Contents

Preface ix

Acknowledgments xii

About the Author xii

Chapter 1 Optimization 1
1.1 Quadratic Minimization 1
1.2 Nonlinear Optimization 8
1.3 Extreme Points 12
1.4 Computer Results 15
1.5 Exercises 18

Chapter 2 The Efficient Frontier 21
2.1 The Efficient Frontier 21
2.2 Computer Programs 33
2.3 Exercises 36

Chapter 3 The Capital Asset Pricing Model 41
3.1 The Capital Market Line 41
3.2 The Security Market Line 51
3.3 Computer Programs 54
3.4 Exercises 58

Chapter 4 Sharpe Ratios and Implied Risk Free Returns 59
4.1 Direct Derivation 60
4.2 Optimization Derivation 66

4.3 Free Problem Solutions 73
4.4 Computer Programs 75
4.5 Exercises 78

Chapter 5 Quadratic Programming Geometry 81
5.1 The Geometry of QPs 81
5.2 Geometry of QP Optimality Conditions 86
5.3 The Geometry of Quadratic Functions 92
5.4 Optimality Conditions for QPs 96
5.5 Exercises 103

Chapter 6 A QP Solution Algorithm 107
6.1 QPSolver: A QP Solution Algorithm 108
6.2 Computer Programs 127
6.3 Exercises 136

Chapter 7 Portfolio Optimization with Constraints 139
7.1 Linear Inequality Constraints: An Example 140
7.2 The General Case 151
7.3 Computer Results 159
7.4 Exercises 163

Chapter 8 Determination of the Entire Efficient Frontier 165
8.1 The Entire Efficient Frontier 165
8.2 Computer Results 183
8.3 Exercises 189

Chapter 9 Sharpe Ratios under Constraints, and Kinks 191
9.1 Sharpe Ratios under Constraints 191
9.2 Kinks and Sharpe Ratios 199
9.3 Computer Results 211
9.4 Exercises 213

Appendix 215

References 217

Index 221