# Table of Contents

# Preface iii

# Introduction 1

- I.1 The Value and Uses of Logic 2 Exercises 5
- I.2 What Can Be Learned about Logic and How Can It Be Learned? 9 Exercises 11
- I.3 Logic versus Psychology 16
- I.4 The Organization of This Book 19 Exercises 20

# **CHAPTER 1**

#### Informal Analysis of Statements 30

- 1.1 Sentences 31 Exercises 31
- 1.2 Cognitive and Noncognitive Uses of Sentences 32 Exercises 33
- 1.3 Statements 34
- 1.4 Recognizing Sentences Used to Express Statements 35 Exercises 37
- 1.5 Self-Evident and Supported Statements 38 Exercises 40
- 1.6 Logical Relationships between Two (or More) Propositions 44
- 1.7 Consistency 45 Exercises 48
- 1.8 Real versus Apparent Disagreements 49 Exercises 52

- 1.9 Verbal Disagreements 52 Exercises 53
- 1.10 Implication 54
- 1.11 Logical Equivalence 55
- 1.12 Independence 56 Exercises 57
- Summary 60

## **CHAPTER 2**

#### Informal Analysis of Arguments 62

- 2.1 Inferences and Arguments 65 Exercises 67
- 2.2 The Logical Sense of 'Argument' 70 Exercises 71
- 2.3 Premises and Conclusions 72 Exercises 74
- 2.4 Problems in Recognizing Intended Arguments 75 Exercises 77
- 2.5 Supplying Missing Statements 78
- 2.6 Deductive and Inductive Arguments 80 Exercises 83
- 2.7 Criteria for Good Arguments 92 Exercises 93
- 2.8 Dealing with Enthymemes 94 Exercises 96
- 2.9 Complex Argument Structures 96
- 2.10 Analyzing Sample Arguments 100
- 2.11 Some Basic Elements of Argument Analysis 107 Exercises 108
- Summary 110

## **CHAPTER 3**

#### Aristotelian Logic: Statements 113

- 3.1 Categorical Statements 113 Exercises 118
- 3.2 Abbreviations 120
- 3.3 Schemas 121 Exercises 128
- 3.4 Venn Diagrams and Categorical Statements 129 Exercises 132
- 3.5 Logical Relations between Categorical Propositions 133 Exercises 136
- 3.6 Immediate Inferences 136 Exercises 140
- 3.7 The Traditional Square of Opposition 140 Exercises 141
- 3.8 The Boolean Interpretation 142 Exercises 144

Summary 152

#### **CHAPTER 4**

#### Aristotelian Logic: Arguments 155

- 4.1 The Categorical Syllogism 156 Exercises 157
- 4.2 Standard-Form Syllogisms 158 Exercises 161
- 4.3 Mood and Figure 164 Exercises 166
- 4.4 Testing the Validity of Syllogisms 166
- 4.5 Testing by Counterexamples 167 Exercises 169
- 4.6 Testing with Venn Diagrams 170 Exercises 171
- 4.7 Testing by Rules 182 Exercises 190
- 4.8 The Boolean Interpretation 191

- 4.9 Syllogistic Arguments in Ordinary Language 192 Exercises 192
- Summary 199

#### CHAPTER 5

#### Propositional Logic: Statements 202

- 5.1 Compound Propositions and Logical Operators 202
- 5.2 Truth-Functional Operators 203 Exercises 205
- 5.3 Propositional Abbreviations and Schemas 205 Exercises 208
- 5.4 Conjunction 209 Exercises 213
- 5.5 Truth Tables 214
- 5.6 Negation 215 Exercises 216
- 5.7 Disjunction 217 Exercises 219
- 5.8 Material Implication 219 Exercises 225
- 5.9 Material Equivalence 225 Exercises 226
- 5.10 Propositions with More Than One Logical Operator 228 Exercises 231
- 5.11 Truth Table Construction 233 Exercises 237
- 5.12 Logically Equivalent Statements 238
- 5.13 Logical Equivalence and Material Equivalence 239 Exercises 242
- 5.14 Tautologies 242
- 5.15 Contradictions 244
- 5.16 Contingent Statements 245 Exercises 246
- Summary 247

