

Business Statistics in Practice

Fourth Edition

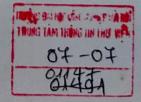
Bruce L. Bowerman Richard T. O'Connell

www.mhhe.com/bowerman4e

TO SERVICE TOTAL

STUDENT CD CONTENT

- Interactive Quizzes
- PowerPoint
- Data Sets
- Visual Statistics 2.2
- MegaStat® for Excel 10.0
 MegaStat® Tutorials
- Excel Templates
- Advanced Topics Appendices
 Business Statistics Center
- Online Learning Center



Bruce L. Bowerman
Richard T. O'Connell

Miami University

Business Statistics in Practice

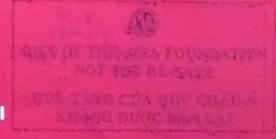
FOURTH EDITION

with additional examples and exercises and selected appendices by
Steven C. Huchendorf

University of Minnesota

with MegaStat software and other contributions by J. Burdene Orris

Butler University





Boston Burr Ridge, IL Dubuque, IA Madison, WI New York San Francisco St. Louis Bangkok Bogotá Caracas Kuala Lumpur Lisbon London Madrid Mexico City Milan Montreal New Delhi Santiago Seoul Singapore Sydney Taipei Toronto



BUSINESS STATISTICS IN PRACTICE

Published by McGraw-Hill/Irwin, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY, 10020. Copyright © 2007 by The McGraw-Hill Companies, Inc. All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written consent of The McGraw-Hill Companies, Inc., including, but not limited to, in any network or other electronic storage or transmission, or broadcast for distance learning.

Some ancillaries, including electronic and print components, may not be available to customers outside the United States.

This book is printed on acid-free paper.

34567890 WCK/WCK 0987

ISBN: 978-0-07-297747-9 MHID: 0-07-297747-7

Editorial director: *Brent Gordon*Executive editor: *Scott Isenberg*Senior developmental editor: *Wanda J. Zeman*

Senior developmental editor: Wanda J. Zeman Senior marketing manager: Douglas Reiner Senior media producer: Victor Chiu Project manager: Laura Griffin

Production supervisor: Debra R. Sylvester Senior designer: Mary E. Kazak

Senior photo research coordinator: Jeremy Cheshareck

Photo researcher: Julie Tesser
Media project manager: Matthew Perry
Senior supplement producer: Carol Loreth
Cover and interior design: Jenny El-Shamy
Cover image: © Glen Allison/Gettyimages

Typeface: 10/12 Times Roman

Compositor: Interactive Composition Corporation

Printer: Quebecor World Versailles Inc.

Library of Congress Cataloging-in-Publication Data

Bowerman, Bruce L.

Business statistics in practice / Bruce L. Bowerman, Richard T. O'Connell; with MegaStat and other contributions by J. Burdeane Orris.— 4th ed.

p. cm.

Includes bibliographical references and indexes.

ISBN: 978-0-07-297747-9

MHID: 0-07-297747-7 (alk. paper)
 Commercial statistics. 2. Statistics. I. O'Connell, Richard T. II. Orris, J. B.

