<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td>xxv</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>xxxi</td>
</tr>
<tr>
<td>About the Author</td>
<td>xxxiii</td>
</tr>
<tr>
<td><strong>Chapter 1. Review of Basic Concepts</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1 Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.2 A Simple Example of a Research Problem</td>
<td>2</td>
</tr>
<tr>
<td>1.3 Discrepancies Between Real and Ideal Research Situations</td>
<td>2</td>
</tr>
<tr>
<td>1.4 Samples and Populations</td>
<td>3</td>
</tr>
<tr>
<td>1.5 Descriptive Versus Inferential Uses of Statistics</td>
<td>4</td>
</tr>
<tr>
<td>1.6 Levels of Measurement and Types of Variables</td>
<td>6</td>
</tr>
<tr>
<td>1.7 The Normal Distribution</td>
<td>10</td>
</tr>
<tr>
<td>1.8 Research Design</td>
<td>15</td>
</tr>
<tr>
<td>1.8.1 Experimental Design</td>
<td>16</td>
</tr>
<tr>
<td>1.8.2 Quasi-Experimental Design</td>
<td>19</td>
</tr>
<tr>
<td>1.8.3 Nonexperimental Research Design</td>
<td>19</td>
</tr>
<tr>
<td>1.8.4 Between-Subjects Versus Within-Subjects or Repeated Measures</td>
<td>20</td>
</tr>
<tr>
<td>1.9 Combinations of These Design Elements</td>
<td>21</td>
</tr>
<tr>
<td>1.10 Parametric Versus Nonparametric Statistics</td>
<td>21</td>
</tr>
<tr>
<td>1.11 Additional Implicit Assumptions</td>
<td>25</td>
</tr>
<tr>
<td>1.12 Selection of an Appropriate Bivariate Analysis</td>
<td>26</td>
</tr>
<tr>
<td>1.13 Summary</td>
<td>29</td>
</tr>
<tr>
<td>Comprehension Questions</td>
<td>37</td>
</tr>
<tr>
<td>**Chapter 2. Basic Statistics, Sampling Error, and Confidence Intervals</td>
<td>41</td>
</tr>
<tr>
<td>2.1 Introduction</td>
<td>41</td>
</tr>
<tr>
<td>2.2 Research Example: Description of a Sample of HR Scores</td>
<td>43</td>
</tr>
<tr>
<td>2.3 Sample Mean (M)</td>
<td>49</td>
</tr>
<tr>
<td>2.4 Sum of Squared Deviations ((SS)) and Sample Variance ((s^2))</td>
<td>54</td>
</tr>
<tr>
<td>2.5 Degrees of Freedom ((df)) for a Sample Variance</td>
<td>56</td>
</tr>
<tr>
<td>2.6 Why Is There Variance?</td>
<td>57</td>
</tr>
<tr>
<td>2.7 Sample Standard Deviation ((s))</td>
<td>59</td>
</tr>
<tr>
<td>2.8 Assessment of Location of a Single X Score Relative to a Distribution of Scores</td>
<td>60</td>
</tr>
<tr>
<td>2.9 A Shift in Level of Analysis: The Distribution of Values of M Across Many Samples From the Same Population</td>
<td>62</td>
</tr>
<tr>
<td>2.10 An Index of Amount of Sampling Error: The Standard Error of the Mean ((\sigma_{\bar{x}}))</td>
<td>63</td>
</tr>
<tr>
<td>2.11 Effect of Sample Size ((N)) on the Magnitude of the Standard Error ((\sigma_{\bar{x}}))</td>
<td>65</td>
</tr>
<tr>
<td>2.12 Sample Estimate of the Standard Error of the Mean ((SE_{\bar{x}}))</td>
<td>68</td>
</tr>
</tbody>
</table>
3.12 Summary
  3.12.1 Logical Problems With NHST
  3.12.2 Other Applications of the t Ratio
  3.12.3 What Does It Mean to Say “p < .05”?

