Preface

Computational Finance is becoming increasingly important in the financial industry. It is the necessary complement to apply the theoretical models to real-world challenges. Indeed, many models used in practice involve complex mathematical problems, for which an exact or a closed-form solution is not available. Consequently, we need to rely on computational techniques and specific numerical algorithms.

This book aims at combining theoretical concepts and their practical implementation. Furthermore, the numerical solution of models is exploited both to enhance the understanding of some mathematical and statistical notions and to acquire sound programming skills in MATLAB®, which can be useful also in several other programming languages.

Most of the content of this book has been taught for several years at a Master's course in Finance to students with a relatively small background in mathematics, probability and statistics. Hence, the book contains a short description of the fundamental tools needed to address the two main fields of quantitative finance: portfolio selection and derivatives pricing. Both fields are developed here, with a particular emphasis on portfolio selection, where we include recent approaches that have appeared only in the literature.

We develop the ability to place financial models in a computational setting. This supports the understanding of theoretical concepts through their practical application.

Audience

This text is intended for students of Economics, Engineering and Applied Mathematics, and for practitioners who wish to investigate some quantitative procedures in the field of finance. The prerequisites are undergraduate courses in Calculus and Financial Mathematics, even though the readers could acquire these notions on their own with a bit of effort.

Scheme of the book
The book contains more than 100 examples and exercises, together with MAT-LAB codes providing the solution for each of them. The road map of the book is as follows. Chapter 1 is devoted to an introduction to the MATLAB®language and development environment, for programming, numerical calculation and visualization applied to simple calculus and financial problems. Chapter 2 introduces basic concepts in probability and statistics, simplifying as much as possible the discussion. Chapter 3 deals with the main constrained optimization models, mainly focusing on recognizing the type of problems treated, and how to implement and solve them in MATLAB®. In Chapter 4 we address Portfolio Optimization, providing several portfolio selection models mainly based on risk-gain analysis. Chapter 5 presents some probabilistic tools which are used in Chapter 6 for describing three methodologies to price derivatives.

Supplemental material
I created the web page http://host.uniroma3.it/docenti/cesarone/Books.htm containing supplemental materials and updates related to this book. Here you can also find where to download the MATLAB®codes described in the book.

Contact information
In spite of my efforts in drafting and checking the text and the MATLAB®codes, some errors and typos could still remain. For this reason, I strongly appreciate any feedback and suggestions kindly sent to the Email address:
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About the author
Francesco Cesarone was born in Rome in 1975. He received a Master's degree in Physics and a Ph.D. degree in Mathematics for Economic and Financial Applications from the Sapienza University of Rome. He initially worked as a researcher in the field of climatology at CNR (National Research Council), then as a PostDoc in finance at the Sapienza University of Rome, and as a consultant for ARPM (Advanced Risk and Portfolio Management, New York, US). Since 2011 he is an Assistant Professor of Computational Finance at the Department of Business Studies of the Roma Tre University. His research interests currently include portfolio selection problems, risk management, risk modeling, and optimal risk decisions, enhanced indexation problems, algorithms for large scale linear, quadratic integer and mixed-integer programming problems, heuristic optimization. He serves as a referee for several scientific journals.

What are the rumors about the book?

"Solving problem and decision analysis. Both are carried out, throughout the book, by precise mathematical elements, concepts and functions (Theory), then by fundamental exercises provided with solutions (Practice). Last, but not the least, the book is easy to read and to understand."

Maria Luisa Ceprini, *Professor expert in Welfare System, Research Associate, MIT, Sloan School of Management, USA*

"An essential guide to understand and apply financial key concepts."

Rosella Giacometti, *Professor in Mathematical Methods for Economics and Actuarial and Financial Sciences, Department of Management, Economics and Quantitative Methods, University of Bergamo, Italy*

"The most important knowledge for quantitative analysts is included in the book. Based on the book, Readers can develop their own numerical tools to find optimal investments and hedge the risk."

Young Shin Aaron Kim, *Associate Professor in Finance, College of Business Stony Brook University, New York, USA*

"Praiseworthy in its coverage of both portfolio theory and option pricing at an introductory but rigorous level. A gentle introduction to computational finance for the student with a healthy combination of theory and numerics. It will be a finance student bible."

Mustafa Celebi Pinar, *Professor of Industrial Engineering, Bilkent University, Ankara, Turkey*

"This book is a clever compilation of theory and exercises. It constitutes an excellent source for instructors to organize a course on quantitative finance and for students to get some knowledge on different quantitative procedures in the field of finance."

Justo Puerto, *Professor of Operations Research and Optimization, Facultad de Matemticas, Universidad de Sevilla, Spain*