III. Title.

HF1017.B654 2007 519.5'024'65—dc22

Brief Table of Contents

Chapter 1 An Introduction to Business Statistics	2	Appendix B Covariance and Correlation	841
Chapter 2 Descriptive Statistics	42	Appendix C (Part 1) Counting Rules	844
Chapter 3 Probability	126	Appendix C (Part 2) The Hypergeometric Distribution	846
Chapter 4 Discrete Random Variables	158	Appendix D (Part 1) The Normal Probability Plot	847
Chapter 5 Continuous Random Variables	194	Appendix D (Part 2) Properties of the Mean and the Variance of a Random Variable, and the Covarian	
Chapter 6 Sampling Distributions	236	Appendix D (Part 3) Derivations of the Mean and Variance of	853
Chapter 7 Confidence Intervals	260	Appendix E Holt–Winters' Models	855
Chapter 8 Hypothesis Testing	304	Answers to Most Odd-Numbered Exercises	863
Chapter 9 Statistical Inferences Based on Two Samples	356	References Photo Credits	872 874
Chapter 10 Experimental Design and Analysis of Variance	402	Index	875
Chapter 11 Simple Linear Regression Analysis	448	Appendix F (Part 1) Stratified Random Sampling	On CD-ROM
Chapter 12 Multiple Regression and Model Building	528	Appendix F (Part 2) Cluster Sampling and Ratio Estimation	On CD-ROM
Chapter 13 Time Series Forecasting	632	Appendix G Using Matrix Algebra to Perform Regression Calculations	On CD-ROM
Chapter 14 Process Improvement Using Control Charts	674	Appendix H The Regression Approach to Two- Way Analysis of Variance	On CD-ROM
Chapter 15 Nonparametric Methods	734	Appendix I Factor Analysis, Cluster Analysis,	On CD-ROM
Chapter 16 Chi-Square Tests	764	and Multidimensional Scaling Appendix J The Box–Jenkins Methodology	On CD-ROM
Chapter 17 Decision Theory	792	Appendix K Holt–Winters' Models	On CD-ROM
Appendix A Statistical Tables	816	Appendix L Individual Charts and c Charts	On CD-ROM

Table of Contents

Chapter 1

A as I	ntro	lustion	to Bus	inann	Ctation	inc
Anı	niroc	llicition	TO BIIS	iness.	STATIST	105

- 1.1 Populations and Samples 3
- 1.2 Sampling a Population of Existing Units 4
- 1.3 Sampling a Process 12
- 1.4 Ratio, Interval, Ordinal, and Nominative Scales of Measurement (Optional)
- 1.5 An Introduction to Survey Sampling (Optional) 21MINITAB, Excel, and MegaStat for Statistics 26
- App 1.1 Getting Started with MINITAB 27
- App 1.2 Getting Started with Excel 33
- App 1.3 Getting Started with MegaStat 36
- App 1.4 Introduction to Internet Exercises 41

Chapter 2

Descriptive Statistics

- 2.1 Describing the Shape of a Distribution 43
- 2.2 Describing Central Tendency 58
- 2.3 Measures of Variation 68
- 2.4 Percentiles, Quartiles, and Box-and-Whiskers Displays 79
- 2.5 Describing Qualitative Data 87
- 2.6 Using Scatter Plots to Study Relationships between Variables (Optional) 94
- 2.7 Misleading Graphs and Charts (Optional) 96
- 2.8 Weighted Means and Grouped Data (Optional) 100
- 2.9 The Geometric Mean (Optional) 104
- App 2.1 Descriptive Statistics Using MINITAB 114
- App 2.2 Descriptive Statistics Using Excel 120
- App 2.3 Descriptive Statistics Using MegaStat 123

Chapter 3

Probability

- 3.1 The Concept of Probability 127
- 3.2 Sample Spaces and Events 129
- 3.3 Some Elementary Probability Rules 136
- 3.4 Conditional Probability and Independence 143

Chapter 4

Discrete Random Variables

- 4.1 Two Types of Random Variables 159
- 4.2 Discrete Probability Distributions 160