Comprehension Questions

Chapter 4. Preliminary Data Screening
  4.1 Introduction: Problems in Real Data
  4.2 Quality Control During Data Collection
  4.3 Example of an SPSS Data Worksheet
  4.4 Identification of Errors and Inconsistencies
  4.5 Missing Values
  4.6 Empirical Example of Data Screening for Individual Variables
    4.6.1 Frequency Distribution Tables
    4.6.2 Removal of Impossible or Extreme Scores
    4.6.3 Bar Chart for a Categorical Variable
    4.6.4 Histogram for a Quantitative Variable
  4.7 Identification and Handling of Outliers
  4.8 Screening Data for Bivariate Analyses
    4.8.1 Bivariate Data Screening for Two Categorical Variables
    4.8.2 Bivariate Data Screening for One Categorical and One Quantitative Variable
    4.8.3 Bivariate Data Screening for Two Quantitative Variables
  4.9 Nonlinear Relations
  4.10 Data Transformations
  4.11 Verifying That Remedies Had the Desired Effects
  4.12 Multivariate Data Screening
  4.13 Reporting Preliminary Data Screening
  4.14 Summary and Checklist for Data Screening
  4.15 Final Notes

Comprehension Questions

Chapter 5. Comparing Group Means Using the Independent Samples t Test
  5.1 Research Situations Where the Independent Samples t Test Is Used
  5.2 A Hypothetical Research Example
  5.3 Assumptions About the Distribution of Scores on the Quantitative Dependent Variable
    5.3.1 Quantitative, Approximately Normally Distributed
    5.3.2 Equal Variances of Scores Across Groups (the Homogeneity of Variance Assumption)
    5.3.3 Independent Observations Both Between and Within Groups
    5.3.4 Robustness to Violations of Assumptions
  5.4 Preliminary Data Screening
  5.5 Issues in Designing a Study
Chapter 5. One-Way Between-Subjects Analysis of Variance

5.6 Formulas for the Independent Samples \( t \) Test
   5.6.1 The Pooled Variances \( t \) Test
   5.6.2 Computation of the Separate Variances
      \( t \) Test and Its Adjusted \( df \)
   5.6.3 Evaluation of Statistical Significance of a \( t \) Ratio
   5.6.4 Confidence Interval Around \( M_1 - M_2 \)
5.7 Conceptual Basis: Factors That Affect the Size of the \( t \) Ratio
   5.7.1 Design Decisions That Affect the Difference Between Group Means, \( M_1 - M_2 \)
   5.7.2 Design Decisions That Affect Pooled Within-Group Variance, \( s^2_p \)
   5.7.3 Design Decisions About Sample Sizes, \( n_1 \) and \( n_2 \)
   5.7.4 Summary: Factors That Influence the Size of \( t \)
5.8 Effect-Size Indexes for \( t \)
   5.8.1 Eta Squared (\( \eta^2 \))
   5.8.2 Cohen’s \( d \)
   5.8.3 Point Biserial \( r (r_{pb}) \)
5.9 Statistical Power and Decisions About Sample Size for the Independent Samples \( t \) Test
5.10 Describing the Nature of the Outcome
5.11 SPSS Output and Model Results Section
5.12 Summary
Comprehension Questions

Chapter 6. One-Way Between-Subjects Analysis of Variance

6.1 Research Situations Where One-Way Between-Subjects Analysis of Variance (ANOVA) Is Used
6.2 Hypothetical Research Example
6.3 Assumptions About Scores on the Dependent Variable for One-Way Between-S ANOVA
6.4 Issues in Planning a Study
6.5 Data Screening
6.6 Partition of Scores Into Components
6.7 Computations for the One-Way Between-S ANOVA
   6.7.1 Comparison Between the Independent Samples \( t \) Test and One-Way Between-S ANOVA
   6.7.2 Summarizing Information About Distances Between Group Means: Computing \( MS_{\text{between}} \)
   6.7.3 Summarizing Information About Variability of Scores Within Groups: Computing \( MS_{\text{within}} \)
   6.7.4 The \( F \) Ratio: Comparing \( MS_{\text{between}} \) With \( MS_{\text{within}} \)
   6.7.5 Patterns of Scores Related to the Magnitudes of \( MS_{\text{between}} \) and \( MS_{\text{within}} \)
   6.7.6 Expected Value of \( F \) When \( H_0 \) Is True
   6.7.7 Confidence Intervals (CIs) for Group Means
Chapter 10. Adding a Third Variable: Preliminary Exploratory Analyses

