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June 2000
Staff room

Book reviews

by Mike Pearson



- [*Elementary Number Theory in Nine Chapters*](#)
 - [*An Introduction to Mathematical Finance*](#)
 - [*Innumeracy*](#)
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Elementary Number Theory in Nine Chapters

by James J. Tattersall

Reviewed by Prof J.D. Barrow (MMP Project, DAMTP, Cambridge University)



Books on numbers tend to be very hard or very easy. This is a nice exception. The author has created a textbook based on real lectures given to American undergraduates that neatly straddles the divide between school and college mathematics. The chapters are self contained and full of extensive explanation, mathematical biographies, worked examples, and a huge number of exercises and challenging problems. But it should be said that these problems are more than merely problems. They are culled from all sorts of historical sources and provide the reader with an historical overview of the way the study of numbers developed, who did what, when, and why. Equally important, the problems are complemented with 74 pages of full worked solutions which make the book equally useful for self or class use. One of the great strengths of the author's style is the way in which he has retained the feel of a lecture in the text. Careful explanations are consistently given and the author is aiming always to explain and take the reader with him, not simply amaze you with his sleights of hand or lose you with a succession of 'obvious' or 'trivial' steps. None the less, parts of this book will be quite challenging to A-level mathematicians, but most of the text uses quite elementary methods in telling ways. It also provides fascinating glimpses of the usefulness of some branches of the purest

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of pure mathematics in the devising of public key codes. There are chapters on intriguing properties of natural numbers, continued fractions, primes, perfect numbers, modular arithmetic, and cryptology which link together results that span thousands of years of human investigation. Some of these discussions introduce us to tantalisingly 'elementary' unsolved problems. If you are going up to win the million pounds on offer for the first proof (or counter-example) of Goldbach's Conjecture, then chapter 3 provides a nice introduction to the Conjecture's history and the current state of play, while the problems give you some opportunity to limber up. A book to study systematically or dip into at random. A ninefold path of enlightenment through the realm of numbers: very strongly recommended.

Book details:

Elementary Number Theory in Nine Chapters

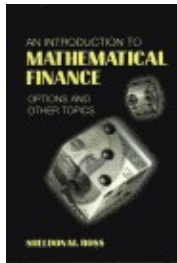
James. J. Tattersall

Cambridge University Press

Hard and Paperback – 407 pages (1999)

ISBN: 0521585317

An Introduction to Mathematical Finance



by Sheldon M. Ross

reviewed by Elie Bassouls (DAMTP, Cambridge University)

This refreshing little (184 pages) book was given an exactly appropriate title. No great mathematical, statistical, or financial expertise is needed to make sense of the material. Beginning with the mathematical aspects, the reader is taken to the central Black Scholes option pricing model through a sensible series of steps, such that it becomes a financially logical conclusion rather than some magical formula relying on abstruse mathematical ideas. Portfolio theory and more advanced asset pricing algorithms follow on, much in the same grain, which I found the great virtue of this text.

The first few chapters summarise basic probability concepts, the Normal distribution and Brownian motion, an understanding of which is essential when attempting to model investments. Interest rates, net present value analysis and the theory of arbitrage are then explained.

After this, the author comes to a position where he can derive a simplified version of the famous Black Scholes option pricing formula, the central theme of this book, as well as one of the foundation stones of mathematical finance. The formula relies on several assumptions. The market in the security and options on it must be liquid. This is alluded to by the statement that one should be able to trade continuously in the security. A clear mention would have helped. Problems inherent in estimating the security's volatility (σ) are investigated, although the model's requirement that it be constant over the option's life can only be guessed from careful reading. An entry level text, should have made the fact clearer. After all, even pretentiously reputed institutions have lost large sums after forgetting about this.

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The concept of utility, and its use in valuing investments begin the next chapter (No. 8), which then presents the capital asset pricing model (CAPM), without naming its authors (Modigliani and Miller). The chapter then touches on portfolio selection. Chapter nine takes a look at Asian and lookback or exotic option pricing, with monte carlo simulation and binomial models. The last two chapters consider cases where prices do not follow a geometric Brownian motion and propose other ways to represent them.

