

CONTENTS

Online Resources	xi
About the Author	xiii
Acknowledgements	xv
Preface	xvii
1 Introduction and R Instructions	1
Basic Terminology	2
Data: Qualitative or Quantitative	5
Data: Cross-Sectional or Longitudinal	7
Descriptive Statistics	9
Probability	9
Statistics: Estimation and Inference	10
Summary	11
Appendix: An Introduction to R	14
Our Approach to Writing This Book	26
2 Descriptive Statistics: Tabular and Graphical Methods	27
Methods of Presenting Qualitative Data	28
Methods of Presenting Quantitative Data	33
Cross-tabulations and Scatter Plots	36
Summary	44
Appendix: Basic Data Manipulation	47
3 Descriptive Statistics: Numerical Methods	55
Measures of Central Tendency	56
Measures of Location	59
Exploratory Data Analysis: The Box Plot Display	60
Measures of Variability	62
The z-Score: A Measure of Relative Location	65
Measures of Association: The Bivariate Case	69
The Geometric Mean	74
Summary	77
Appendix: Vectorization	80
4 Introduction to Probability	83
Some Important Definitions	84
Counting Rules	85

Assigning Probabilities	89
Events and Probabilities	91
Probabilities of Unions and Intersections of Events	94
Conditional Probability	98
Bayes' Theorem	102
Summary	104
5 Discrete Probability Distributions	109
Some Important Definitions	110
The Discrete Uniform Probability Distribution	112
The Expected Value and Standard Deviation of a Discrete Random Variable	114
The Binomial Probability Distribution	115
The Poisson Probability Distribution	121
The Hypergeometric Probability Distribution	126
The Hypergeometric Probability Distribution: The General Case	129
Summary	131
Appendix: Using R to Find Probabilities—Binomial, Poisson, and Hypergeometric	134
6 Continuous Probability Distributions	137
Continuous Uniform Probability Distribution	138
Normal Probability Distribution	142
Exponential Probability Distribution	152
Optional Material: A Derivation of the Cumulative Exponential Probability Function	157
Summary	158
Appendix: Using R to Find Probabilities for Continuous Probability Distributions—Uniform, Standard Normal, General Normal, and Exponential	160
7 Point Estimation and Sampling Distributions	165
Populations and Samples	167
The Simple Random Sample	168
The Sample Statistic: \bar{x} , s , and \bar{p}	171
The Sampling Distribution of \bar{x}	171
The Sampling Distribution of \bar{p}	178
Some Other Commonly Used Sampling Methods	182
Summary	185
Appendix: Using R to Select a Random Sample from a Data Set	188
8 Confidence Interval Estimation	191
Interval Estimate of μ When σ is Known	193
Interval Estimate of μ When σ is Unknown	198
Sample Size Determination in the Case of μ	205
Interval Estimate of p	206

Sample Size Determination in the Case of p	208
Summary	210
9 Hypothesis Tests: Introduction, Basic Concepts, and an Example	215
Summary	226
10 Hypothesis Tests about Means and Proportions: Applications	231
The Lower-Tail Hypothesis Test about μ : σ is Known	232
The Two-Tail Hypothesis Test about μ : σ is Known	235
The Upper-Tail Hypothesis Test about μ : σ is Unknown	237
The Two-Tail Hypothesis Test about μ : σ is Unknown	240
Hypothesis Tests about p	242
Calculating the Probability of a Type II Error: β	247
Adjusting the Sample Size to Control the Size of β	250
Summary	252
11 Comparisons of Means and Proportions	257
The Difference between μ_1 and μ_2 : Independent Samples	258
The Difference between μ_1 and μ_2 : Paired Samples	264
The Difference between p_1 and p_2 : Independent Samples	271
Summary	276
12 Simple Linear Regression	283
Simple Linear Regression: The Model	284
The Estimated Regression Equation	285
Goodness of Fit: The Coefficient of Determination, r^2	291
The Hypothesis Test about β_1	296
Alternative Approaches to Testing Significance	302
So Far, We Have Tested Only b_1 ; Will We Also Test b_0 ?	303
Assumptions: What Are They?	304
Assumptions: How Are They Validated?	305
Optional Material: Derivation of the Expressions for the Least Square Estimates of β_0 and β_1	309
Summary	311
13 Multiple Regression	319
Simple Linear Regression: A Reprise	320
Multiple Regression: The Model	324
Multiple Regression: The Multiple Regression Equation	325
The Estimated Multiple Regression Equation	325
Multiple Regression: Two Independent Variables	326
Assumptions: What Are They? Can We Validate Them?	335
Tests of Significance: The Overall Regression Model	336

Tests of Significance: The Independent Variables 340
 There Must Be An Easier Way Than This, Right? 344
 Using the Estimated Regression Equation for Prediction 345
 Independent Variable Selection: The Best-Subsets Method 346
 Summary 353

Index 363