10.1 Three-Variable Research Situations

10.2 First Research Example

10.3 Exploratory Statistical Analyses for Three-Variable Research Situations

10.4 Separate Analysis of the $X_1$, $Y$ Relationship for Each Level of the Control Variable $X_2$

10.5 Partial Correlation Between $X_1$ and $Y$, Controlling for $X_2$

10.6 Understanding Partial Correlation as the Use of Bivariate Regression to Remove Variance Predictable by $X_1$ From Both $X_2$ and $Y$

10.7 Computation of Partial $r$ From Bivariate Pearson Correlations

10.8 Intuitive Approach to Understanding Partial $r$

10.9 Significance Tests, Confidence Intervals, and Statistical Power for Partial Correlations

10.10 Interpretation of Various Outcomes for $r_{12}$ and $r_{11}$

10.11 Two-Variable Causal Models

10.12 Three-Variable Models: Some Possible Patterns of Association Among $X_1$, $Y$, and $X_2$

10.12.1 $X_1$ and $Y$ Are Not Related Whether You Control for $X_2$ or Not

10.12.2 $X_2$ Is Irrelevant to the $X_1$, $Y$ Relationship

10.12.3 When You Control for $X_2$, the $X_1$, $Y$ Correlation Drops to 0 or Close to 0

10.12.3.1 Completely Spurious Correlation

10.12.3.2 Completely Mediated Association Between $X_1$ and $Y$

10.12.4 When You Control for $X_2$, the Correlation Between $X_1$ and $Y$ Becomes Smaller (but Does Not Drop to 0 and Does Not Change Sign)

10.12.4.1 $X_2$ Partly Accounts for the $X_1$, $Y$ Association, or $X_1$ and $X_2$ Are Correlated Predictors of $Y$

10.12.4.2 $X_2$ Partly Mediates the $X_1$, $Y$ Relationship

10.12.5 Suppression: When You Control for $X_2$, the $X_1$, $Y$ Correlation Becomes Larger Than $r_{12}$ or Becomes Opposite in Sign Relative to $r_{1Y}$

10.12.5.1 Suppression of Error Variance in a Predictor Variable

10.12.5.2 Sign of $X_1$ as a Predictor of $Y$ Reverses When Controlling for $X_2$

10.12.5.3 Predictor Variables With Opposite Signs

10.12.6 “None of the Above”

10.13 Mediation Versus Moderation

10.13.1 Preliminary Analysis to Identify Possible Moderation

10.13.2 Preliminary Analysis to Detect Possible Mediation

10.13.3 Experimental Tests for Mediation Models

10.14 Model Results

10.15 Summary

Comprehension Questions
Chapter 11. Multiple Regression With Two Predictor Variables 429

11.1 Research Situations Involving Regression With Two Predictor Variables 429
11.2 Hypothetical Research Example 431
11.3 Graphic Representation of Regression Plane 432
11.4 Semipartial (or “Part”) Correlation 433
11.5 Graphic Representation of Partition of Variance in Regression With Two Predictors 434
11.6 Assumptions for Regression With Two Predictors 438
11.7 Formulas for Regression Coefficients, Significance Tests, and Confidence Intervals 441
  11.7.1 Formulas for Standard Score Beta Coefficients 441
  11.7.2 Formulas for Raw Score \( b \) Coefficients 443
  11.7.3 Formula for Multiple \( R \) and Multiple \( R^2 \) 444
  11.7.4 Test of Significance for Overall Regression: Overall \( F \) Test for \( H_0: R = 0 \) 444
  11.7.5 Test of Significance for Each Individual Predictor: \( t \) Test for \( H_0: b_i = 0 \) 445
  11.7.6 Confidence Interval for Each \( b \) Slope Coefficient 445
11.8 SPSS Regression Results 446
11.9 Conceptual Basis: Factors That Affect the Magnitude and Sign of \( \beta \) and \( b \) Coefficients in Multiple Regression With Two Predictors 447
11.10 Tracing Rules for Causal Model Path Diagrams 451
11.11 Comparison of Equations for \( \beta \), \( b \), \( pr \), and \( sr \) 453
11.12 Nature of Predictive Relationships 454
11.13 Effect-Size Information in Regression With Two Predictors 455
  11.13.1 Effect Size for Overall Model 455
  11.13.2 Effect Size for Individual Predictor Variables 455
11.14 Statistical Power 456
11.15 Issues in Planning a Study 457
  11.15.1 Sample Size 457
  11.15.2 Selection of Predictor Variables 457
  11.15.3 Multicollinearity Among Predictors 458
  11.15.4 Range of Scores 459
11.16 Results 459
11.17 Summary 462
Comprehension Questions 466

