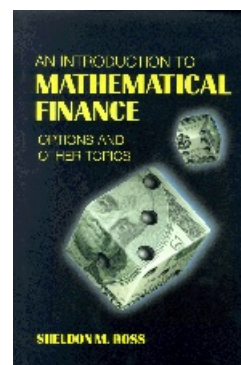


An Introduction to Mathematical Finance

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Sheldon M Ross
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A few years ago, anyone interested in learning more about the detailed mathematics of finance had very few choices. They could get a good start with a book like Hull's *Options, Futures and Other Derivatives*. Beyond that, there were only a few advanced texts and a number of journal articles. Essentially, the interested student was left to serve an apprenticeship on the trading floor as very few secrets were being leaked to outsiders.

These days there is a huge choice of texts and Sheldon Ross's *An Introduction to Mathematical Finance* has a lot of work to do to earn a place on the bookshelf. It starts with an introduction to elementary statistical ideas such as probability and the central limit theorem. It then introduces normal and log-normal motion. The finance part starts with sections on present value, pricing by arbitrage and the arbitrage theorem. The author then puts these together to derive and discuss the Black-Scholes formula and goes on to utility and utility functions. A chapter on pricing exotic options follows, here the book starts to get practical, with examples of Monte Carlo methods, importance sampling and antithetic variables. This is rounded off by an example data set and a brief discussion of non-normality. Sitting slightly oddly at the end is a chapter on autoregression and mean reversion.

As an overview of topics, it sounds like a good choice. Unfortunately, the actual coverage leaves something to be desired. My main complaint is that the level varies. At times the mathematics is suitable for beginners, but then the author assumes that a reader, who does not know what a probability is, is nevertheless conversant with calculus, logs and exponentials. The mathematically adept will find the approach rather too simple, except occasionally where the author resorts to 'it can be shown that' and leaves the reader stranded.

If it is really aimed at someone whose maths is weak, I have two serious objections. One is that the sets of problems at the end of each chapter have no solutions or hints given. Perhaps the author hopes that the book will become a standard college text, thus assuring his fortune! More seriously though, the mathematically weak student is often a concrete rather than abstract thinker. They want to know the direction of an argument before seeing the proof. Ross seems ignorant of this and blithely launches into topics in full mathematical mode. For example, one section starts 'Suppose that you must choose one of two possible investments, each of which can result in any of n consequences, denoted C_1, \dots, C_n . Suppose that if the first investment is chosen then consequence i will result with probability $p_i \dots$ '. This turns out to be a discussion of utility, but it is too abstract, and gives the reader no idea of what utility is really about. Similarly, utility functions are only defined in terms of mathematical properties, which make them easy to use (principally that they be concave) rather than from a real life consideration.

A final quibble - the book is meant to be an up to date discussion of trading methods. The discussion of Black-Scholes in terms of geometric Brownian motion is fine. However, the author goes on to point out that historical volatility and implied volatility are often different. He describes implied volatility as having the difficulty that it varies with strike price and term. In other words he completely misses the point that it is precisely the market's way of dealing with the fact that prices do not move log-normally. This is a vitally important point, especially in a book for beginners, because so much is published by academics who think they have found a flaw in Black-Scholes. Of course they have, but they cannot make money with it because it is a flaw that the market is aware of and corrects. Such an apparent ignorance of real trading methods is quite surprising and reduces my faith in areas of the book where I was hoping to learn something.

The book's weaknesses, I have to say, are fairly specific. This is partly because I was reading the book from the point of view of a teacher. There are positive aspects - for example, it would sit well on the shelf of someone who struggled with Hull. Also, as a reference for the basic techniques it is reliable and has sufficient examples to make it easy to use. Finally, for someone who needs a primer in basic statistics, it does the job admirably. However, to follow the rest of the book, such a reader would need further help on other aspects of maths. The material on statistical techniques for analysis, particularly the Monte Carlo method, is clear and contains sufficient examples for competent programmers to try it out for themselves. If the book were to be used as an accompaniment to a lecture course, many of my criticisms would be palliated too. As the author is a lecturer, perhaps that is what he had in mind.

An Introduction to Mathematical Finance does the job it claims to on the cover, but I doubt it would appeal to anyone

but a total beginner, and then only with a certain amount of help. I am not sure that a book at this level could do anything else - if it is to be approachable, it must be basic. However, it does strongly illustrate that a book is no substitute for a good teacher!

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[◀ Previous article](#) | [Next article ▶](#) | [This volume ▲](#) | [This issue ▲](#)

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The book is necessarily mathematical, but I hope not too mathematical. It is expected that readers have a solid understanding of calculus, linear algebra, and probability, but to a level no higher than would be expected from a strong first year undergraduate in a numerate subject. That is not to say the material is easy, xi xii Preface rather the difficulty arises from the sheer breath of application and the perhaps unfamiliar real-world contexts. Suppose, for example, that he receives £106 on closing his account. 1 An Introduction to the Mathematics of Finance. <http://dx.doi.org/10.1016/B978-0-08-098240-3.00001-1> © 2013 Institute and Faculty of Actuaries (RC000243). Published by Elsevier Ltd. All rights reserved. Mathematics for nance : an introduction to nancial engineering. - (Springer undergraduate mathematics series) 1. Business mathematics 2. Finance "Mathematical models I. Title II. Zastawniak, Tomasz, 1959-332" 0151 ISBN 1852333308. Library of Congress Cataloging-in-Publication Data. CapinÅ'ski, Marek, 1951-. Mathematics for nance : an introduction to nancial engineering / Marek CapinÅ'ski and. Tomasz Zastawniak. p. cm. "An Introduction to Mathematical Finance with Applications. p. 83. CrossRef. Google Scholar. Petters, Arlie O. and Dong, Xiaoying 2016. An Introduction to Mathematical Finance with Applications. p. 383. CrossRef. Google Scholar. " an excellent introduction to the subject " the book is ideally suited for self-study and provides a very accessible entry point to this fascinating field."™ Source: ISI Short Book Reviews. " " this excellent text achieves its aim to provide a highly accessible and at the same time accurate presentation of the subject. I would recommend it."™ Source: The Statistician. " " an excellent introduction to the mathematics of finance " very useful as a text for an introductory course."™ Source: Zentralblatt Math.