2.2.1 Mean, 16
2.2.2 Variance, 16
2.2.3 Standard Error of Mean, 17
2.2.4 Skewness, 17
2.2.5 Kurtosis, 18
2.2.6 Percentiles, 19

2.3 Application of Descriptive Statistics, 19
2.3.1 Testing Normality of Data and Identifying Outliers, 20

2.4 Computation of Descriptive Statistics Using SPSS, 25
2.4.1 Preparation of Data File, 25
2.4.2 Defining Variables, 26
2.4.3 Entering Data, 26
2.4.4 SPSS Commands, 26

2.5 Interpretations of the Results, 29

2.6 Developing Profile Chart, 31

2.7 Summary of SPSS Commands, 33

2.8 Exercise, 33
2.8.1 Short Answer Questions, 33
2.8.2 Multiple Choice Questions, 34

2.9 Case Study on Descriptive Analysis, 36

3 Correlation Coefficient and Partial Correlation 41

3.1 Introduction, 41
3.2 Correlation Matrix and Partial Correlation, 43
3.2.1 Product Moment Correlation Coefficient, 43
3.2.2 Partial Correlation, 45

3.3 Application of Correlation Matrix and Partial Correlation, 46

3.4 Correlation Matrix with SPSS, 46
3.4.1 Computation in Correlation Matrix, 46
3.4.2 Interpretations of Findings, 51

3.5 Partial Correlation with SPSS, 51
3.5.1 Computation of Partial Correlations, 52
3.5.2 Interpretation of Partial Correlation, 55

3.6 Summary of the SPSS Commands, 56
3.6.1 For Computing Correlation Matrix, 56
3.6.2 For Computing Partial Correlations, 57

3.7 Exercise, 57
3.7.1 Short Answer Questions, 57
3.7.2 Multiple Choice Questions, 57
3.7.3 Assignment, 60

3.8 Case Study on Correlation, 60

4 Comparing Means 65

4.1 Introduction, 65
4.2 One-Sample t-Test, 66
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Section</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2</td>
<td>4.2.1</td>
<td>Application of One-Sample t-Test</td>
<td>67</td>
</tr>
<tr>
<td>4.3</td>
<td>4.3</td>
<td>Two-Sample t-Test for Unrelated Groups</td>
<td>67</td>
</tr>
<tr>
<td>4.3.1</td>
<td>Assumptions While Using t-Test</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>4.3.2</td>
<td>Case I: Two-Tailed Test</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>4.3.3</td>
<td>Case II: Right Tailed Test</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>4.3.4</td>
<td>Case III: Left Tailed Test</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>4.3.5</td>
<td>Application of Two-Sample t-Test</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>4.4</td>
<td>Paired t-Test for Related Groups</td>
<td>70</td>
</tr>
<tr>
<td>4.4.1</td>
<td>Case I: Two-Tailed Test</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>4.4.2</td>
<td>Case II: Right Tailed Test</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>4.4.3</td>
<td>Case III: Left Tailed Test</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>4.4.4</td>
<td>Application of Paired t-Test</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>4.5</td>
<td>One-Sample t-Test with SPSS</td>
<td>73</td>
</tr>
<tr>
<td>4.5.1</td>
<td>Computation in t-Test for Single Group</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>4.5.2</td>
<td>Interpretation of Findings</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>4.6</td>
<td>4.6</td>
<td>Two-Sample t-Test for Independent Groups with SPSS</td>
<td>78</td>
</tr>
<tr>
<td>4.6.1</td>
<td>Computation in Two-Sample t-Test</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>4.6.2</td>
<td>Interpretation of Findings</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>4.7</td>
<td>4.7</td>
<td>Paired t-Test for Related Groups with SPSS</td>
<td>85</td>
</tr>
<tr>
<td>4.7.1</td>
<td>Computation in Paired t-Test</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>4.7.2</td>
<td>Interpretation of Findings</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>4.8</td>
<td>4.8</td>
<td>Summary of SPSS Commands for t-Tests</td>
<td>90</td>
</tr>
<tr>
<td>4.8.1</td>
<td>One-Sample t-Test</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>4.8.2</td>
<td>Two-Sample t-Test for Independent Groups</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>4.8.3</td>
<td>Paired t-Test</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>4.9</td>
<td>4.9</td>
<td>Exercise</td>
<td>91</td>
</tr>
<tr>
<td>4.9.1</td>
<td>Short Answer Questions</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>4.9.2</td>
<td>Multiple Choice Questions</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td>4.9.3</td>
<td>Assignment</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>4.10</td>
<td>4.10</td>
<td>Case Study</td>
<td>94</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Independent Measures ANOVA</td>
<td>100</td>
</tr>
<tr>
<td>5.1</td>
<td>Introduction</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>5.2</td>
<td>One-Way Analysis of Variance</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>5.2.1</td>
<td>One-Way ANOVA Model</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>5.2.2</td>
<td>Post Hoc Test</td>
<td>102</td>
<td></td>
</tr>
<tr>
<td>5.2.3</td>
<td>Application of One-Way ANOVA</td>
<td>103</td>
<td></td>
</tr>
<tr>
<td>5.3</td>
<td>One-Way ANOVA with SPSS (Equal Sample Size)</td>
<td>103</td>
<td></td>
</tr>
<tr>
<td>5.3.1</td>
<td>Computation in One-Way ANOVA (Equal Sample Size)</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td>5.3.2</td>
<td>Interpretation of Findings</td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>5.4</td>
<td>One-Way ANOVA with SPSS (Unequal Sample Size)</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>5.4.1</td>
<td>Computation in One-Way ANOVA (Unequal Sample Size)</td>
<td>111</td>
<td></td>
</tr>
<tr>
<td>5.4.2</td>
<td>Interpretation of Findings</td>
<td>114</td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>Two-Way Analysis of Variance</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>5.5.1</td>
<td>Assumptions in Two-Way Analysis of Variance</td>
<td>116</td>
<td></td>
</tr>
</tbody>
</table>
5.5.2 Hypotheses in Two-Way ANOVA, 116
5.5.3 Factors, 117
5.5.4 Treatment Groups, 117
5.5.5 Main Effect, 117
5.5.6 Interaction Effect, 117
5.5.7 Within-Groups Variation, 117
5.5.8 F-Statistic, 117
5.5.9 Two-Way ANOVA Table, 118
5.5.10 Interpretation, 118
5.5.11 Application of Two-Way Analysis of Variance, 118