Chapter 12. Dummy Predictor Variables in Multiple Regression 469

12.1 Research Situations Where Dummy Predictor Variables Can Be Used 469
12.2 Empirical Example 471
12.3 Screening for Violations of Assumptions 473
12.4 Issues in Planning a Study 477
12.5 Parameter Estimates and Significance Tests for Regressions With Dummy Variables 477
12.6 Group Mean Comparisons Using One-Way Between-S ANOVA 478
Chapter 13. Factorial ANOVA
13.9 Nature of the Relationships, Follow-Up Tests, and Information to Include in the Results
13.9.1 Nature of a Two-Way Interaction 523
13.9.2 Nature of Main Effect Differences 524
13.10 Factorial ANOVA Using the SPSS GLM Procedure 524
13.10.1 Further Discussion of Results: Comparison of the Factorial ANOVA (in Figures 13.7 and 13.8) With the One-Way ANOVA (in Figure 13.1) 531
13.11 Summary 534
Appendix: Nonorthogonal Factorial ANOVA (ANOVA With Unbalanced Numbers of Cases in the Cells or Groups) 536
Comprehension Questions 543

Chapter 14. Multiple Regression With More Than Two Predictors 547
14.1 Research Questions 547
14.2 Empirical Example 550
14.3 Screening for Violations of Assumptions 550
14.4 Issues in Planning a Study 555
14.5 Computation of Regression Coefficients With k Predictor Variables 557
14.6 Methods of Entry for Predictor Variables 559
14.6.1 Standard or Simultaneous Method of Entry 560
14.6.2 Sequential or Hierarchical (User-Determined) Method of Entry 560
14.6.3 Statistical (Data-Driven) Order of Entry 560
14.7 Variance Partitioning in Regression for Standard or Simultaneous Regression Versus Regressions That Involve a Series of Steps 561
14.8 Significance Test for an Overall Regression Model 564
14.9 Significance Tests for Individual Predictors in Multiple Regression 565
14.10 Effect Size 569
14.10.1 Effect Size for Overall Regression (Multiple R) 569
14.10.2 Effect Sizes for Individual Predictor Variables (sr²) 569
14.11 Changes in F and R as Additional Predictors Are Added to a Model in Sequential or Statistical Regression 570
14.12 Statistical Power 570
14.13 Nature of the Relationship Between Each X Predictor and Y (Controlling for Other Predictors) 571
14.14 Assessment of Multivariate Outliers in Regression 572
14.15 SPSS Example and Results 573
14.15.1 SPSS Screen Shots, Output, and Results for Standard Regression 574
14.15.2 SPSS Screen Shots, Output, and Results for Sequential Regression 579
14.15.3 SPSS Screen Shots, Output, and Results for Statistical Regression 584
14.16 Summary 589
Comprehension Questions 608
Chapter 15. Moderation: Tests for Interaction in Multiple Regression

