

# CONTENTS

**PREFACE**            **v**

**PART ONE**  
**DESCRIPTIVE STATISTICS**            **1**

|                        |          |
|------------------------|----------|
| <b>CHAPTER ONE</b>     |          |
| <b>BASIC CONCEPTS</b>  | <b>3</b> |
| Objectives             | 3        |
| Purpose of Statistics  | 3        |
| Descriptive Statistics | 4        |
| Inferential Statistics | 5        |
| Variables              | 9        |
| Scales of Measurement  | 12       |
| Summary                | 18       |

|   |           |
|---|-----------|
| <b>CHAPTER TWO</b>                            |           |
| <b>FREQUENCY DISTRIBUTIONS AND GRAPHS</b>     | <b>23</b> |
| Objectives                                    | 23        |
| Purpose of Frequency Distributions and Graphs | 24        |
| Frequency Distributions                       | 24        |
| Graphing Frequency Distributions              | 34        |
| Forms of a Frequency Polygon                  | 42        |
| Summary                                       | 45        |

|  |     |            |
|--|-----|------------|
| <b>CHAPTER THREE</b>                             |     |            |
| <b>MEASURES OF CENTRAL TENDENCY</b>              |     | <b>51</b>  |
| Objectives                                       | 51  |            |
| Averages   | 52  |            |
| Mode   | 52  |            |
| Median   | 54  |            |
| Mean   | 63  |            |
| How To Mislead with Measures of Central Tendency |     | 70         |
| Comparison of the Mean, Median, and Mode         |     | 70         |
| Selecting a Measure of Central Tendency          | 74  |            |
| Summary  | 79  |            |
| <b>CHAPTER FOUR</b>                              |     |            |
| <b>MEASURES OF VARIABILITY</b>                   |     | <b>82</b>  |
| Objectives                                       | 82  |            |
| Introduction                                     | 83  |            |
| The Range  | 84  |            |
| Quartile Deviation                               | 86  |            |
| Variance   | 90  |            |
| Standard Deviation                               | 94  |            |
| A Comparison of the Measures of Variability      |     | 105        |
| Summary  | 107 |            |
| <b>CHAPTER FIVE</b>                              |     |            |
| <b>INTERPRETATION OF INDIVIDUAL SCORES</b>       |     | <b>112</b> |
| Objectives                                       | 112 |            |
| Percentile Rank                                  | 113 |            |
| Percentiles                                      | 118 |            |
| Quartiles and Deciles                            | 123 |            |
| Standard Scores                                  | 125 |            |
| Summary  | 134 |            |
| <b>CHAPTER SIX</b>                               |     |            |
| <b>THE NORMAL CURVE</b>                          |     | <b>138</b> |
| Objectives                                       | 138 |            |
| The Concept of the Normal Curve                  | 138 |            |
| The Standard Normal Curve Table                  | 146 |            |
| Using the Normal Curve Table                     | 148 |            |
| Summary  | 157 |            |
| <b>CHAPTER SEVEN</b>                             |     |            |
| <b>CORRELATION</b>                               |     | <b>162</b> |
| Objectives                                       | 162 |            |

|  |     |
|--|-----|
| Scattergrams                                       | 164 |
| Bivariate Frequency Distribution                   | 170 |
| Calculation of the Pearson Correlation Coefficient | 172 |
| Factors Influencing the Correlation Coefficient    | 184 |
| Interpreting a Correlation Coefficient             | 186 |
| Summary  | 187 |

## CHAPTER EIGHT

### PREDICTION 195

|                            |     |
|----------------------------|-----|
| Objectives                 | 195 |
| Prediction                 | 196 |
| Predicting z-Scores        | 198 |
| Regression toward the Mean | 199 |
| Least Squares Criterion    | 203 |
| Standard Error of Estimate | 214 |
| Summary                    | 220 |

## CHAPTER NINE

### OTHER MEASURES OF RELATIONSHIP 226

|  |     |
|--|-----|
| Objectives   | 226 |
| Spearman Rank Correlation Coefficient: $\rho_s$      | 227 |
| Point-Biserial Correlation Coefficient: $\rho_{pbi}$ | 232 |
| Biserial Correlation Coefficient: $\rho_{bi}$        | 236 |
| Tetrachoric Correlation: $r_t$                       | 241 |
| The Phi Coefficient: $r_\phi$ or Simply $\phi$       | 244 |
| Coefficient of Contingency                           | 248 |
| Summary  | 249 |