		Table o
	4.3 The Binomial Distribution 171	
	4.4 The Poisson Distribution (Optional) 182	
	App 4.1 Binomial and Poisson Probabilities Using MINITAB 190	
	App 4.2 Binomial and Poisson Probabilities Using Excel 191	
	App 4.3 Binomial and Poisson Probabilities Using MegaStat 193	
	Chapter 5	
	Continuous Random Variables	
	5.1 Continuous Probability Distributions 195	
	5.2 The Uniform Distribution 197	
	5.3 The Normal Probability Distribution 200	
	5.4 Approximating the Binomial Distribution by Using the Normal Distribution (Optional) 218	
	5.5 The Exponential Distribution (Optional) 222	
	5.6 The Cumulative Normal Table (Optional) 224	
	App 5.1 Normal Distribution Using MINITAB 232	
	App 5.2 Normal Distribution Using Excel 233	
	App 5.3 Normal Distribution Using MegaStat 235	
	Chanter 6	
	Chapter 6 Sampling Distributions	
	6.1 The Sampling Distribution of the Sample Mean 237 6.2 The Sampling Distribution of the Sample Proportion 250	
	App 6.1 Simulating Sampling Distributions Using MINITAB 259	
	Chapter 7	
	Confidence Intervals	
	7.1 z-Based Confidence Intervals for a Population Mean: σ Known 261	70
	7.2 t-Based Confidence Intervals for a Population Mean: σ Unknown 2'	/0
	7.3 Sample Size Determination 278	
	 7.4 Confidence Intervals for a Population Proportion 282 7.5 Confidence Intervals for Parameters of Finite Populations (Optional) 	289
	7.6 A Comparison of Confidence Intervals and Tolerance Intervals (Option	
	App 7.1 Confidence Intervals Using MINITAB 299	inary =>
	App 7.2 Confidence Intervals Using Excel 301	
	App 7.3 Confidence Intervals Using MegaStat 302	
	· ·	
	Chapter 8	
	Hypothesis Testing 8.1 The Null and Alternative Hypotheses and Errors in Hypothesis Testing	305
	Cidad Alternations	311
	Two Cided Altermetives	322
	8.3 $\equiv z$ Tests about a Population Mean (σ Known): Two-Sided Alternatives 8.4 $\equiv t$ Tests about a Population Mean (σ Unknown) 327	
	8.5 z Tests about a Population Proportion 332	
	8.6 Type II Error Probabilities and Sample Size Determination (Optional)	337
	8.7 The Chi-Square Distribution (Optional) 343	
ď	The one offered the second	

8.8 Statistical Inference for a Population Variance (Optional) 344

4.3 The Binomial Distribution 171
4.4 The Poisson Distribution (Optional) 182
App 4.1 Binomial and Poisson Probabilities Using MINITAB 190
App 4.2 Binomial and Poisson Probabilities Using Excel 191
App 4.3 Binomial and Poisson Probabilities Using MegaStat 193
Chapter 5
Continuous Random Variables
5.1 Continuous Probability Distributions 195
5.2 The Uniform Distribution 197
5.3 The Normal Probability Distribution 200
5.4 Approximating the Binomial Distribution by Using the
Normal Distribution (Optional) 218
5.5 The Exponential Distribution (Optional) 222
5.6 The Cumulative Normal Table (Optional) 224
App 5.1 Normal Distribution Using MINITAB 232
App 5.2 Normal Distribution Using Excel 233
App 5.3 Normal Distribution Using MegaStat 235
Chapter 6
Chapter 6
Sampling Distributions
6.1 The Sampling Distribution of the Sample Mean 237
6.2 The Sampling Distribution of the Sample Proportion 250
App 6.1 Simulating Sampling Distributions Using MINITAB 259
Chapter 7
Confidence Intervals
7.1 z-Based Confidence Intervals for a Population Mean: σ Known 261
7.2 t-Based Confidence Intervals for a Population Mean: σ Unknown 270
7.3 Sample Size Determination 278
7.4 Confidence Intervals for a Population Proportion 282
7.5 Confidence Intervals for Parameters of Finite Populations (Optional) 289
7.6 A Comparison of Confidence Intervals and Tolerance Intervals (Optional) 293
App 7.1 Confidence Intervals Using MINITAB 299
App 7.2 Confidence Intervals Using Excel 301
App 7.3 Confidence Intervals Using MegaStat 302
AND DESCRIPTION OF THE PROPERTY OF THE PROPERT
Chapter 8
Hypothesis Testing
8.1 The Null and Alternative Hypotheses and Errors in Hypothesis Testing 305
8.2 z Tests about a Population Mean (σ Known): One-Sided Alternatives 311
8.3 z Tests about a Population Mean (σ Known): Two-Sided Alternatives 322
8.4 t Tests about a Population Mean (σ Unknown) 327
8.5 z Tests about a Population Proportion 332
8.6 Type II Error Probabilities and Sample Size Determination (Optional) 337