15.1 Moderation Versus Mediation

15.2 Situations in Which Researchers Test Interactions

15.2.1 Factorial ANOVA Designs

15.2.2 Regression Analyses That Include Interaction Terms

15.3 When Should Interaction Terms Be Included in Regression Analysis?

15.4 Types of Predictor Variables Included in Interactions

15.4.1 Interaction Between Two Categorical Predictor Variables

15.4.2 Interaction Between a Quantitative and a Categorical Predictor Variable

15.4.3 Interaction Between Two Quantitative Predictor Variables

15.5 Assumptions and Preliminary Data Screening

15.6 Issues in Designing a Study

15.7 Sample Size and Statistical Power in Tests of Moderation or Interaction

15.8 Effect Size for Interaction

15.9 Additional Issues in Analysis

15.10 Preliminary Example: One Categorical and One Quantitative Predictor Variable With No Significant Interaction

15.11 Example 1: Significant Interaction Between One Categorical and One Quantitative Predictor Variable

15.12 Graphing Regression Lines for Subgroups

15.13 Interaction With a Categorical Predictor With More Than Two Categories

15.14 Results Section for Interaction Involving One Categorical and One Quantitative Predictor Variable

15.15 Example 2: Interaction Between Two Quantitative Predictors

15.16 Results for Example 2: Interaction Between Two Quantitative Predictors

15.17 Graphing the Interaction for Selected Values of Two Quantitative Predictors

15.18 Results Section for Example 2: Interaction of Two Quantitative Predictors

15.19 Additional Issues and Summary

Comprehension Questions

Chapter 16. Mediation

16.1 Definition of Mediation

16.1.1 Path Model Notation

16.1.2 Circumstances When Mediation May Be a Reasonable Hypothesis

16.2 A Hypothetical Research Example Involving One Mediating Variable

16.3 Limitations of Causal Models

16.3.1 Reasons Why Some Path Coefficients May Be Not Statistically Significant

16.3.2 Possible Interpretations for a Statistically Significant Path

16.4 Questions in a Mediation Analysis

16.5 Issues in Designing a Mediation Analysis Study

16.5.1 Type and Measurement of Variables in Mediation Analysis

16.5.2 Temporal Precedence or Sequence of Variables in Mediation Studies

16.5.3 Time Lags Between Variables

16.6 Assumptions in Mediation Analysis and Preliminary Data Screening
17.8 Conceptual Basis: Factors That Affect the Magnitude of $SS_{adj}$ and $SS_{residual}$ and the Pattern of Adjusted Group Means

17.9 Effect Size

17.10 Statistical Power

17.11 Nature of the Relationship and Follow-Up Tests:
   Information to Include in the Results Section

17.12 SPSS Analysis and Model Results

17.13 Additional Discussion of ANCOVA Results

17.14 Summary

Appendix: Alternative Methods for the Analysis of Pretest/Posttest Data

Comprehension Questions

Chapter 18. Discriminant Analysis

18.1 Research Situations and Research Questions

18.2 Introduction of an Empirical Example

18.3 Screening for Violations of Assumptions

18.4 Issues in Planning a Study

18.5 Equations for Discriminant Analysis

18.6 Conceptual Basis: Factors That Affect the Magnitude of Wilks's $\Lambda$

18.7 Effect Size

18.8 Statistical Power and Sample Size Recommendations

18.9 Follow-Up Tests to Assess What Pattern of Scores Best Differentiates Groups

18.10 Results

18.11 One-Way ANOVA on Scores on Discriminant Functions

18.12 Summary

Appendix: Eigenvalue/Eigenvector Problem

Comprehension Questions

Chapter 19. Multivariate Analysis of Variance

19.1 Research Situations and Research Questions

19.2 Introduction of the Initial Research Example: A One-Way MANOVA

19.3 Why Include Multiple Outcome Measures?

19.4 Equivalence of MANOVA and DA

19.5 The General Linear Model

19.6 Assumptions and Data Screening

19.7 Issues in Planning a Study

19.8 Conceptual Basis of MANOVA and Some Formulas for MANOVA

19.9 Multivariate Test Statistics

19.10 Factors That Influence the Magnitude of Wilks's $\Lambda$

19.11 Effect Size for MANOVA

19.12 Statistical Power and Sample Size Decisions

19.13 SPSS Output for a One-Way MANOVA: Career Group Data From Chapter 18

19.14 A $2 \times 3$ Factorial MANOVA of the Career Group Data

   19.14.1 Potential Follow-Up Tests to Assess the Nature of Significant Main Effects
Chapter 20. Principal Components and Factor Analysis

