

CONTENTS

<i>List of Boxes</i>	xiii
<i>Preface</i>	xv
<i>Introduction</i>	xvii

Part I SETS AND NUMBERS

1 Naive Sets and Russell's Paradox	3
1.1 Sets	3
1.2 Membership and the Axiom of Extensionality	4
1.3 Unions, Intersections, and the Empty Set	5
1.4 Subsets	6
1.5 Members versus Subsets	6
1.6 Power Sets	8
1.7 The Axiom of Comprehension	9
1.8 Russell's Set	10
1.9 Russell's Paradox	11
1.10 Barbers and Sets	12
1.11 Alternatives to Naive Set Theory	13
Further Reading	15
Exercises	15
2 Infinite Sets	17
2.1 Some Infinite Sets	17
2.2 Different Kinds of Numbers	18

2.3	Two Senses of 'More'	20
2.4	Denumerability	22
2.5	More Denumerable Sets	24
2.6	The Non-Denumerability of the Real Numbers	25
2.7	The Abundance of the Real Numbers	27
	Further Reading	28
	Exercises	28
3	Orders of Infinity	30
3.1	Some Harder Stuff	30
3.2	The Numerical Size of Sets	30
3.3	The Reals and the Power Set of the Natural Numbers	32
3.4	The Continuum Hypothesis	35
3.5	An Infinity of Infinities	36
3.6	The Generalized Continuum Hypothesis	38
	Further Reading	40
	Exercises	40

Part II

ANALYTICITY, A PRIORICITY, AND NECESSITY

4	Kinds of Truths	45
4.1	Three Distinctions among Truths	45
4.2	Analytic and Synthetic	45
4.3	A Priori and A Posteriori	46
4.4	Synthetic A Prioris	47
4.5	How is Synthetic A Priori Knowledge Possible?	49
4.6	Pure and Applied Geometry	50
	Further Reading	56
	Exercises	56
5	Possible Worlds	58
5.1	Necessity and Contingency	58
5.2	A Posteriori Necessities	59

5.3	A Priori Contingencies	60
5.4	Possibility and Necessity	61
5.5	Possible Worlds	62
5.6	Necessity and Possibility in terms of Worlds	63
5.7	Constraints on Possible Worlds	64
5.8	Essential Properties	66
5.9	The Nature of Necessity	67
5.10	Different Kinds of Possibility	68
	Further Reading	70
	Exercises	70
6	Naming and Necessity	72
6.1	Two Readings of Statements of Necessity	72
6.2	Scope Distinctions	73
6.3	Julius and the Inventor of the Zip	74
6.4	Rigid Designators	75
6.5	The Causal Theory of Reference	76
6.6	Rigidity and the Causal Theory	77
6.7	De Dicto and De Re	78
6.8	Necessary and A Priori Again	80
6.9	A Limit to Scepticism about A Posteriori Necessity	81
	Further Reading	85
	Exercises	85

Part III

THE NATURE AND USES OF PROBABILITY

7	Kinds of Probability	89
7.1	Probabilities of Propositions	89
7.2	Kolmogorov's Axioms	89
7.3	Some Consequences	90
7.4	Joint Probabilities	91
7.5	Subjective and Objective Probabilities	94

7.6	Subjective Probability	95
7.7	Action, Utility, and Subjective Probability	96
7.8	Dutch Books	98
7.9	Objective Probability	99
	Further Reading	102
	Exercises	102
8	Constraints on Credence	104
8.1	The Principal Principle	104
8.2	Conditional Probability	106
8.3	Updating Degrees of Belief—Conditionalization	107
8.4	Bayes' Theorem	109
8.5	Conditional Probabilities and Conditional Statements	110
8.6	Material Conditionals	111
8.7	Indicative and Subjunctive Conditionals	114
8.8	Rational and Metaphysical Changes	115
	Further Reading	117
	Exercises	117
9	Correlations and Causes	119
9.1	Probabilistic Independence	119
9.2	Probabilistic Dependence	120
9.3	Correlation	121
9.4	Causation and Correlation	122
9.5	Screening Off	123
9.6	Spurious Correlations	124
9.7	Randomized Experiments	125
9.8	Survey Research	127
9.9	Simpson's Paradox	129
	Further Reading	131
	Exercises	131

Part IV
LOGICS AND THEORIES

10	Syntax and Semantics	137
10.1	Validity	137
10.2	Logic and Metalogic	138
10.3	Different Kinds of Logic	139
10.4	Truth-Functional Connectives	139
10.5	Syntax and Semantics	142
10.6	Syntactic Consequence	143
10.7	Semantic Consequence	144
	Further Reading	148
	Exercises	148
11	Soundness and Completeness	149
11.1	Soundness and Completeness	149
11.2	Proving Soundness and Completeness	150
11.3	Reflections on Circularity	151
11.4	Predicate Logic	153
11.5	Predicate Syntax	154
11.6	Predicate Semantics	156
11.7	Predicate Logic—Soundness and Completeness	157
11.8	Predicate Logic—Undecidability	157
11.9	Second-Order Logic	159
11.10	The Incompleteness of Second-Order Logic	161
	Further Reading	163
12	Theories and Gödel's Theorem	164
12.1	Theories	164
12.2	Syntax and Semantics for Theories	165
12.3	Theoretical Completeness	166

12.4	Completeness for Theories versus Completeness for Logics	168
12.5	Gödel's Theorem Stated	169
12.6	A Sketch of Gödel's Proof	170
12.7	The Inescapability of Gödel's Theorem	173
12.8	Meta-Theorizing	174
	Further Reading	177
	Solutions to Exercises	179
	<i>Index</i>	189