

# Brief Contents

## **Part 1: Business Statistics: Introduction and Background**

1. A Preview of Business Statistics 1
2. Visual Description of Data 15
3. Statistical Description of Data 57
4. Data Collection and Sampling Methods 101

## **Part 2: Probability**

5. Probability: Review of Basic Concepts 133
6. Discrete Probability Distributions 167
7. Continuous Probability Distributions 205

## **Part 3: Sampling Distributions and Estimation**

8. Sampling Distributions 243
9. Estimation from Sample Data 269

## **Part 4: Hypothesis Testing**

10. Hypothesis Tests Involving a Sample Mean or Proportion 309
11. Hypothesis Tests Involving Two Sample Means or Proportions 361
12. Analysis of Variance Tests 409
13. Chi-Square Applications 465
14. Nonparametric Methods 503

## **Part 5: Regression, Model Building, and Time Series**

15. Simple Linear Regression and Correlation 549
16. Multiple Regression and Correlation 599
17. Model Building 643
18. Models for Time Series and Forecasting 685

## **Part 6: Special Topics**

19. Decision Theory 735
20. Total Quality Management 755
21. Ethics in Statistical Analysis and Reporting (CD chapter)

## **Appendices**

- A. Statistical Tables 799
- B. Selected Answers 835

Index/Glossary 839

# Contents

## **PART 1: BUSINESS STATISTICS: INTRODUCTION AND BACKGROUND**

<b>Chapter 1: A Preview of Business Statistics</b>	<b>1</b>
1.1 Introduction	2
1.2 Statistics: Yesterday and Today	3
1.3 Descriptive versus Inferential Statistics	5
1.4 Types of Variables and Scales of Measurement	8
1.5 Statistics in Business Decisions	11
1.6 Business Statistics: Tools Versus Tricks	11
1.7 Summary	12
<b>Chapter 2: Visual Description of Data</b>	<b>15</b>
2.1 Introduction	16
2.2 The Frequency Distribution and the Histogram	16
2.3 The Stem-and-Leaf Display and the Dotplot	24
2.4 Other Methods for Visual Representation of the Data	28
2.5 The Scatter Diagram	37
2.6 Tabulation, Contingency Tables, and the Excel PivotTable Wizard	43
2.7 Summary	48
Integrated Case: Thorndike Sports Equipment (Meet the Thorndikes: See Video Unit One.)	53
Integrated Case: Springdale Shopping Survey	54
<b>Chapter 3: Statistical Description of Data</b>	<b>57</b>
3.1 Introduction	58
3.2 Statistical Description: Measures of Central Tendency	59
3.3 Statistical Description: Measures of Dispersion	67
3.4 Additional Dispersion Topics	77
3.5 Descriptive Statistics from Grouped Data	83
3.6 Statistical Measures of Association	86
3.7 Summary	90
Integrated Case: Thorndike Sports Equipment	96
Integrated Case: Springdale Shopping Survey	97
Business Case: Baldwin Computer Sales (A)	97

Seeing Statistics Applet 1: Influence of a Single Observation on the Median	99
Seeing Statistics Applet 2: Scatter Diagrams and Correlation	100
<b>Chapter 4: Data Collection and Sampling Methods</b>	<b>101</b>
4.1 Introduction	102
4.2 Research Basics	102
4.3 Survey Research	105
4.4 Experimentation and Observational Research	109
4.5 Secondary Data	112
4.6 The Basics of Sampling	117
4.7 Sampling Methods	119
4.8 Summary	127
Integrated Case: Thorndike Sports Equipment—Video Unit Two	131
Seeing Statistics Applet 3: Sampling	132

