemson University
 Philip Levine
 William Patterson College
 Eddie M. Lewis
 University of Southern Mississippi
 Fred Leysieffer
 Florida State University
 Binshan Lin
 Louisiana State University
 at Shreveport
 Pi-Erh Lin
 Florida State University
 Robert Ling
 Clemson University
 G. E. Martin
 Clarkson University
 Brenda Masters
 Oklahoma State University
 Ruth K. Meyer
 St. Cloud State University
 Paul I. Nelson
 Kansas State University
 Paula M. Oas
 General Office Products
 William M. Partian
 Fordham College
 Vijay Pisharody
 University of Minnesota
 P. V. Rao
 University of Florida

Don Robinson
Illinois State University
Jan Saraph
St. Cloud State University
Craig W. Slinkman
University of Texas at Arlington
Robert K. Smidt
California Polytechnic State
University
William L. Soule
University of Maine
Donald N. Steinnes
University of Minnesota at Duluth
Virgil F. Stone
Texas A and I University
Katheryn Szabet
La Salle University
Alireza Tahai
Mississippi State University
Chipei Tseng
Northern Illinois University
Pankaj Vaish
Arthur Andersen & Company

Robert W. Van Cleave
University of Minnesota
Charles F. Warnock
Colorado State University
William J. Weida
United States Air Force Academy
T. J. Wharton
University of New Hampshire
Kathleen M. Whitcomb
University of South Carolina
Edna White
Florida Atlantic University
Steve Wickstrom
University of Minnesota
James Willis
Louisiana State University
Douglas A. Wolfe
Ohio State University
Dilek Yeldan
Bilkent University, Turkey
Fike Zahroon
Moorhead State University

Contents

CHAPTER 1	What Is Statistics?	1
	1.1 Statistics: What Is It?	2
	1.2 The Elements of Statistics	6
	1.3 Statistics: Witchcraft or Science?	10
	1.4 Processes (Optional)	11
	1.5 The Role of Statistics in Managerial Decision-Making	16
CHAPTER 2	Graphical Descriptions of Data	23
	2.1 Types of Data	24
	2.2 Graphical Methods for Describing Qualitative Data: The Bar Chart (Optional)	30
	2.3 Graphical Methods for Describing Qualitative Data: The Pie Chart (Optional)	38
	2.4 Graphical Methods for Describing Quantitative Data: Stem and Leaf Displays	42
	2.5 Graphical Methods for Describing Quantitative Data: Histograms	51
	2.6 Graphical Methods for Describing Quantitative Data: Cumulative Relative Frequency Distributions (Optional)	64
	2.7 Graphical Methods for Describing Quantitative Data Produced Over Time: The Time Series Plot (Optional)	68
	2.8 Distorting the Truth with Pictures (Optional)	71
CHAPTER 3	Numerical Descriptive Measures	85
	3.1 The Arithmetic Mean: A Measure of Central Tendency	86
	3.2 The Median: Another Measure of Central Tendency	92
	3.3 The Mode: A Third Measure of Central Tendency	96
	3.4 The Range: A Measure of Variability	101
	3.5 The Variance and Standard Deviation: Measures of Variability	104
	3.6 Calculation Formulas for Variance and Standard Deviation	107

	3.7	Intpreting the Standard Deviation	113
	3.8	Measures of Relative Standing	123
	3.9	Box Plots: Graphical Descriptions Based on Quartiles (Optional)	130
CHAPTER	4	Probability	149
	4.1	Events, Sample Spaces, and Probability	150
	4.2	Compound Events	165
	4.3	Complementary Events	168
	4.4	Conditional Probability	174
	4.5	Probabilities of Unions and Intersections	179
	4.6	Random Sampling	190
CHAPTER	5	Random Variables and Probability Distributions	207
	5.1	Two Types of Random Variables	208
	5.2	Probability Distributions for Discrete Random Variables	210
	5.3	The Binomial Distribution	222
	5.4	The Poisson Distribution (Optional)	236
	5.5	Probability Distributions for Continuous Random Variables	242
	5.6	The Normal Distribution	243
	5.7	Approximating a Binomial Distribution with a Normal Distribution	257
	5.8	The Uniform Distribution (Optional)	264
	5.9	The Exponential Distribution (Optional)	268
CHAPTER	6	Sampling Distributions	283
	6.1	Introduction to Sampling Distributions	285
	6.2	Properties of Sampling Distributions: Unbiasedness and Minimum Variance	290
	6.3	The Sampling Distribution of the Sample Mean	293
	6.4	The Relationship Between Sample Size and a Sampling Distribution	301
CHAPTER	7	Inferences Based on a Single Sample: Estimation	319
	7.1	Large-Sample Estimation of a Population Mean	320
	7.2	Determining the Sample Size Necessary to Estimate a Population Mean	328
	7.3	Small-Sample Estimation of a Population Mean	332
	7.4	Large-Sample Estimation of a Binomial Probability	340
	7.5	Determining the Sample Size Necessary to Estimate a Binomial Probability	345