5.6 Two-Way ANOVA Using SPSS, 119
5.6.1 Computation in Two-Way ANOVA, 121
5.6.2 Interpretation of Findings, 126

5.7 Summary of the SPSS Commands, 137
5.7.1 One-Way ANOVA, 137
5.7.2 Two-Way ANOVA, 138

5.8 Exercise, 138
5.8.1 Short Answer Questions, 138
5.8.2 Multiple Choice Questions, 139
5.8.3 Assignment, 142

5.9 Case Study on One-Way ANOVA Design, 143
5.10 Case Study on Two-Way ANOVA, 147

6 Repeated Measures ANOVA

6.1 Introduction, 153
6.2 One-Way Repeated Measures ANOVA, 154
6.2.1 Assumptions in One-Way Repeated Measures ANOVA, 155
6.2.2 Application in Sports Research, 155
6.2.3 Steps in Solving One-Way Repeated Measures ANOVA, 156
6.3 One-Way Repeated Measures ANOVA Using SPSS, 157
6.3.1 Computation in the One-Way Repeated Measures ANOVA, 157
6.3.2 Interpretation of Findings, 161
6.3.3 Findings of the Study, 165
6.3.4 Inference, 166
6.4 Two-Way Repeated Measures ANOVA, 166
6.4.1 Assumptions in Two-Way Repeated Measures ANOVA, 166
6.4.2 Application in Sports Research, 167
6.4.3 Steps in Solving Two-Way Repeated Measures ANOVA, 167
6.5 Two-Way Repeated Measures ANOVA Using SPSS, 168
6.5.1 Computation in Two-Way Repeated Measures ANOVA, 170
6.5.2 Interpretation of Findings, 173
6.5.3 Findings of the Study, 181
6.5.4 Inference, 181
6.6 Summary of the SPSS Commands for One-Way Repeated Measures ANOVA, 182
CONTENTS

6.7  Summary of the SPSS Commands for Two-Way Repeated Measures
     ANOVA, 182
6.8  Exercise, 183
     6.8.1 Short Answer Questions, 183
     6.8.2 Multiple Choice Questions, 183
     6.8.3 Assignment, 185
6.9  Case Study on Repeated Measures Design, 186

7  Analysis of Covariance
     7.1  Introduction, 190
     7.2  Conceptual Framework of Analysis of Covariance, 191
     7.3  Application of ANCOVA, 192
     7.4  ANCOVA with SPSS, 193
          7.4.1 Computation in ANCOVA, 194
     7.5  Summary of the SPSS Commands, 201
     7.6  Exercise, 202
          7.6.1 Short Answer Questions, 202
          7.6.2 Multiple Choice Questions, 202
          7.6.3 Assignment, 203
     7.7  Case Study on ANCOVA Design, 204

