CONTENTS

Preface xiii

Acknowledgments of Reviewers and Contributors xvii

Key Features xix

Supplements for Students and Instructors xx

Chapter 1

Sampling and Descriptive Statistics 1

Introduction 1

- **1.1** Sampling 3
- **1.2** Summary Statistics 13
- **1.3** Graphical Summaries 25

Chapter 2

Probability 48

Introduction 48

- **2.1** Basic Ideas 48
- **2.2** Counting Methods 62
- **2.3** Conditional Probability and Independence 69
- **2.4** Random Variables 90
- **2.5** Linear Functions of Random Variables 116
- **2.6** Jointly Distributed Random Variables 127

Chapter 3

Propagation of Error 164

Introduction 164

- **3.1** Measurement Error 164
- **3.2** Linear Combinations of Measurements 170

- **3.3** Uncertainties for Functions of One Measurement 180
- **3.4** Uncertainties for Functions of Several Measurements 186

Chapter 4

Commonly Used Distributions 200 Introduction 200

- **4.1** The Bernoulli Distribution 200
- **4.2** The Binomial Distribution 203
- **4.3** The Poisson Distribution 215
- **4.4** Some Other Discrete Distributions 230
- **4.5** The Normal Distribution 241
- **4.6** The Lognormal Distribution 256
- **4.7** The Exponential Distribution 262
- **4.8** Some Other Continuous Distributions 271
- **4.9** Some Principles of Point Estimation 280
- **4.10** Probability Plots 285
- **4.11** The Central Limit Theorem 290
- **4.12** Simulation 302

Chapter 5

Confidence Intervals 322

Introduction 322

- **5.1** Large-Sample Confidence Intervals for a Population Mean 323
- **5.2** Confidence Intervals for Proportions 338
- **5.3** Small-Sample Confidence Intervals for a Population Mean 344

- x Contents
- **5.4** Confidence Intervals for the Difference Between Two Means 354
- **5.5** Confidence Intervals for the Difference Between Two Proportions 358
- 5.6 Small-Sample Confidence Intervals for the Difference Between Two Means 363
- **5.7** Confidence Intervals with Paired Data 370
- **5.8** Prediction Intervals and Tolerance Intervals 374
- **5.9** Using Simulation to Construct Confidence Intervals 379

Chapter 6

Hypothesis Testing 396

Introduction 396

- **6.1** Large-Sample Tests for a Population Mean 396
- **6.2** Drawing Conclusions from the Results of Hypothesis Tests 405
- **6.3** Tests for a Population Proportion 413
- **6.4** Small-Sample Tests for a Population Mean 418
- **6.5** Large-Sample Tests for the Difference Between Two Means 423
- **6.6** Tests for the Difference Between Two Proportions 430
- **6.7** Small-Sample Tests for the Difference Between Two Means 435
- **6.8** Tests with Paired Data 444
- **6.9** Distribution-Free Tests 450
- **6.10** The Chi-Square Test 459
- **6.11** The F Test for Equality of Variance 469

- **6.12** Fixed-Level Testing 473
- **6.13** Power 479
- 6.14 Multiple Tests 488
- **6.15** Using Simulation to Perform Hypothesis Tests 492

Chapter 7

Correlation and Simple Linear Regression 505

Introduction 505

- 7.1 Correlation 505
- **7.2** The Least-Squares Line 523
- **7.3** Uncertainties in the Least-Squares Coefficients 539
- **7.4** Checking Assumptions and Transforming Data 560

Chapter 8

Multiple Regression 592

Introduction 592

- **8.1** The Multiple Regression Model 592
- **8.2** Confounding and Collinearity 610
- **8.3** Model Selection 619

Chapter 9

Factorial Experiments 658

Introduction 658

- **9.1** One-Factor Experiments 658
- **9.2** Pairwise Comparisons in One-Factor Experiments 683
- **9.3** Two-Factor Experiments 696
- **9.4** Randomized Complete Block Designs 721
- **9.5** 2^{*p*} Factorial Experiments 731

Contents xi

Chapter 10
Statistical Quality Control 761
Introduction 761
10.1 Basic Ideas 761
10.2 Control Charts for Variables 764

10.3 Control Charts for Attributes 784

10.4 The CUSUM Chart 789

10.5 Process Capability 793

Appendix A: Tables 800Appendix B: Partial Derivatives 825Appendix C: Bibliography 827Answers to Odd-Numbered Exercises 830Index 898