- CHAPTER 8 Inferences Based on a Single Sample: Tests of Hypotheses 355**
- 8.1 The Elements of a Test of Hypothesis 356
 - 8.2 Large-Sample Test of a Hypothesis About a Population Mean 363
 - 8.3 Observed Significance Levels: p -Values 372
 - 8.4 Small-Sample Test of Hypothesis About a Population Mean 376
 - 8.5 A Nonparametric Test About a Population Median (Optional) 383
 - 8.6 Large-Sample Test of Hypothesis About a Binomial Probability 388
 - 8.7 Calculating Type II Error Probabilities: More About β (Optional) 395
- CHAPTER 9 Inferences for Means Based on Two Samples 411**
- 9.1 Large-Sample Inferences About the Difference Between Two Population Means: Independent Sampling 412
 - 9.2 Small-Sample Inferences About the Difference Between Two Population Means: Independent Sampling 420
 - 9.3 Inferences About the Difference Between Two Population Means: Paired Difference Experiments 430
 - 9.4 Determining the Sample Size 444
 - 9.5 A Nonparametric Test for Comparing Two Populations: Independent Sampling (Optional) 448
 - 9.6 A Nonparametric Test for Comparing Two Populations: Paired Difference Experiment (Optional) 457
- CHAPTER 10 Comparing Population Proportions 475**
- 10.1 Inferences About the Difference Between Population Proportions: Independent Binomial Experiments 476
 - 10.2 Determining the Sample Size 485
 - 10.3 Comparing Population Proportions for a Multinomial Experiment (Optional) 488
 - 10.4 Contingency Table Analysis (Optional) 497
- CHAPTER 11 Regression Analysis 521**
- 11.1 Probabilistic Models 522
 - 11.2 Fitting the Straight-Line Model: The Method of Least Squares 526
 - 11.3 Model Assumptions 535
 - 11.4 Inferences About the Slope β_1 of the Straight-Line Model 540
 - 11.5 The Coefficient of Correlation 546
 - 11.6 The Coefficient of Determination 549

- 11.7 Using the Straight-Line Model for Estimation and Prediction 557
- 11.8 Using the Computer for Regression 565
- 11.9 Multiple Regression Models (Optional) 571
- 11.10 Residual Analysis: Checking the Regression Assumptions (Optional) 593

CHAPTER 12 **Methods for Quality Improvement** 635

- 12.1 History of the Quality Movement in the United States 636
- 12.2 Quality: What Is It? 639
- 12.3 Systems Thinking 640
- 12.4 Process Management 647
- 12.5 Statistical Control 652
- 12.6 The Logic of Control Charts 662
- 12.7 A Control Chart for Monitoring the Mean of a Process: The \bar{x} -Chart 667
- 12.8 A Control Chart for Monitoring the Variation of a Process: The R-Chart 684
- 12.9 A Control Chart for Monitoring the Proportion of Defectives Generated by a Process: The p -Chart 693

APPENDIX A **Basic Counting Rules** 711

APPENDIX B **Tables** 715

- Table I Random Numbers 717
- Table II Binomial Probabilities 720
- Table III Poisson Probabilities 724
- Table IV Normal Curve Areas 729
- Table V Exponentials 730
- Table VI Critical Values of t 731
- Table VII Percentage Points of the F Distribution, $\alpha = .10$ 732
- Table VIII Percentage Points of the F Distribution, $\alpha = .05$ 734
- Table IX Percentage Points of the F Distribution, $\alpha = .025$ 736
- Table X Percentage Points of the F Distribution, $\alpha = .01$ 738
- Table XI Critical Values of T_L and T_U for the Wilcoxon Rank Sum Test: Independent Samples 740
- Table XII Critical Values of T_0 in the Wilcoxon Paired Difference Signed Rank Test 741
- Table XIII Critical Values of χ^2 742
- Table XIV Control Chart Constants 744

APPENDIX C **Demographic Data Set** 745

- Answers to Odd-Numbered Exercises 749
- Index 757

Case Studies

- 1.1 The Consumer Price Index 2
- 1.2 Taste-Preference Scores for Beer 3
- 1.3 Monitoring the Unemployment Rate 4
- 1.4 Auditing Parts and Equipment for Airline Maintenance 4
- 1.5 The Decennial Census of the United States 5
- 1.6 Quality Improvement: U.S. Firms Respond to the Challenge from Japan 15
- 2.1 Pareto Analysis 32
- 2.2 *Statistical Abstract of the United States* 39
- 2.3 Appraising the Market Value of an Asset 57
- 2.4 Deming Warns Against Knee-Jerk Use of Histograms 70
- 3.1 Hotels: A Rational Method for Overbooking 89
- 3.2 Measuring Investors' Reactions to a Corporate Selloff Announcement: The General Electric/Utah International Case 90
- 3.3 The Delphi Technique for Obtaining a Consensus of Opinion 95
- 3.4 More on the Delphi Technique 103
- 3.5 Becoming More Sensitive to Customer Needs 118
- 3.6 Deciding When to Respond to Consumer Complaints 126
- 4.1 Bloom County Probabilities 153
- 4.2 Purchase Patterns and the Conditional Probability of Purchasing 178
- 4.3 The 1970 Draft Lottery 192
- 5.1 Assessing the Effects of the Deadly Dutch Elm Disease 212
- 5.2 The Space Shuttle *Challenger*: Catastrophe in Space 228
- 5.3 Evaluating Customer Response to a New Sales Program 232
- 5.4 Evaluating an Investment's Risk 253
- 5.5 Assessing the Reliability of Computer Software 271
- 6.1 Evaluating the Condition of Rental Cars 299
- 6.2 Reducing Investment Risk Through Diversification 300
- 7.1 Dancing to the Customer's Tune: The Need to Assess Customer Preferences 324
- 8.1 Statistics Is Murder! 361
- 8.2 Statistical Quality Control, Part 1 368
- 8.3 Statistical Quality Control, Part 2 392
- 9.1 Comparing Salaries for Equivalent Work 438
- 10.1 Hotel Room Interviewing—Anxiety and Suspicion 481
- 10.2 Investigating Response Bias in a Diary Survey 493
- 10.3 Deceived Survey Respondents: Once Bitten, Twice Shy 504
- 11.1 Estimating the Cost of a Construction Project 552
- 11.2 Predicting Corporate Executive Compensation 573
- 11.3 Predicting the Sales of Crest Toothpaste 581
- 12.1 Deming's 14 Points 650