8  Nonparametric Tests in Sports Research
     8.1  Introduction, 209
     8.2  Chi-Square Test, 211
          8.2.1 Testing Goodness of Fit, 211
          8.2.2 Yates’ Correction, 212
          8.2.3 Contingency Coefficient, 212
     8.3  Goodness of Fit with SPSS, 212
          8.3.1 Computation in Goodness of Fit, 213
          8.3.2 Interpretation of Findings, 216
     8.4  Testing Independence of Two Attributes, 216
          8.4.1 Interpretation, 218
     8.5  Testing Association with SPSS, 219
          8.5.1 Computation in Chi-Square, 219
          8.5.2 Interpretation of Findings, 223
     8.6  Mann–Whitney U Test: Comparing Two Independent Samples, 224
          8.6.1 Computation in Mann–Whitney U Statistic Using SPSS, 224
          8.6.2 Interpretation of Findings, 226
     8.7  Wilcoxon Signed-Rank Test: For Comparing Two Related Groups, 227
          8.7.1 Computation in Wilcoxon Signed-Rank Test
                      Using SPSS, 228
          8.7.2 Interpretation of Findings, 230
     8.8  Kruskal–Wallis Test, 231
          8.8.1 Computation in Kruskal–Wallis Test Using SPSS, 232
8.8.2 Interpretation of Findings, 234
8.9 Friedman Test, 234
  8.9.1 Computation in Friedman Test Using SPSS, 235
  8.9.2 Interpretation of Findings, 237
8.10 Summary of the SPSS Commands, 237
  8.10.1 Computing Chi-Square Statistic (for Testing Goodness
       of Fit), 237
  8.10.2 Computing Chi-Square Statistic (for Testing
       Independence), 238
  8.10.3 Computation in Mann–Whitney U Test, 238
  8.10.4 Computation in Wilcoxon Signed-Rank Test, 239
  8.10.5 Computation in Kruskal–Wallis Test, 239
  8.10.6 Computation in Friedman Test, 239
8.11 Exercise, 240
  8.11.1 Short Answer Questions, 240
  8.11.2 Multiple Choice Questions, 241
  8.11.3 Assignment, 243
8.12 Case Study on Testing Independence of Attributes, 243

9 Regression Analysis and Multiple Correlations

  9.1 Introduction, 246
  9.2 Understanding Regression Equation, 247
    9.2.1 Methods of Regression Analysis, 247
    9.2.2 Multiple Correlation, 248
  9.3 Application of Regression Analysis, 248
  9.4 Multiple Regression Analysis with SPSS, 249
    9.4.1 Computation in Regression Analysis, 249
    9.4.2 Interpretation of Findings, 254
  9.5 Summary of SPSS Commands for Regression Analysis, 259
  9.6 Exercise, 259
    9.6.1 Short Answer Questions, 259
    9.6.2 Multiple Choice Questions, 260
    9.6.3 Assignment, 261
  9.7 Case Study on Regression Analysis, 263

10 Application of Discriminant Function Analysis

  10.1 Introduction, 268
  10.2 Basics of Discriminant Function Analysis, 268
    10.2.1 Discriminating Variables, 268
    10.2.2 Dependent Variable, 268
    10.2.3 Discriminant Function, 268
    10.2.4 Classification Matrix, 269
    10.2.5 Stepwise Method of Discriminant Analysis, 269
    10.2.6 Power of Discriminating Variable, 269
10.2.7 Canonical Correlation, 269
10.2.8 Wilks’ Lambda, 270
10.3 Assumptions in Discriminant Analysis, 270
10.4 Why to Use Discriminant Analysis, 270
10.5 Steps in Discriminant Analysis, 271
10.6 Application of Discriminant Function Analysis, 272
10.7 Discriminant Analysis Using SPSS, 274
10.7.1 Computation in Discriminant Analysis, 274
10.7.2 Interpretation of Findings, 279
10.8 Summary of the SPSS Commands for Discriminant Analysis, 284
10.9 Exercise, 284
10.9.1 Short Answer Questions, 284
10.9.2 Multiple Choice Questions, 285
10.9.3 Assignment, 286
10.10 Case Study on Discriminant Analysis, 288

11 Logistic Regression for Developing Logit Model in Sport

11.1 Introduction, 293
11.2 Understanding Logistic Regression, 294
11.3 Application of Logistic Regression in Sports Research, 295
11.4 Assumptions in Logistic Regression, 297
11.5 Steps in Developing Logistic Model, 297
11.6 Logistic Analysis Using SPSS, 297
11.6.1 Block 0, 299
11.6.2 Block 1, 299
11.6.3 Computation in Logistic Regression with SPSS, 299
11.7 Interpretation of Findings, 304
11.7.1 Case Processing and Coding Summary, 304
11.7.2 Analyzing Logistic Models, 305
11.8 Summary of the SPSS Commands for Logistic Regression, 310
11.9 Exercise, 310
11.9.1 Short Answer Questions, 310
11.9.2 Multiple Choice Questions, 311
11.9.3 Assignment, 312
11.10 Case Study on Logistic Regression, 313

12 Application of Factor Analysis

12.1 Introduction, 319
12.2 Terminologies Used in Factor Analysis, 320
12.2.1 Principal Component Analysis, 320
12.2.2 Eigenvalue, 320
12.2.3 Kaiser Criterion, 321
12.2.4 The Scree Test, 321
12.2.5 Communality, 321
12.2.6 Factor Loading, 322
12.2.7 Varimax Rotation, 322
12.3 Assumptions in Factor Analysis, 322
12.4 Steps in Factor Analysis, 323
12.5 Application of Factor Analysis, 323
12.6 Factor Analysis with SPSS, 324
12.6.1 Computation in Factor Analysis Using SPSS, 326
12.7 Summary of the SPSS Commands for Factor Analysis, 336
12.8 Exercise, 336
12.8.1 Short Answer Questions, 336
12.8.2 Multiple Choice Questions, 337
12.8.3 Assignment, 338
12.9 Case Study on Factor Analysis, 339

Appendix 346
Bibliography 360
Index 368