Altogether, a lot of ground gets covered in a small volume. So, one should regret not so much that fully rigorous mathematical demonstrations are not always given, but that their omission is not noted. For example, rigorous formulation of the Black Scholes model invokes stochastic integrals and Ito's lemma. At least a footnote to this effect could have helped. The reader does not need great preliminary expertise to follow the text, but those indeed lacking it could falsely believe the subject to be a lot simpler than it actually to be. Thus, I would recommend the book as an ideal appetiser in the subject, or to provide surface level understanding of it, but warn of its limitations. Despite this, I found the reading undemanding, yet interesting. I liked the way in which the author managed to write a story, which makes sense, for both mathematicians and financiers.

Book details:

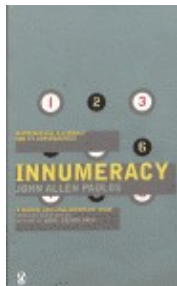
An Introduction to Mathematical Finance

Sheldon M. Ross

Hardback – 224 pages (1999)

Cambridge University Press ISBN: 0521770432

Innumeracy



by John Allen Paulos

reviewed by Mike Pearson (Plus editorial)

To be innumerate, my dictionary says, is to be "ignorant of or unskilled in mathematics and science". Lots of us don't like maths, and even take a perverse pride in our inability to manipulate numbers – "Well, don't ask me, I'm useless at maths!" This book, by a Professor of Mathematics, is about how innumeracy affects our lives – mainly in the form of mathematical misconceptions and inconsistencies.

The first couple of chapters deal with big numbers, and the problem we have visualising anything with a lot of noughts on the end of it. With big numbers go probabilities (such as being a road traffic accident statistic or winning a lottery) and the multiplication principle (how many different dinners can you concoct out of four appetisers, seven main courses and three deserts?). But the bit I liked best in this section is the observation that the size of a virus to a person is as the person to the earth, and an atom to a person is as a person to the earth's orbit round the sun.

In chapter two there's more about probability and coincidence, and in chapter three Professor Paulos tackles the topic of Pseudoscience. "Any bit of nonsense can be computerised – astrology, biorhythms, the I Ching – but that doesn't make the nonsense any more valid." He also considers the phenomenon of predictive dreams,

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and comes to the conclusion that about 3.6% of people are likely to have accurate predictive dreams in any one year (see pp 51 et seq.)

Professor Paulos ascribes the innumeracy that is so widespread in society to early mathematical education being poor. He believes that the basic algorithms are taught – but not their application. The student learns how to add, subtract, multiply, divide, and handle fractions, decimals and percentages, but not when it's appropriate to do so. He would like to see estimation and inductive reasoning on the school syllabus, and a greater use made of puzzles, games and riddles with a mathematical bent. The problem with innumeracy is not only the resulting inability to handle numbers in everyday life, but the likelihood of being taken in both by pseudoscience backed up by pseudomathematics, and by pseudostatistics peddled by politicians, salespersons or anyone else.

This book contains a great deal of interest to those who teach mathematics and to the reasonably numerate. I would disagree with Stefan Kanfer, who is quoted on the back cover as saying, "Those who break into a sweat at the mention of calculus or plane geometry can relax. This elegant little survival manual is brief, witty, and full of practical applications." Yes, possibly, but not in a form that the truly innumerate would be able to understand.

There are two other drawbacks to this book – firstly, the large number of American references within examples (usually concerning strange American games like baseball, which may or may not be comprehensible to us Brits), and secondly a problem for the much younger generation who are now practically unable to cope with feet and inches – all the American units are Imperial.

But still an interesting book for the educator.

Book details:

Innumeracy

Johna Allen Paulos

Paperback – 135 pages (1999)

Penguin Mathematics ISBN: 0–14–029120–2



Plus is part of the family of activities in the Millennium Mathematics Project, which also includes the NRICH and MOTIVATE sites.