20.1 Research Situations
20.2 Path Model for Factor Analysis
20.3 Factor Analysis as a Method of Data Reduction
20.4 Introduction of an Empirical Example
20.5 Screening for Violations of Assumptions
20.6 Issues in Planning a Factor-Analytic Study
20.7 Computation of Loadings
20.8 Steps in the Computation of Principal Components or Factor Analysis
   20.8.1 Computation of the Correlation Matrix $R$
   20.8.2 Computation of the Initial Loading Matrix $A$
   20.8.3 Limiting the Number of Components or Factors
   20.8.4 Rotation of Factors
   20.8.5 Naming or Labeling Components or Factors
20.9 Analysis 1: Principal Components Analysis of Three Items Retaining All Three Components
   20.9.1 Communality for Each Item Based on All Three Components
   20.9.2 Variance Reproduced by Each of the Three Components
   20.9.3 Reproduction of Correlations From Loadings on All Three Components
20.10 Analysis 2: Principal Component Analysis of Three Items Retaining Only the First Component
   20.10.1 Communality for Each Item Based on One Component
   20.10.2 Variance Reproduced by the First Component
   20.10.3 Partial Reproduction of Correlations From Loadings on Only One Component
20.11 Principal Components Versus Principal Axis Factoring
20.12 Analysis 3: PAF of Nine Items, Two Factors Retained, No Rotation
   20.12.1 Communality for Each Item Based on Two Retained Factors
   20.12.2 Variance Reproduced by Two Retained Factors
   20.12.3 Partial Reproduction of Correlations From Loadings on Only Two Factors
20.13 Geometric Representation of Correlations Between Variables and Correlations Between Components or Factors
   20.13.1 Factor Rotation
20.14 The Two Sets of Multiple Regressions
   20.14.1 Construction of Factor Scores (Such as Score on $F_1$) From $z$ Scores
   20.14.2 Prediction of Standard Scores on Variables ($x$) From Factors ($F_1, F_2, \ldots, F_p$)
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.15 Analysis 4: PAF With Varimax Rotation</td>
<td>875</td>
</tr>
<tr>
<td>20.15.1 Variance Reproduced by Each Factor at Three Stages in the Analysis</td>
<td>880</td>
</tr>
<tr>
<td>20.15.2 Rotated Factor Loadings</td>
<td>880</td>
</tr>
<tr>
<td>20.15.3 Example of a Reverse-Scored Item</td>
<td>880</td>
</tr>
<tr>
<td>20.16 Questions to Address in the Interpretation of Factor Analysis</td>
<td>881</td>
</tr>
<tr>
<td>20.16.1 How Many Factors or Components or Latent Variables Are Needed to Account for (or Reconstruct) the Pattern of Correlations Among the Measured Variables?</td>
<td>881</td>
</tr>
<tr>
<td>20.16.2 How “Important” Are the Factors or Components? How Much Variance Does Each Factor or Component Explain?</td>
<td>881</td>
</tr>
<tr>
<td>20.16.3 What, if Anything, Do the Retained Factors or Components Mean? Can We Label or Name Our Factors?</td>
<td>882</td>
</tr>
<tr>
<td>20.16.4 How Adequately Do the Retained Components or Factors Reproduce the Structure in the Original Data—That Is, the Correlation Matrix?</td>
<td>883</td>
</tr>
<tr>
<td>20.17 Results Section for Analysis 4: PAF With Varimax Rotation</td>
<td>883</td>
</tr>
<tr>
<td>20.18 Factor Scores Versus Unit-Weighted Composites</td>
<td>885</td>
</tr>
<tr>
<td>20.19 Summary of Issues in Factor Analysis</td>
<td>888</td>
</tr>
<tr>
<td>20.20 Optional: Brief Introduction to Concepts in Structural Equation Modeling</td>
<td>890</td>
</tr>
<tr>
<td>Appendix: The Matrix Algebra of Factor Analysis</td>
<td>895</td>
</tr>
<tr>
<td>Comprehension Questions</td>
<td>899</td>
</tr>
</tbody>
</table>

