# Contents

## CHAPTER 1 Introduction to Biostatistics

1.1 Introduction 1  
1.2 Some Basic Concepts 2  
1.3 Measurement and Measurement Scales 5  
1.4 The Simple Random Sample 7  
1.5 Computers and Biostatistical Analysis 10  
1.6 Summary 12  
    Review Questions and Exercises 12  
    References 13

## CHAPTER 2 Descriptive Statistics

2.1 Introduction 15  
2.2 The Ordered Array 16  
2.3 Grouped Data—The Frequency Distribution 17  
2.4 Descriptive Statistics—Measures of Central Tendency 32  
2.5 Descriptive Statistics—Measures of Dispersion 36  
2.6 Measures of Central Tendency Computed from Grouped Data 42  
2.7 The Variance and Standard Deviation—Grouped Data 48  
2.8 Summary 51  
    Review Questions and Exercises 52  
    References 56

## CHAPTER 3 Some Basic Probability Concepts

3.1 Introduction 59  
3.2 Two Views of Probability—Objective and Subjective 60  
3.3 Elementary Properties of Probability 62  
3.4 Calculating the Probability of an Event 63  
3.5 Summary 72  
    Review Questions and Exercises 73  
    References 77
## CHAPTER 4 Probability Distributions

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Introduction</td>
<td>79</td>
</tr>
<tr>
<td>4.2</td>
<td>Probability Distributions of Discrete Variables</td>
<td>79</td>
</tr>
<tr>
<td>4.3</td>
<td>The Binomial Distribution</td>
<td>85</td>
</tr>
<tr>
<td>4.4</td>
<td>The Poisson Distribution</td>
<td>94</td>
</tr>
<tr>
<td>4.5</td>
<td>Continuous Probability Distributions</td>
<td>97</td>
</tr>
<tr>
<td>4.6</td>
<td>The Normal Distribution</td>
<td>100</td>
</tr>
<tr>
<td>4.7</td>
<td>Normal Distribution Applications</td>
<td>107</td>
</tr>
<tr>
<td>4.8</td>
<td>Summary</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Review Questions and Exercises</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>116</td>
</tr>
</tbody>
</table>

## CHAPTER 5 Some Important Sampling Distributions

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Introduction</td>
<td>119</td>
</tr>
<tr>
<td>5.2</td>
<td>Sampling Distributions</td>
<td>120</td>
</tr>
<tr>
<td>5.3</td>
<td>Distribution of the Sample Mean</td>
<td>121</td>
</tr>
<tr>
<td>5.4</td>
<td>Distribution of the Difference Between Two Sample Means</td>
<td>130</td>
</tr>
<tr>
<td>5.5</td>
<td>Distribution of the Sample Proportion</td>
<td>135</td>
</tr>
<tr>
<td>5.6</td>
<td>Distribution of the Difference Between Two Sample Proportions</td>
<td>139</td>
</tr>
<tr>
<td>5.7</td>
<td>Summary</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>Review Questions and Exercises</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>References</td>
<td>144</td>
</tr>
</tbody>
</table>

## CHAPTER 6 Estimation

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Introduction</td>
<td>147</td>
</tr>
<tr>
<td>6.2</td>
<td>Confidence Interval for a Population Mean</td>
<td>151</td>
</tr>
<tr>
<td>6.3</td>
<td>The t Distribution</td>
<td>158</td>
</tr>
<tr>
<td>6.4</td>
<td>Confidence Interval for the Difference Between Two Population Means</td>
<td>164</td>
</tr>
<tr>
<td>6.5</td>
<td>Confidence Interval for a Population Proportion</td>
<td>173</td>
</tr>
<tr>
<td>6.6</td>
<td>Confidence Interval for the Difference Between Two Population Proportions</td>
<td>175</td>
</tr>
<tr>
<td>6.7</td>
<td>Determination of Sample Size for Estimating Means</td>
<td>177</td>
</tr>
<tr>
<td>6.8</td>
<td>Determination of Sample Size for Estimating Proportions</td>
<td>180</td>
</tr>
<tr>
<td>6.9</td>
<td>Confidence Interval for the Variance of a Normally Distributed Population</td>
<td>182</td>
</tr>
<tr>
<td>6.10</td>
<td>Confidence Interval for the Ratio of the Variances of Two Normally Distributed Populations</td>
<td>187</td>
</tr>
</tbody>
</table>
## CONTENTS

9.7 The Correlation Coefficient 389
9.8 Some Precautions 401
9.9 Summary 402
   Review Questions and Exercises 403
   References 410

**CHAPTER 10 Multiple Regression and Correlation** 415

10.1 Introduction 415
10.2 The Multiple Linear Regression Model 416
10.3 Obtaining the Multiple Regression Equation 418
10.4 Evaluating the Multiple Regression Equation 428
10.5 Using the Multiple Regression Equation 436
10.6 The Multiple Correlation Model 441
10.7 Summary 450
   Review Questions and Exercises 451
   References 456

**CHAPTER 11 Regression Analysis—Some Additional Techniques** 459

11.1 Introduction 459
11.2 Qualitative Independent Variables 460
11.3 Variable Selection Procedures 476
11.4 Logistic Regression 483
11.5 Summary 491
   Review Questions and Exercises 492
   References 500

**CHAPTER 12 The Chi-Square Distribution and the Analysis of Frequencies** 503

12.1 Introduction 503
12.2 The Mathematical Properties of the Chi-Square Distribution 504
12.3 Tests of Goodness-of-Fit 507
12.4 Tests of Independence 520
12.5 Tests of Homogeneity 529
12.6 The Fisher Exact Test 537
12.7 Relative Risk, Odds Ratio, and the Mantel–Haenszel Statistic 542
12.8 Summary 555
   Review Questions and Exercises 556
   References 562
CHAPTER 13 Nonparametric and Distribution-Free Statistics

13.1 Introduction 567
13.2 Measurement Scales 569
13.3 The Sign Test 569
13.4 The Wilcoxon Signed-Rank Test for Location 578
13.5 The Median Test 583
13.6 The Mann–Whitney Test 586
13.7 The Kolmogorov–Smirnov Goodness-of-Fit Test 591
13.8 The Kruskal–Wallis One-Way Analysis of Variance by Ranks 598
13.9 The Friedman Two-Way Analysis of Variance by Ranks 608
13.10 The Spearman Rank Correlation Coefficient 613
13.11 Nonparametric Regression Analysis 622
13.12 Summary 625
Review Questions and Exercises 625
References 629

CHAPTER 14 Vital Statistics

14.1 Introduction 633
14.2 Death Rates and Ratios 634
14.3 Measures of Fertility 641
14.4 Measures of Morbidity 643
14.5 Summary 645
References 645

APPENDIX I Some Basic MINITAB Data Handling Commands 647

APPENDIX II Statistical Tables 651

Answers to Odd-Numbered Exercises 759

Index 777