8.7 The Chi-Square Distribution (Optional) 343

8.8 Statistical Inference for a Population Variance (Optional) 344

xviii

- Table of Contents App 8.1 One-Sample Hypothesis Testing Using MINITAB App 8.2 One-Sample Hypothesis Testing Using Excel 353 App 8.3 One-Sample Hypothesis Testing Using MegaStat 354 Chapter 9 Statistical Inferences Based on Two Samples 9.1 Comparing Two Population Means by Using Independent Samples: Variances Known 357 9.2 Comparing Two Population Means by Using Independent Samples: Variances Unknown 363 9.3 Paired Difference Experiments 371 9.4 Comparing Two Population Proportions by Using Large, Independent Samples 379 9.5 Comparing Two Population Variances by Using Independent Samples 385 App 9.1 Two-Sample Hypothesis Testing Using MINITAB App 9.2 Two-Sample Hypothesis Testing Using Excel 399 App 9.3 Two-Sample Hypothesis Testing Using MegaStat 400 Chapter 10 Experimental Design and Analysis of Variance 10.1 Basic Concepts of Experimental Design 403 10.2 One-Way Analysis of Variance 406 10.3 The Randomized Block Design 10.4 Two-Way Analysis of Variance 426 App 10.1 Experimental Design and Analysis of Variance Using MINITAB App 10.2 Experimental Design and Analysis of Variance Using Excel 444 App 10.3 Experimental Design and Analysis of Variance Using MegaStat 445 Chapter 11 Simple Linear Regression Analysis 11.1 The Simple Linear Regression Model 449 11.2 The Least Squares Estimates, and Point Estimation and Prediction 11.3 Model Assumptions and the Standard Error 468 11.4 Testing the Significance of the Slope and y Intercept 471 11.5 Confidence and Prediction Intervals 479 11.6 Simple Coefficients of Determination and Correlation 486 11.7 Testing the Significance of the Population Correlation Coefficient (Optional) 11.8 An F Test for the Model 493
 - 11.9 Residual Analysis (Optional) 496
 - 11.10 Some Shortcut Formulas (Optional) 514
 - App 11.1 Simple Linear Regression Analysis Using MINITAB 523
 - App 11.2 Simple Linear Regression Analysis Using Excel 524
 - App 11.3 Simple Linear Regression Analysis Using MegaStat 526

Chapter 12

Multiple Regression and Model Building

- Part 1 Basic Multiple Regression 529
- 12.1 The Multiple Regression Model 529

12.2 The Least Squares Estimates, and Point Estimation and Prediction 536	
12.3 Model Assumptions and the Standard Error 543	
$12.4 = R^2$ and Adjusted $R^2 = 545$	
12.5 The Overall F Test 547	
12.6 Testing the Significance of an Independent Variable 549	
12.7 Confidence and Prediction Intervals 553	
Part 2 Using Squared and Interaction Terms (Optional) 557	
12.8 The Quadratic Regression Model (Optional) 557	
12.9 Interaction (Optional) 565	
Part 3 Dummy Variables and Advanced Statistical Inferences (Optional) 572	
12.10 Using Dummy Variables to Model Qualitative Independent Variables (Optional) 572	
12.11 The Partial F Test: Testing the Significance of a Portion of a Regression Model (Optional) 584	
Part 4 Model Building and Model Diagnostics (Optional) 587	
12.12 Model Building, and the Effects of Multicollinearity (Optional) 587	
12.13 Residual Analysis in Multiple Regression (Optional) 599	
12.14 Diagnostics for Detecting Outlying and Influential Observations (Optional) 60	03
12.15 Logistic Regression (Optional) 609	
App 12.1 Multiple Linear Regression Analysis Using MINITAB 622	
App 12.2 Multiple Linear Regression Analysis Using Excel 626	
App 12.3 Multiple Linear Regression Analysis Using MegaStat 628	
Chapter 13	
Chapter 13 Time Series Forecasting	
Time Series Forecasting	
Time Series Forecasting 13.1 Time Series Components and Models 633	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670 App 13.3 Time Series Analysis Using MegaStat 671	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670 App 13.3 Time Series Analysis Using MegaStat 671 Chapter 14	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670 App 13.3 Time Series Analysis Using MegaStat 671 Chapter 14 Process Improvement Using Control Charts	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670 App 13.3 Time Series Analysis Using MegaStat 671 Chapter 14 Process Improvement Using Control Charts	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670 App 13.3 Time Series Analysis Using MegaStat 671 Chapter 14 Process Improvement Using Control Charts 14.1 Quality: Its Meaning and a Historical Perspective 675 14.2 Statistical Process Control and Causes of Process Variation 679	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670 App 13.3 Time Series Analysis Using MegaStat 671 Chapter 14 Process Improvement Using Control Charts 14.1 Quality: Its Meaning and a Historical Perspective 675 14.2 Statistical Process Control and Causes of Process Variation 679 14.3 Sampling a Process, Rational Subgrouping, and Control Charts 681	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670 App 13.3 Time Series Analysis Using MegaStat 671 Chapter 14 Process Improvement Using Control Charts 14.1 Quality: Its Meaning and a Historical Perspective 675 14.2 Statistical Process Control and Causes of Process Variation 679 14.3 Sampling a Process, Rational Subgrouping, and Control Charts 681 14.4 Tand R Charts 686	
Time Series Forecasting 13.1 Time Series Components and Models 633 13.2 Time Series Regression: Basic Models 634 13.3 Time Series Regression: More Advanced Models (Optional) 640 13.4 Multiplicative Decomposition 644 13.5 Exponential Smoothing 651 13.6 Forecast Error Comparisons 659 13.7 Index Numbers 660 App 13.1 Time Series Analysis Using MINITAB 669 App 13.2 Time Series Analysis Using Excel 670 App 13.3 Time Series Analysis Using MegaStat 671 Chapter 14 Process Improvement Using Control Charts 14.1 Quality: Its Meaning and a Historical Perspective 675 14.2 Statistical Process Control and Causes of Process Variation 679 14.3 Sampling a Process, Rational Subgrouping, and Control Charts 681 14.4 Tand R Charts 686	