## PART TWO

### INFERENCEAL STATISTICS 257

#### CHAPTER TEN

#### THE LOGIC OF INFERENCEAL STATISTICS 259

|   |     |
|---|-----|
| Objectives  | 259 |
| Introduction  | 259 |
| Binomial Probability                                  | 269 |
| Aids Available for Determining Binomial Probabilities | 277 |
| Normal Curve Approximation of the Binomial            | 278 |
| Summary   | 281 |

#### CHAPTER ELEVEN

#### RANDOMNESS AND SAMPLING ERROR IN HYPOTHESIS TESTING 287

|            |     |
|------------|-----|
| Objectives | 287 |
|------------|-----|

|  |     |     |
|--|-----|-----|
| Introduction   | 287 |     |
| Random Sampling  | 288 |     |
| Random Assignment  | 290 |     |
| Concept of Sampling Error  | 291 |     |
| The Lawful Nature of Sampling Errors                                 | 292 |     |
| Using the Normal Curve To Test Hypotheses about a<br>Population Mean | 295 |     |
| The Principal and the Superintendent                                 | 299 |     |
| One-tailed and Two-tailed Tests                                      | 303 |     |
| Areas of Rejection and Retention for Raw Score Means                 |     | 306 |
| The Effect of Numbers on the Likelihood of Type II Errors            |     | 307 |
| Steps in Testing a Hypothesis about a Population Mean                |     | 308 |
| Summary  | 308 |     |

## CHAPTER TWELVE

### THE *t*-TESTS 313

|   |     |     |
|---|-----|-----|
| Objectives  | 313 |     |
| Degrees of Freedom  | 315 |     |
| Using the <i>t</i> -Distribution for Hypothesis Testing                                   | 317 |     |
| The <i>t</i> -Test for Significance of the Difference between Means                       |     | 322 |
| The Null Hypothesis   | 326 |     |
| The Logic of the <i>t</i> -Test   | 327 |     |
| Assumptions Necessary for a <i>t</i> -Test  | 329 |     |
| Significance of the Difference between Two Means:   |     |     |
| Independent Samples   | 330 |     |
| Significance of the Difference between Two Means: Correlated or<br>Nonindependent Samples | 334 |     |
| The <i>t</i> -Test for Two Correlated Samples   | 336 |     |
| Comparison of the Power of Tests Based on Independent and<br>Correlated Samples           | 340 |     |
| The <i>t</i> -Tests for Pearson <i>r</i> Correlation Coefficients                         |     | 342 |
| Summary   | 344 |     |

## CHAPTER THIRTEEN

### ONE-WAY ANALYSIS OF VARIANCE 349

|  |     |     |
|--|-----|-----|
| Objectives   | 349 |     |
| Introduction   | 349 |     |
| Partitioning the Sum of Squares                        | 354 |     |
| The <i>F</i> -Ratio                                    | 356 |     |
| Using the <i>F</i> -Table                              | 357 |     |
| Computational Formulas for Sums of Squares             |     | 359 |
| Comparison of Group Means Following the <i>F</i> -Test |     | 364 |

|   |     |
|---|-----|
| Assumptions Underlying Analysis of Variance | 365 |
| Summary                                     | 365 |

## **CHAPTER FOURTEEN**

### **TWO-WAY ANALYSIS OF VARIANCE 371**

|  |     |
|--|-----|
| Objectives                                   | 371 |
| Factorial ANOVA                              | 371 |
| Computation for Two-Way Analysis of Variance | 374 |
| K-Factor Analysis of Variance                | 386 |
| Summary                                      | 388 |

## **CHAPTER FIFTEEN**

### **NONPARAMETRIC STATISTICS 394**

|  |     |
|--|-----|
| Objectives   | 394 |
| Introduction   | 394 |
| Chi Square   | 395 |
| Summary, Goodness-of-Fit Chi Square                          | 400 |
| Chi Square Test of the Independence of Categorical Variables | 402 |
| Restrictions in the Use of the Chi Square                    | 409 |
| Correlation Coefficients Derived from Chi Square             | 411 |
| Sign Test  | 413 |
| Median Test  | 416 |
| Comparison of Parametric and Nonparametric Statistics        | 419 |
| Summary  | 420 |

## **APPENDIX 427**

## **INDEX 455**