

Contents

Preface	xvii	
About the	Author	XX

CHAPTER 1

Basic Concepts

$\checkmark 1.1$	Important Terms	2
	The product reliation	11

- 1.2 Descriptive and Inferential Statistics 5
- 1.3 Measurement Scales 6
- 1.4 Using Computers 9
- 1.5 The Plan of the Book 9

CHAPTER 2

Describing and Exploring Data 15

- 2.1 Plotting Data 16
- 2.2 Histograms 18
- 2.3 Fitting Smooth Lines to Data 21
- 2.4 Stem-and-Leaf Displays 24
- 2.5 Describing Distributions 27
- 2.6 Notation 30
- 2.7 Measures of Central Tendency 32
- 2.8 Measures of Variability 36
- 2.9 Boxplots: Graphical Representations of Dispersions and Extreme Scores 48
- 2.10 Obtaining Measures of Central Tendency and Dispersion Using SPSS 51
- 2.11 Percentiles, Quartiles, and Deciles 52
- 2.12 The Effect of Linear Transformations on Data 52

2.1 The Name of Distribution 60
3.1 The Normal Distribution 68
3.2 The Standard Normal Distribution 71
3.3 Using the Tables of the Standard Normal Distribution 73
3.4 Setting Probable Limits on an Observation 75
3.5 Assessing Whether Data Are Normally Distributed 76
3.6 Measures Related to z 79
CHAPTER 4 Sampling Distributions and Hypothesis Testing 85
4.1 Two Simple Examples Involving Course Evaluations and Rude Motorists 8
4.2 Sampling Distributions 88
4.3 Theory of Hypothesis Testing 90
4.4 The Null Hypothesis 92
4.5 Test Statistics and Their Sampling Distributions 95
4.6 Making Decisions About the Null Hypothesis 95
4.7 Type I and Type II Errors 96
4.8 One- and Two-Tailed Tests 99
4.9 What Does It Mean to Reject the Null Hypothesis? 101
4.10 An Alternative View of Hypothesis Testing 102
4.11 Effect Size 104
4.12 A Final Worked Example 105
4.13 Back to Course Evaluations and Rude Motorists 106
CHAPTER 5 Basic Concepts of Probability 111
5.1 Probability 112
5.2 Basic Terminology and Rules 114
5.2 Discrete versus Continuous Variables 118
5.4 Probability Distributions for Discrete Variables 118
5.5 Probability Distributions for Continuous Variables 119
5.6 Permutations and Combinations 120
5.7 Bayes' Theorem 123
5.8 The Binomial Distribution 127
5.9 Using the Binomial Distribution to Test Hypotheses 131
5.10 The Multinomial Distribution 133
CHAPTER 6 Categorical Data and Chi-Square 139
6.1 The Chi-Square Distribution 140
6.2 The Chi-Square Goodness-of-Fit Test—One-Way Classification 141
6.3 Two Classification Variables: Contingency Table Analysis 145

An Additional Example—A 4 × 2 Design 148

6.4

6.6	Summary of the Assumptions of Chi-Square 152
6.7	Dependent or Repeated Measurements 153
6.8	One- and Two-Tailed Tests 155
6.9	Likelihood Ratio Tests 156
6.10	Mantel-Haenszel Statistic 157
6.11	Effect Sizes 159
6.12	A Measure of Agreement 165
6.13	Writing Up the Results 167
Нуро	thesis Tests Applied to Means 179
7.1	Sampling Distribution of the Mean 180
7.2	Testing Hypotheses About Means—σ Known 183
7.3	Testing a Sample Mean When σ Is Unknown—The One–Sample t Test 185
7.4	Hypothesis Tests Applied to Means—Two Matched Samples 194
7.5	Hypothesis Tests Applied to Means—Two Independent Samples 203
7.6	A Second Worked Example 211
7.7	Heterogeneity of Variance: The Behrens–Fisher Problem 213
7.8	Hypothesis Testing Revisited 216
Powe	
8.1	Factors Affecting the Power of a Test 227
8.2	Effect Size 229
8.3	Power Calculations for the One-Sample t 231
8.4	Power Calculations for Differences Between Two Independent Means 233
8.5	Power Calculations for Matched-Sample t 236
8.6	Power Calculations in More Complex Designs 238
8.7	The Use of G*Power to Simplify Calculations 238
8.8	Retrospective Power 239
8.9	Writing Up the Results of a Power Analysis 241
Corre	elation and Regression 245
9.1	Scatterplot 247
9.2	The Relationship Between Stress and Health 249
9.3	The Covariance 250
9.4	The Pearson Product-Moment Correlation Coefficient (r) 252
9.5	The Regression Line 253
9.6	Other Ways of Fitting a Line to Data 257
9.7	The Accuracy of Prediction 258
9.8	Assumptions Underlying Regression and Correlation 264