Chapter 21. Reliability, Validity, and Multiple-Item Scales 901

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.1 Assessment of Measurement Quality</td>
<td>901</td>
</tr>
<tr>
<td>21.1.1 Reliability</td>
<td>901</td>
</tr>
<tr>
<td>21.1.2 Validity</td>
<td>902</td>
</tr>
<tr>
<td>21.1.3 Sensitivity</td>
<td>902</td>
</tr>
<tr>
<td>21.1.4 Bias</td>
<td>903</td>
</tr>
<tr>
<td>21.2 Cost and Invasiveness of Measurements</td>
<td>904</td>
</tr>
<tr>
<td>21.2.1 Cost</td>
<td>904</td>
</tr>
<tr>
<td>21.2.2 Invasiveness</td>
<td>904</td>
</tr>
<tr>
<td>21.2.3 Reactivity of Measurement</td>
<td>904</td>
</tr>
<tr>
<td>21.3 Empirical Examples of Reliability Assessment</td>
<td>905</td>
</tr>
<tr>
<td>21.3.1 Definition of Reliability</td>
<td>905</td>
</tr>
<tr>
<td>21.3.2 Test-Retest Reliability Assessment for a Quantitative Variable</td>
<td>906</td>
</tr>
<tr>
<td>21.3.3 Interobserver Reliability Assessment for Scores on a Categorical Variable</td>
<td>908</td>
</tr>
<tr>
<td>21.4 Concepts From Classical Measurement Theory</td>
<td>910</td>
</tr>
<tr>
<td>21.4.1 Reliability as Partition of Variance</td>
<td>911</td>
</tr>
<tr>
<td>21.4.2 Attenuation of Correlations Due to Unreliability of Measurement</td>
<td>912</td>
</tr>
<tr>
<td>21.5 Use of Multiple-Item Measures to Improve Measurement Reliability</td>
<td>914</td>
</tr>
<tr>
<td>21.6 Computation of Summated Scales</td>
<td>919</td>
</tr>
<tr>
<td>21.6.1 Assumption: All Items Measure Same Construct and Are Scored in Same Direction</td>
<td>919</td>
</tr>
<tr>
<td>21.6.2 Initial (Raw) Scores Assigned to Individual Responses</td>
<td>919</td>
</tr>
<tr>
<td>21.6.3 Variable Naming, Particularly for Reverse-Worded Questions</td>
<td>920</td>
</tr>
</tbody>
</table>
Chapter 22. Analysis of Repeated Measures 953
22.1 Introduction 953
22.2 Empirical Example: Experiment to Assess Effect of Stress on Heart Rate 954
   22.2.1 Analysis of Data From the Stress/HR Study as a Between-S or Independent Samples Design 955
   22.2.2 Independent Samples $t$ Test for the Stress/HR Data 956
   22.2.3 One-Way Between-S ANOVA for the Stress/HR Data 956
22.3 Discussion of Sources of Within-Group Error in Between-S Versus Within-S Data 956
22.4 The Conceptual Basis for the Paired Samples $t$ Test and One-Way Repeated Measures ANOVA 960
22.5 Computation of a Paired Samples $t$ Test to Compare Mean HR Between Baseline and Pain Conditions 965
22.6 SPSS Example: Analysis of Stress/HR Data Using a Paired Samples $t$ Test 967
22.7 Comparison Between Independent Samples $t$ Test and Paired Samples $t$ Test 969
22.8 SPSS Example: Analysis of Stress/HR Data Using a Univariate One-Way Repeated Measures ANOVA 973
22.9 Using the SPSS GLM Procedure for Repeated Measures ANOVA 976
22.10 Screening for Violations of Assumptions in Univariate Repeated Measures 984
22.11 The Greenhouse-Geisser ε and Huynh-Feldt ε Correction Factors 987
22.12 MANOVA Approach to Analysis of Repeated Measures Data 989
22.13 Effect Size 990
22.14 Statistical Power 991
22.15 Planned Contrasts 993
22.16 Results 995
22.17 Design Problems in Repeated Measures Studies 996
22.18 More Complex Designs 999
22.19 Alternative Analyses for Pretest and Posttest Scores 999
22.20 Summary 1003
Comprehension Questions 1004

Chapter 23. Binary Logistic Regression 1007
23.1 Research Situations 1007
   23.1.1 Types of Variables 1007
   23.1.2 Research Questions 1007
   23.1.3 Assumptions Required for Linear Regression Versus Binary Logistic Regression 1008
23.2 Simple Empirical Example: Dog Ownership and Odds of Death 1009
23.3 Conceptual Basis for Binary Logistic Regression Analysis 1010
   23.3.1 Why Ordinary Linear Regression Is Inadequate 1010
   23.3.2 Modifying the Method of Analysis to Handle These Problems 1012
23.4 Definition and Interpretation of Odds 1013
23.5 A New Type of Dependent Variable: The Logit 1015