
Contents

Preface	ix
What This Book Is About	ix
Comments for Students and Instructors	xii
Comments for Instructors	xiii
Comments and Corrections	xiv
Acknowledgments	xv
I. Basic Quantitative Concepts	
Chapter 1. Scales of Measurement	3
1.1. Introduction	3
1.2. Metric Units	3
1.3. Conversions	5
1.4. Estimation	8
1.5. A Feature of Human Perception	9
1.6. Logarithms	10
1.7. Logarithmic Scales	13
1.8. Project	14
Exercises	19
References for Chapter 1	23
Chapter 2. Ratios, Percents, Proportions	25
2.1. Introduction	25
2.2. Ratios and Percentages	27
2.3. Concentrations	31
2.4. Probabilities	32

2.5. Proportions	35
2.6. Project	36
Exercises	41
References for Chapter 2	46
Chapter 3. Part I Summary Project	47
3.1. Background	47
3.2. Questions	49
Reference for Chapter 3	54
II. Elementary Modeling	
Chapter 4. Linear Functions as Models	57
4.1. Introduction	57
4.2. Functions	58
4.3. Linear Functions	60
4.4. Mathematical Models	65
4.5. Linear Regression	67
4.6. Project	72
Exercises	75
References for Chapter 4	78
Chapter 5. Exponential Functions as Models	79
5.1. Introduction	79
5.2. Exponential Functions	82
5.3. Exponential Models	86
5.4. Semi-Log Plots and Fitting Exponential Models	90
5.5. Project	94
Exercises	96
References for Chapter 5	101
Chapter 6. Power Functions as Models	103
6.1. Introduction	103
6.2. Power Functions	104
6.3. Log-Log Plots and Fitting Power Law Models	109
6.4. Power Law Distributions	113
6.5. Project	120
Exercises	122
References for Chapter 6	125

Chapter 7. Discrete Time Dynamic Modeling and Difference Equations	127
7.1. Introduction	127
7.2. Difference Equations	129
7.3. Modeling with Difference Equations	131
7.4. Equilibria and Stability of Solutions	134
7.5. Logistic Growth Models	138
7.6. Some Higher Order Difference Equations (Optional)	145
7.7. Some Technical Notes (Optional)	149
7.8. Project	151
Exercises	153
References for Chapter 7	159
Chapter 8. Modeling with Systems of Difference Equations	161
8.1. Introduction	161
8.2. Age-Structured Population Models	162
8.3. Epidemiological Models	168
8.4. Predator-Prey Models	172
8.5. Some Technical Notes (Optional)	178
8.6. Project	179
Exercises	184
References for Chapter 8	189
III. Data Analysis and Statistics	
Chapter 9. Descriptive Statistics	193
9.1. Introduction	193
9.2. Measures of the Center of a Data Set	195
9.3. Measures of Spread and Distribution	197
9.4. Exploratory Data Analysis	207
9.5. The R^2 Statistic and the Correlation Coefficient (Optional)	211
9.6. Project	214
Exercises	217
References for Chapter 9	220
Chapter 10. Probability Distributions and Random Variables	221
10.1. Introduction	221
10.2. Conditional Probabilities and Independence	222
10.3. Probability Mass Functions and Discrete Distributions	227
10.4. Expected Value and Variance	236
10.5. Probability Density Functions and Continuous Distributions	241

10.6. Normal Distributions	246
10.7. Z -Scores and Computing Normal Probabilities	247
10.8. Some Technical Notes (Optional)	251
10.9. Project	254
Exercises	259
Chapter 11. Statistics of Sampling	263
11.1. Introduction	263
11.2. Models of Sampling	263
11.3. Sample Means from Normal Populations and t -Distributions	267
11.4. The Central Limit Theorem and an Application	273
11.5. χ^2 and F -distributions	276
11.6. Project	278
Exercises	281
Reference for Chapter 11	284
Chapter 12. Hypothesis Testing and Statistical Inference	285
12.1. Introduction	285
12.2. The Logic of Hypothesis Tests	286
12.3. Tests for Means and Proportions	290
12.4. p -Values and Hypothesis Tests	296
12.5. Small-Sample Test for Differences of Means	297
12.6. χ^2 Tests for Model Fit and Independence	300
12.7. Hypothesis Tests on Regression Coefficients	305
12.8. Project	308
Exercises	311
References for Chapter 12	317
Index	319