## PART 2: PROBABILITY

<b>Chapter 5: Probability: Review of Basic Concepts</b>	<b>133</b>
5.1 Introduction	134
5.2 Probability: Terms and Approaches	135
5.3 Unions and Intersections of Events	139
5.4 Addition Rules for Probability	143
5.5 Multiplication Rules for Probability	146
5.6 Bayes' Theorem and the Revision of Probabilities	150
5.7 Counting: Permutations and Combinations	156
5.8 Summary	160
Integrated Case: Thorndike Sports Equipment	165
Integrated Case: Springdale Shopping Survey	166
Business Case: Baldwin Computer Sales (B)	166
<b>Chapter 6: Discrete Probability Distributions</b>	<b>167</b>
6.1 Introduction	168
6.2 The Binomial Distribution	175
6.3 The Hypergeometric Distribution	183
6.4 The Poisson Distribution	187
6.5 Simulating Observations from a Discrete Probability Distribution	194
6.6 Summary	199
Integrated Case: Thorndike Sports Equipment	203
<b>Chapter 7: Continuous Probability Distributions</b>	<b>205</b>
7.1 Introduction	206
7.2 The Normal Distribution	208

## Contents

<b>7.3 The Standard Normal Distribution</b>	212
<b>7.4 The Normal Approximation to the Binomial Distribution</b>	223
<b>7.5 The Exponential Distribution</b>	227
<b>7.6 Simulating Observations from a Continuous Probability Distribution</b>	232
<b>7.7 Summary</b>	235
Integrated Case: Thorndike Sports Equipment (Corresponds to Thorndike Video Unit Three)	239
Integrated Case: Thorndike Golf Products Division	240
<b>Seeing Statistics Applet 4: Size and Shape of Normal Distribution</b>	240
<b>Seeing Statistics Applet 5: Normal Distribution Areas</b>	241
<b>Seeing Statistics Applet 6: Normal Approximation to Binomial Distribution</b>	242

## PART 3: SAMPLING DISTRIBUTIONS AND ESTIMATION

<b>Chapter 8: Sampling Distributions</b>	<b>243</b>
<b>8.1 Introduction</b>	244
<b>8.2 A Preview of Sampling Distributions</b>	244
<b>8.3 The Sampling Distribution of the Mean</b>	247
<b>8.4 The Sampling Distribution of the Proportion</b>	253
<b>8.5 Sampling Distributions When the Population Is Finite</b>	256
<b>8.6 Computer Simulation of Sampling Distributions</b>	258
<b>8.7 Summary</b>	261
Integrated Case: Thorndike Sports Equipment	265
<b>Seeing Statistics Applet 7: Distribution of Means: Fair Dice</b>	267
<b>Seeing Statistics Applet 8: Distribution of Means: Loaded Dice</b>	268
<b>Chapter 9: Estimation from Sample Data</b>	<b>269</b>
<b>9.1 Introduction</b>	270
<b>9.2 Point Estimates</b>	271
<b>9.3 A Preview of Interval Estimates</b>	272
<b>9.4 Confidence Interval Estimates for the Mean: <math>\sigma</math> Known</b>	275
<b>9.5 Confidence Interval Estimates for the Mean: <math>\sigma</math> Unknown</b>	280
<b>9.6 Confidence Interval Estimates for the Population Proportion</b>	287
<b>9.7 Sample Size Determination</b>	291
<b>9.8 When the Population Is Finite</b>	297
<b>9.9 Summary</b>	301
Integrated Case: Thorndike Sports Equipment (Thorndike Video Unit Four)	306
Integrated Case: Springdale Shopping Survey	306
<b>Seeing Statistics Applet 9: Confidence Interval Size</b>	307
<b>Seeing Statistics Applet 10: Comparing the Normal and Student <math>t</math> Distributions</b>	308
<b>Seeing Statistics Applet 11: Student <math>t</math> Distribution Areas</b>	308

