

Contents

Preface xi

Introduction xiii

1 Proportions, Rates, and Ratios 1

1.1 Proportions 1

1.1.1 Comparative studies 2

1.1.2 Screening tests 5

1.1.3 Displaying proportions 7

1.2 Rates 12

1.2.1 Changes 12

1.2.2 Measures of morbidity and mortality 13

1.2.3 Standardization of rates 15

1.3 Ratios 18

1.3.1 Relative risk 18

1.3.2 Odds and odds ratio 19

1.3.3 Standardized mortality ratio 22

Exercises 24

2 Summarization of Continuous Measurements 36

2.1 Tabular and Graphical Methods 36

- 2.1.1 Frequency distribution 36
- 2.1.2 Histogram and the frequency polygon 36
- 2.1.3 Cumulative frequency graph and percentiles 45

2.2 Numerical Methods 50

- 2.2.1 Mean 51
- 2.2.2 Other measures of location 54
- 2.2.3 Measures of dispersion 54

2.3 Life-Table Methods 58

- 2.3.1 Survival data 58
- 2.3.2 Kaplan-Meier curve 58
- 2.3.3 Actuarial method 60

Exercises 63

3 Probability and Probability Models 72

3.1 Probability 72

- 3.1.1 The certainty of uncertainty 72
- 3.1.2 Probability 73
- 3.1.3 Statistical relationship 74

3.2 The Normal Distribution 80

- 3.2.1 Shape of the normal curve 80
- 3.2.2 Areas under the standard normal curve 83
- 3.2.3 The normal as a probability model 89

3.3 Some Other Distributions 92

- 3.3.1 The binomial distribution 92
- 3.3.2 The Poisson distribution 94
- 3.3.3 Other statistical tables 96

Exercises 96

4 Confidence Estimation 100

4.1 Basic Concepts 101

- 4.1.1 Statistics as variables 101
- 4.1.2 Sampling distributions 102
- 4.1.3 Introduction to confidence estimation 104

4.2 Estimation of Means 105

- 4.2.1 Confidence intervals for a mean 106
- 4.2.2 Uses of small samples 109
- 4.2.3 Difference of means 110

4.3 Estimation of Proportions and Odds Ratios 114

4.3.1 Confidence interval for a proportion 115

4.3.2 Difference of proportions 116

4.3.3 Methods for odds ratios 118

Exercises 120**5 Introduction to Hypothesis Testing 125****5.1 Basic Concepts 127**

5.1.1 Hypothesis tests 127

5.1.2 Statistical evidence 128

5.1.3 Errors 129

5.2 Analogies 131

5.2.1 Trials by jury 132

5.2.2 Medical screening tests 132

5.2.3 Common expectations 133

5.3 Summaries and Conclusions 134

5.3.1 Rejection region 134

5.3.2 p -Values 136

5.3.3 Relationship to confidence intervals 138

Exercises 140**6 Some Simple Statistical Tests 144****6.1 Comparisons of Proportions 144**

6.1.1 One-sample problem 144

6.1.2 Matched data 146

6.1.3 Comparison of two or several independent samples 148

6.2 Comparisons of Means 160

6.2.1 One-sample problem 160

6.2.2 Matched data 162

6.2.3 Comparison of two independent samples 163

6.3 Regression and Correlation 166

6.3.1 Basic concepts 167

6.3.2 Coefficient of correlation 169

6.3.3 Testing for independence 173

Exercises 176**7 Introduction to Other Selected Topics 189****7.1 More on Explanatory Data Analysis 189**

7.1.1 One-way scatter plots 189

7.1.2 Box plots 190

7.1.3 Stem-and-leaf diagrams 191

7.2 Sample Size Determination	192
7.2.1 Estimation of means and proportions	192
7.2.2 Comparison of two means	195
7.2.3 Comparison of two proportions	197
7.3 Nonparametric Methods	199
7.3.1 The Wilcoxon rank-sum test	200
7.3.2 Ordered $2 \times k$ contingency tables	202
7.3.3 Rank correlations	205
Exercises	207

Concluding Remarks 213

Bibliography: Index of Data Sets 217

Appendices

A Table of Random Numbers	225
B Areas Under the Standard Normal Curve	227
C Percentiles of the t-Distribution	228
D Percentiles of Chi-Square Distribution	229

Answers to Selected Exercises 231

Index 245