Contents

CHAPTER

1	Logic: The Subject Matter 1	
	GENERAL CONSIDERATIONS 2 The Subject Matter 2 Deductive and Inductive Correctness of Arguments Statements/Propositions 11	5
	ARGUMENTS IN ORDINARY LANGUAGE14Identifying Premisses and Conclusions14Incompletely Stated Arguments18	

CHAPTER

2 Introduction to the Artificial Language 27

BACKGROUND 28

THE SYMBOLS32The Conditional32Conjunctions37Disjunctions42Negation44

MORE COMPLEX SYMBOLIZATIONS 48 Punctuation in the Artificial Language Structure 48 Disjunctions Revisited 53 Additional Translation Patterns 56

CHAPTER

3 Truth-Values and Validity 63

DETERMINING THE TRUTH AND FALSITY OF STATEMENTS EXPRESSED WITH ARTIFICIAL LANGUAGE SYMBOLS 64

xi

Conjunction64Disjunction68Negation68Conditionals69

TRUTH-VALUES COMBINED WITH PUNCTUATION 74

TRUTH-TABLE CONSTRUCTION76Exclusive 'or' Statements80

TAUTOLOGOUS, CONTRADICTORY, AND CONTINGENT STATEMENT FORMS AND STATEMENTS 81 Statement Forms 81 Statements 83

USING TRUTH TABLES TO DETERMINE WHETHER ARGUMENT FORMS ARE VALID 86 Truth-Table Recipe for Argument-Form Validity 89

DRAWBACKS 93

CHAPTER

4 Introduction to Formal Proofs 96

FORM-INSTANCE RELATIONSHIPS 96 Instances 97 Parallel-Instances 101

APPLYING INSTANCE AND PARALLEL-INSTANCE RELATIONSHIPS TO TAUTOLOGOUS, CONTRADICTORY, AND CONTINGENT STATEMENTS 106

APPLYING INSTANCE AND PARALLEL-INSTANCE RELATIONSHIPS TO VALID AND INVALID ARGUMENTS 108

SUMMARY 110

DEDUCTION: FORMAL PROOFS 111 Modus Ponens 111 Simplification, Conjunction, and Addition 117 Complex Formal Proofs 120 The Goals Approach to Formal Proofs 121 Summary of Valid Inferential Forms 123 CONDITIONAL-PROOF PROCEDURE 129 Intuitive Support 129Use in Formal Proofs 130 **Restrictions** 130 **Conditional-Proof Strategies** 131 **Justification of Conditional Proof** 137SUMMARY 137 Valid Inferential Forms 137**Conditional-Proof Procedure** 138 The Goals Approach to Formal Proofs 138

CHAPTER

5 Formal Proofs: Equivalence Inferential Forms 142

THE BICONDITIONAL142Symbolization142Truth-Values145

LOGICAL EQUIVALENCE 146 Summary: Material and Logical Equivalence 147

EQUIVALENCE INFERENTIAL FORMS 149 Initial Survey 149 Specific Descriptions 153

FORMAL-PROOF STRATEGIES AND SUGGESTIONS 160The Goals Approach 160**Recapitulation of Valid Inferential Forms** 163**Recapitulation of the Conditional-Proof** Procedure 164Summary of Equivalence Inferential Forms 164INDIRECT-PROOF PROCEDURE 169A Practical Example 168Using Indirect Proof in Formal Proofs 169Indirect-Proof Strategies 172**Justification of Indirect Proof** 177 **OPTIONAL VALID INFERENTIAL FORMS** 179 179Rationale

Modus Tollens, Disjunctive Syllogism, Hypothetical Syllogism, and Constructive Dilemma 180 Justification of Our Optional Inferential Forms as Derived Rules 185

CHAPTER

6	Partial Truth Tables and Truth Trees 188
	PARTIAL TRUTH TABLES 188 Guidelines for Partial Truth Tables 192 Additional Suggestions 195
	TRUTH TREES 200 Consistent and Inconsistent Sets of Statement Forms 200 Constructing Truth Trees 203 Determining Whether Argument Forms Are
	Determining Whether a Statement Form Is Tautologous, Self-contradictory, or Contingent 221 Similarities between Truth Tables and Truth Trees 223

CHAPTER

7 Monadic Predication 225

SYMBOLIZATION 228 Singular Statements 228 Types of Predication Statements 232 Universal Statements 234 Existential Statements 244 Requirements for Well-Formed Formulas (WFFs) 259

FORMAL PROOFS260Universal Instantiation (U.I.)261Quantifier Negation (Q.N.)263Existential Instantiation (E.I.)267Negation of a Conditional (N.C.)270

MULTIPLE QUANTIFICATIONS 274 Symbolization 274 Formal Proofs 281

INVALIDITY 287 General Concepts 287 Partial Truth Tables 289 Truth Trees for Predicate Logic 296 Multiple Quantifications 305 CHAPTER

8 Polyadic Predication 308

SYMBOLIZATION 310
Individual Constants 310
Quantifiers 311
Steps for Symbolizing by Paraphrasing 314
Additional Individual Variables 318

FORMAL PROOFS 319 Application of Available Inference Rules 319 Revised Forms of U.I., E.I., and Q.N. 321 Dyadic Relations 323 Triadic Predicates 328

INVALIDITY 332 Partial Truth Tables 332 Truth Trees 336

CHAPTER

9 Theorems and Introductory Metalogic 341 CONSTRUCTING FORMAL PROOFS TO DERIVE THEOREMS 341 Relationships between Statements and Arguments 341 Tautologies 346 Self-Contradictions 349 INTRODUCTION TO METALOGIC 351

System Soundness and Consistency 351 System Completeness 353 ND's Failings 364

Appendixes

A. AN ALTERNATIVE ACCOUNT OF STATEMENTS AND PROPOSITIONS 367

B. JUSTIFICATION OF CONDITIONAL PROOF 369

C. GLOSSARY OF ALL DEFINED TERMS 372

D. ANSWERS FOR ALL CONCEPT REVIEW QUESTIONS 379

E. ANSWERS FOR SELECTED PROBLEMS 394

Index 443