## PART 4: HYPOTHESIS TESTING

<b>Chapter 10: Hypothesis Tests Involving a Sample Mean or Proportion</b>	<b>309</b>
10.1 Introduction	310
10.2 Hypothesis Testing: Basic Procedures	315
10.3 Testing a Mean, Population Standard Deviation Known	318
10.4 Confidence Intervals and Hypothesis Testing	327
10.5 Testing a Mean, Population Standard Deviation Unknown	328
10.6 Testing a Proportion	336
10.7 The Power of a Hypothesis Test	343
10.8 Summary	351
Integrated Case: Thorndike Sports Equipment	356
Integrated Case: Springdale Shopping Survey	357
Business Case: Pronto Pizza (A)	358
Seeing Statistics Applet 12: z-Interval and Hypothesis Testing	359
Seeing Statistics Applet 13: Statistical Power of a Test	360
<b>Chapter 11: Hypothesis Tests Involving Two Sample Means or Proportions</b>	<b>361</b>
11.1 Introduction	362
11.2 The Pooled-Variances $t$ -Test for Comparing the Means of Two Independent Samples	363
11.3 The Unequal-Variances $t$ -Test for Comparing the Means of Two Independent Samples	371
11.4 The $z$ -Test for Comparing the Means of Two Independent Samples	378
11.5 Comparing Two Means When the Samples Are Dependent	383
11.6 Comparing Two Sample Proportions	388
11.7 Comparing the Variances of Two Independent Samples	394
11.8 Summary	399
Integrated Case: Thorndike Sports Equipment	405
Integrated Case: Springdale Shopping Survey	405
Business Case: Circuit Systems, Inc. (A)	406
Seeing Statistics Applet 14: Distribution of Difference Between Sample Means	408
<b>Chapter 12: Analysis of Variance Tests</b>	<b>409</b>
12.1 Introduction	410
12.2 Analysis of Variance: Basic Concepts	410
12.3 One-Way Analysis of Variance	414
12.4 The Randomized Block Design	427
12.5 Two-Way Analysis of Variance	439
12.6 Summary	454
Integrated Case: Thorndike Sports Equipment (Video Unit Six)	460
Integrated Case: Springdale Shopping Survey	460
Business Case: Fastest Courier in the West	461

## Contents

Seeing Statistics Applet 15: <i>F</i> Distribution and ANOVA	462
Seeing Statistics Applet 16: Interaction Graph in Two-Way ANOVA	463
<b>Chapter 13: Chi-Square Applications</b>	<b>465</b>
13.1 Introduction	466
13.2 Basic Concepts in Chi-Square Testing	466
13.3 Tests for Goodness of Fit and Normality	469
13.4 Testing the Independence of Two Variables	477
13.5 Comparing Proportions from <i>k</i> Independent Samples	484
13.6 Estimation and Tests Regarding the Population Variance	487
13.7 Summary	495
Integrated Case: Thorndike Sports Equipment	500
Integrated Case: Springdale Shopping Survey	500
Business Case: Baldwin Computer Sales (C)	501
Seeing Statistics Applet 17: Chi-Square Distribution	502
<b>Chapter 14: Nonparametric Methods</b>	<b>503</b>
14.1 Introduction	504
14.2 Wilcoxon Signed Rank Test for One Sample	506
14.3 Wilcoxon Signed Rank Test for Comparing Paired Samples	511
14.4 Wilcoxon Rank Sum Test for Comparing Two Independent Samples	515
14.5 Kruskal-Wallis Test for Comparing More Than Two Independent Samples	519
14.6 Friedman Test for the Randomized Block Design	523
14.7 Other Nonparametric Methods	528
14.8 Summary	543
Integrated Case: Thorndike Sports Equipment	547
Business Case: Circuit Systems, Inc. (B)	548
<b>PART 5: REGRESSION, MODEL BUILDING, AND TIME SERIES</b>	
<b>Chapter 15: Simple Linear Regression and Correlation</b>	<b>549</b>
15.1 Introduction	550
15.2 The Simple Linear Regression Model	551
15.3 Interval Estimation Using the Sample Regression Line	559
15.4 Correlation Analysis	565
15.5 Estimation and Tests Regarding the Sample Regression Line	570
15.6 Additional Topics in Regression and Correlation Analysis	576
15.7 Summary	584
Integrated Case: Thorndike Sports Equipment	593
Integrated Case: Springdale Shopping Survey	594
Business Case: Pronto Pizza (B)	594
Seeing Statistics Applet 18: Regression: Point Estimate for <i>y</i>	596
Seeing Statistics Applet 19: Point Insertion Diagram and Correlation	597
Seeing Statistics Applet 20: Regression Error Components	598