# **CHAPTER 6**

## Propositional Logic: Arguments 251

- 6.1 Truth-Functional Validity 252
- 6.2 Contradictory Premises and Tautological Conclusions 253
- 6.3 Abbreviating Truth-Functional Arguments 254
- 6.4 Schematizing Truth-Functional Arguments 255 Exercises 257
- 6.5 Testing Validity by Truth Tables 260 Exercises 269
- 6.6 The Short Truth Table Method 270 Exercises 272
- 6.7 Truth-Functional Arguments and Corresponding Conditionals 273 Exercises 276
- 6.8 The Propositional Calculus 276
- 6.9 Constructing a Formal Proof 277
- 6.10 Inference Rules 281 Exercises 284
- 6.11 Rules of Thumb for Proof Construction 294
- 6.12 The Rule of Rigor 296 Exercises 297
- 6.13 The Replacement Rule 300 Exercises 304
- 6.14 Conditional Proof 321 Exercises 325
- 6.15 Indirect Proof 325
- 6.16 Deductive Completeness 327 Exercises 328
- Summary 329

## **CHAPTER 7**

#### Quantificational Logic: Statements 333

- 7.1 Predicates and Individuals 333
- 7.2 Variables and Constants 335 Exercises 337

- 7.3 Compound Propositions 337 Exercises 339
- 7.4 Existential Quantifiers 339 Exercises 342
- 7.5 Universal Quantifiers 346 Exercises 347
- 7.6 Negation and Quantifier Exchange 352 Exercises 354
- 7.7 Multiple Quantifiers 357 Exercises 361
- Summary 366

## **CHAPTER 8**

#### Quantificational Logic: Arguments 368

- 8.1 Universal Instantiation 369 Exercises 371
- 8.2 Existential Generalization 372 Exercises 374
- 8.3 Existential Instantiation 375 Exercises 378
- 8.4 Universal Generalization 378 Exercises 381
- Summary 387

#### **CHAPTER 9**

#### Inductive Arguments 389

- 9.1 Enumerative Inductions 391 Exercises 397
- 9.2 Relative Strength of Enumerative Inductions 402 Exercises 405
- 9.3 The Possible Elimination of Inductions by Analogy 425 Exercises 427
- 9.4 Statistical Inductions 428 Exercises 434
- Summary 438

## **CHAPTER 10**

#### Scientific Method 441

- 10.1 The Hypothetico-Deductive Method 441 Exercises 443
- 10.2 Hypothetico-Deductive Method and Inductive Generalization 447 Exercises 449
- 10.3 Crucial Experiments 452
- 10.4 Scientific Method 459 Exercises 460
- 10.5 Causal Explanations 462
- 10.6 Kinds of Cause 463 Exercises 467
- 10.7 Mill's Method 474 Exercises 482
- 10.8 Replicability and Controls 489 Exercises 491
- 10.9 The Role of Logic in Science 501 Exercises 503
- Summary 505

# **CHAPTER 11**

# **Probability 509**

- 11.1 Some Basic Terminology 510 Exercises 512
- 11.2 Two General Principles of Probability 513 Exercises 513
- 11.3 Three Theories of Probability 514 Exercises 516
- 11.4 Independent and Mutually Exclusive Outcomes 522
- 11.5 The Probability Calculus 524 Exercises 526

Summary 534

## **CHAPTER 12**

#### Informal Fallacies 537

- 12.1 Disguised Nonarguments 538 Exercises 545
- 12.2 Valid but Fallacious Arguments 546 Exercises 553
- 12.3 Other Informal Fallacies 564 Exercises 564

Summary 568

# **CHAPTER 13**

#### Definitions 571

- 13.1 Kinds of Definitions 572 Exercises 573
- 13.2 Uses of Definitions 581 Exercises 584
- 13.3 Criteria for Good Definitions 594 Exercises 597
- Summary 598

# **CHAPTER 14**

#### Applied Logic 601

- 14.1 Burden of Proof 602
- 14.2 The Principle of Induction 604 Exercises 606
- 14.3 Choosing the Appropriate System 607 Exercises 623

Summary 623

# Answers to Odd-Numbered Exercises 625

#### Index 687