

Contents

<i>Preface</i>	vii
<i>Preface to the First Edition</i>	ix
1. The Theory of Interest	1
1.1 Simple Interest	1
1.2 Compound Interest	3
1.3 Continuously Compounded Interest	4
1.4 Present Value	6
1.5 Rate of Return	12
1.6 Exercises	13
2. Discrete Probability	17
2.1 Events and Probabilities	18
2.2 Addition Rule	19
2.3 Conditional Probability and Multiplication Rule	20
2.4 Random Variables and Probability Distributions	23
2.5 Binomial Random Variables	25
2.6 Expected Value	26
2.7 Variance and Standard Deviation	32
2.8 Exercises	36
3. Normal Random Variables and Probability	39
3.1 Continuous Random Variables	39
3.2 Expected Value of Continuous Random Variables	42
3.3 Variance and Standard Deviation	45

3.4	Normal Random Variables	46
3.5	Central Limit Theorem	54
3.6	Lognormal Random Variables	57
3.7	Properties of Expected Value	61
3.8	Properties of Variance	64
3.9	Exercises	66
4.	The Arbitrage Theorem	71
4.1	The Concept of Arbitrage	71
4.2	Duality Theorem of Linear Programming	73
4.2.1	Dual Problems	78
4.3	The Fundamental Theorem of Finance	86
4.4	Exercises	88
5.	Random Walks and Brownian Motion	91
5.1	Intuitive Idea of a Random Walk	91
5.2	First Step Analysis	92
5.3	Intuitive Idea of a Stochastic Process	105
5.4	Itô Processes	115
5.5	Itô's Lemma	116
5.6	Stock Market Example	118
5.7	Exercises	121
6.	Forwards and Futures	123
6.1	Definition of a Forward Contract	123
6.2	Pricing a Forward Contract	125
6.3	Dividends and Pricing	130
6.4	Incorporating Transaction Costs	131
6.5	Futures	133
6.6	Exercises	136
7.	Options	139
7.1	Properties of Options	140
7.2	Pricing an Option Using a Binary Model	143
7.3	Black-Scholes Partial Differential Equation	146
7.4	Boundary and Initial Conditions	148
7.5	Exercises	150

8.	Solution of the Black-Scholes Equation	153
8.1	Fourier Transforms	153
8.2	Inverse Fourier Transforms	156
8.3	Changing Variables in the Black-Scholes PDE	158
8.4	Solving the Black-Scholes Equation	161
8.5	Binomial Model (Optional)	165
8.6	Exercises	177
9.	Derivatives of Black-Scholes Option Prices	181
9.1	Theta	181
9.2	Delta	183
9.3	Gamma	185
9.4	Vega	186
9.5	Rho	188
9.6	Relationships Between Δ , Θ , and Γ	189
9.7	Exercises	191
10.	Hedging	193
10.1	General Principles	193
10.2	Delta Hedging	196
10.3	Delta Neutral Portfolios	201
10.4	Gamma Neutral Portfolios	202
10.5	Exercises	204
11.	Optimizing Portfolios	207
11.1	Covariance and Correlation	207
11.2	Optimal Portfolios	215
11.3	Utility Functions	218
11.4	Expected Utility	224
11.5	Portfolio Selection	226
11.6	Minimum Variance Analysis	230
11.7	Mean-Variance Analysis	241
11.8	Exercises	246
12.	American Options	251
12.1	Parity and American Options	251
12.2	American Puts Valued by a Binomial Model	255
12.3	Properties of the Binomial Pricing Formula	261

12.4	Optimal Exercise Time	266
12.5	Exercises	269
Appendix A Sample Stock Market Data		273
Appendix B Solutions to Chapter Exercises		277
B.1	The Theory of Interest	277
B.2	Discrete Probability	280
B.3	Normal Random Variables and Probability	286
B.4	The Arbitrage Theorem	298
B.5	Random Walks and Brownian Motion	305
B.6	Forwards and Futures	311
B.7	Options	313
B.8	Solution of the Black-Scholes Equation	316
B.9	Derivatives of Black-Scholes Option Prices	324
B.10	Hedging	327
B.11	Optimizing Portfolios	332
B.12	American Options	343
<i>Bibliography</i>		347
<i>Index</i>		351