<b>Chapter 16: Multiple Regression and Correlation</b>	<b>599</b>
16.1 Introduction	600
16.2 The Multiple Regression Model	601
16.3 Interval Estimation in Multiple Regression	608
16.4 Multiple Correlation Analysis	613
16.5 Significance Tests in Multiple Regression and Correlation	615
16.6 Overview of the Computer Analysis and Interpretation	621
16.7 Additional Topics in Multiple Regression and Correlation	631
16.8 Summary	633
Integrated Case: Thorndike Sports Equipment	638
Integrated Case: Springdale Shopping Survey	639
Business Case: Easton Realty Company (A)	640
Business Case: Circuit Systems, Inc. (C)	642
<b>Chapter 17: Model Building</b>	<b>643</b>
17.1 Introduction	644
17.2 Polynomial Models with One Quantitative Predictor Variable	644
17.3 Polynomial Models with Two Quantitative Predictor Variables	652
17.4 Qualitative Variables	657
17.5 Data Transformations	662
17.6 Multicollinearity	665
17.7 Stepwise Regression	668
17.8 Selecting a Model	673
17.9 Summary	675
Integrated Case: Thorndike Sports Equipment	679
Integrated Case: Fast-Growing Companies	679
Business Case: Westmore MBA Program	680
Business Case: Easton Realty Company (B)	683
<b>Chapter 18: Models for Time Series and Forecasting</b>	<b>685</b>
18.1 Introduction	686
18.2 Time Series	686
18.3 Smoothing Techniques	691
18.4 Seasonal Indexes	699
18.5 Forecasting	706
18.6 Evaluating Alternative Models: <i>MAD</i> and <i>MSE</i>	711
18.7 Autocorrelation, The Durbin-Watson Test, and Autoregressive Forecasting	713
18.8 Index Numbers	722
18.9 Summary	728
Integrated Case: Thorndike Sports Equipment (Video Unit Five)	734

**PART 6: SPECIAL TOPICS**

<b>Chapter 19: Decision Theory</b>	<b>735</b>
19.1 Introduction	736
19.2 Structuring the Decision Situation	736
19.3 Non-Bayesian Decision Making	740
19.4 Bayesian Decision Making	743
19.5 The Opportunity Loss Approach	747
19.6 Incremental Analysis and Inventory Decisions	749
19.7 Summary	752
Integrated Case: Thorndike Sports Equipment (Video Unit Seven)	754
Appendix to Chapter 19: The Expected Value of Imperfect Information (located on CD)	
<b>Chapter 20: Total Quality Management</b>	<b>755</b>
20.1 Introduction	756
20.2 A Historical Perspective and Defect Detection	758
20.3 The Emergence of Total Quality Management	760
20.4 Practicing Total Quality Management	762
20.5 Some Statistical Tools for Total Quality Management	766
20.6 Statistical Process Control: The Concepts	771
20.7 Control Charts for Variables	772
20.8 Control Charts for Attributes	782
20.9 More on Computer-Assisted Statistical Process Control	790
20.10 Summary	791
Integrated Case: Thorndike Sports Equipment	795
Integrated Case: Willard Bolt Company	796
Seeing Statistics Applet 21: Mean Control Chart	797
<b>Appendix A: Statistical Tables</b>	<b>799</b>
<b>Appendix B: Selected Answers</b>	<b>835</b>
<b>Index/Glossary</b>	<b>839</b>

**CD Chapter 21: Ethics in Statistical Analysis and Reporting**