14.8 Cause-and-Effect and Defect Concentration Diagrams (Optional) 722

- App 14.1 Control Charts Using MINITAB 730
- App 14.2 Control Charts Using Excel 731
- App 14.3 Control Charts Using MegaStat 733

Chapter 15

XX

Nonparametric Methods

- 15.1 The Sign Test: A Hypothesis Test about the Median 736
- 15.2 The Wilcoxon Rank Sum Test 740
- 15.3 The Wilcoxon Signed Ranks Test 746
- 15.4 Comparing Several Populations Using the Kruskal-Wallis H Test 750
- 15.5 Spearman's Rank Correlation Coefficient 752
- App 15.1 Nonparametric Methods Using MINITAB 758
- App 15.2 Nonparametric Methods Using MegaStat 761

Chapter 16

Chi-Square Tests

- 16.1 Chi-Square Goodness of Fit Tests 765
- 16.2 A Chi-Square Test for Independence 774
- App 16.1 Chi-Square Tests Using MINITAB 784
- App 16.2 Chi-Square Tests Using Excel 787
- App 16.3 Chi-Square Tests Using MegaStat 790

Chapter 17

Decision Theory

- 17.1 Bayes' Theorem 793
- 17.2 Introduction to Decision Theory 798
- 17.3 Decision Making Using Posterior Probabilities 804
- 17.4 Introduction to Utility Theory 810

Appendix A

Statistical Tables 816

Appendix B

Covariance and Correlation 841

Appendix C (Part 1)

Counting Rules 844

Appendix C (Part 2)

The Hypergeometric Distribution 846

Appendix D (Part 1)

The Normal Probability Plot 847

Appendix D (Part 2)

Properties of the Mean and the Variance of a Random Variable, and the Covariance 850

Appendix D (Part 3)

Derivations of the Mean and Variance of \bar{x} and \hat{p} 853

Appendix E

Holt-Winters' Models 855

Answers to Most Odd-Numbered Exercises 863

References 872

Photo Credits 874

Index 875

Appendix F (Part 1) On CD-ROM Stratified Random Sampling

Appendix F (Part 2) On CD-ROM
Cluster Sampling and Ratio Estimation

Appendix G On CD-ROM

Using Matrix Algebra to Perform Regression Calculations

Appendix H On CD-ROM

The Regression Approach to Two-Way Analysis of Variance

Appendix I On CD-ROM

Factor Analysis, Cluster Analysis, and Multidimensional Scaling

Appendix J On CD-ROM

The Box–Jenkins Methodology

Appendix K On CD-ROM Holt–Winters' Models

Appendix L On CD-ROM

Individual Charts and c Charts