Chi-Square for Ordinal Data 151

6.5

CHAPTER 7

CHAPTER 8

CHAPTER 9

CHAPTER 10

	9.10 A Computer Example Showing the Role of Test-Taking Skills 268
	9.11 Hypothesis Testing 271
	9.12 One Final Example 279
	9.13 The Role of Assumptions in Correlation and Regression 280
	9.14 Factors That Affect the Correlation 281
	9.15 Power Calculation for Pearson's r 283
CHAPTER 10	Alternative Correlational Techniques 293
	10.1 Point-Biserial Correlation and Phi: Pearson Correlations by Another Name 294
	10.2 Biserial and Tetrachoric Correlation: Non-Pearson Correlation Coefficients 303
	10.3 Correlation Coefficients for Ranked Data 303
	10.4 Analysis of Contingency Tables with Ordered Variables 306
	10.5 Kendall's Coefficient of Concordance (W) 309
CHAPTER 11	Simple Analysis of Variance 317
	11.1 An Example 318
	11.2 The Underlying Model 319
	11.3 The Logic of the Analysis of Variance 321
	11.4 Calculations in the Analysis of Variance 324
	11.5 Writing Up the Results 330
	11.6 Computer Solutions 330
	11.7 Unequal Sample Sizes 332
	11.8 Violations of Assumptions 334
	11.9 Transformations 336
	11.10 Fixed versus Random Models 343
	11.11 The Size of an Experimental Effect 343
	11.12 Power 348
	11.13 Computer Analyses 354
CHAPTER 12	Multiple Comparisons Among Treatment Means 363
	12.1 Error Rates 364
	12.2 Multiple Comparisons in a Simple Experiment on Morphine Tolerance 367
	12.3 A Priori Comparisons 369
	12.4 Confidence Intervals and Effect Sizes for Contrasts 384
	12.5 Reporting Results 387
	12.6 Post Hoc Comparisons 389
	12.7 Comparison of the Alternative Procedures 397
	12.8 Which Test? 398

Confidence Limits on Y 266

			Trend Analysis 402	
HAPTER	13		orial Analysis of Variance 413	
		13.1	An Extension of the Eysenck Study 416	
		13.2	Structural Models and Expected Mean Squares 420	
		13.3	Interactions 421	
		13.4	Simple Effects 423	
		13.5	Analysis of Variance Applied to the Effects of Smoking 426	
		13.6	Multiple Comparisons 428	
		13.7	Power Analysis for Factorial Experiments 429	
		13.8	Expected Mean Squares and Alternative Designs 430	
		13.9	Measures of Association and Effect Size 438	
		13.10	Reporting the Results 443	
		13.11	Unequal Sample Sizes 444	
		13.12	Higher-Order Factorial Designs 446	
		13.13	A Computer Example 453	
			to a stryient an an exist Sizes in an Analysis of Cover	
HAPTER	14	Repe	eated-Measures Designs 461	
		14.1	The Structural Model 464	
		14.2	F Ratios 464	
		14.3	The Covariance Matrix 465	
		14.4	Analysis of Variance Applied to Relaxation Therapy 466	
		14.5	Contrasts and Effect Sizes in Repeated Measures Designs 469	
		14.6	Writing Up the Results 471	
		14.7	One Between-Subjects Variable and One Within-Subjects Variable 47	1
		14.8	Two Between-Subjects Variables and One Within-Subjects Variable 4	83
		14.9	Two Within-Subjects Variables and One Between-Subjects Variable 4	-88
		14.10	Intraclass Correlation 495	
		14.11	Other Considerations 498	
		14.12	Mixed Models for Repeated-Measures Designs 499	
HAPTER	15	Multi	iple Regression 515	
		15.1	Multiple Linear Regression 516 Using Additional Predictors 527	
			Using Additional Predictors 527 Standard Errors and Tests of Regression Coefficients 520	
		15.3 15.4	Standard Errors and Tests of Regression Coefficients 529 Residual Variance 530	
			Distribution Assumptions 531	
		15.5	Distribution Assumptions 331	

15.6 The Multiple Correlation Coefficient 532

12.9 Computer Solutions 399

		15.7	Geometric Representation of Multiple Regression 534
		15.8	Partial and Semipartial Correlation 535
		15.9	Suppressor Variables 538
		15.10	Regression Diagnostics 539
		15.11	Constructing a Regression Equation 546
		15.12	The "Importance" of Individual Variables 551
		15.13	Using Approximate Regression Coefficients 552
		15.14	Mediating and Moderating Relationships 553
		15.15	Logistic Regression 561
CHAPTER 16	16	A SHOW IN	yses of Variance and Covariance as General or Models 579
		16.1	The General Linear Model 580
		16.2	One-Way Analysis of Variance 583
		16.3	Factorial Designs 586
		16.4	Analysis of Variance with Unequal Sample Sizes 593
		16.5	The One-Way Analysis of Covariance 598
		16.6	Computing Effect Sizes in an Analysis of Covariance 609
		16.7	Interpreting an Analysis of Covariance 611
		16.8	Reporting the Results of an Analysis of Covariance 612
		16.9	The Factorial Analysis of Covariance 612
		16.10	Using Multiple Covariates 621
			Alternative Experimental Designs 621
	455		er Temorite kalls of Sanghee Applied and Astronal Inc
CHAPTER			Linear Analysis 629
		17.1	Two-Way Contingency Tables 631
		17.2	Model Specification 636
		17.3	Testing Models 638
		17.4	Odds and Odds Ratios 641
		17.5	Treatment Effects (Lambda) 642
			Three-Way Tables 643
			Deriving Models 648
		17.8	Treatment Effects 652
		123	Multiple Linear Regimesination 1.71
	4.0	D	maling and Mannarametria Annrasahas to Data

CHAPTER 18 Resampling and Nonparametric Approaches to Data 659

- 18.1 Bootstrapping as a General Approach 661
- 18.2 Bootstrapping with One Sample 663
- 18.3 Resampling with Two Paired Samples 665
- 18.4 Resampling with Two Independent Samples 668

18.5 Bootstrapping Confidence Limits on a Correlation Coefficient 670

- 18.6 Wilcoxon's Rank-Sum Test 673
- 18.7 Wilcoxon's Matched-Pairs Signed-Ranks Test 678
- 18.8 The Sign Test 682
- 18.9 Kruskal-Wallis One-Way Analysis of Variance 683
- 18.10 Friedman's Rank Test for k Correlated Samples 684

Appendices 690

References 724

Answers to Exercises 735

Index 757