letters

The “fear” factor

The Editor’s account, in the April issue of Mathematics Today, of his experience teaching aptitude students certainly struck a chord with me. I spent most of my career teaching in Further Education and taught mathematics on a variety of vocational courses—engineering, accountancy, business studies etc.—as well as GCSE and A level. For the last few years I have been fortunate to be teaching in one of the leading independent girls schools, engaging with highly committed intelligent pupils who virtually without exception achieve A grade in mathematics A level (and in Further Mathematics if they take double maths). Certainly the “fear” factor that you identify is present. The pupils have been subject to tests and examinations from an early age so it is not surprising that their view of education is shaped by this experience. It is sad to hear younger pupils ask almost immediately upon embarking on a new topic, “Will this be in the test?” before we have barely scratched the surface of the mathematics we are trying to study. In the sixth form the text books we use are no longer books principally about mathematics (and also useful for the exam), but examination manuals written in many cases by the examiners and prepared from beginning to end with phrases such as “you do not need to remember this proof for the exam”, “you will meet this sort of question in the exam”. The examples presented and the exercises set do not extend at all from the syllabus, there is nothing to stretch the brightest pupil. A simple example—the syllabus specifies that only cubic equations will be tested with the factor theorem. Hence the chapter in the book has an exercise consisting entirely of cubic polynomials. Sadly even the brightest pupils are focussed mainly on examinations due to this conditioning and many, though not all, can switch off from anything that does not seem directly relevant to the examination.

There is, however, a further factor at work, and that is that education is no longer seen as valuable in itself but only as a means to an end; for the individual attaining a well-paid job, for the nation the contribution it can make to economic growth and prosperity. This view is projected so consistently that again the pupils are imbued with this. One has always encountered, quite reasonably, the question “What is the use of this?” when teaching. Variations that are now occurring are on the lines of “How will I use this in the future?” or “What is the use of this to me?” The pupils want to be assured that each topic studied will produce a direct benefit to them in the future.

It is not the pupils at fault in any of this, but the system in which they find themselves being educated - if that is the right word. □

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UK Nuclear Power Consultation

The Future of Nuclear Power: The role of nuclear power in a low carbon UK economy

On the 23 May 2007 the Government launched a major consultation about nuclear power generation.

To help the country tackle climate change and give secure energy supplies, it is the Government’s preliminary view that it is in the public interest to allow energy companies the option of investing in new nuclear power stations.

As part of this, we want to hear what you, your members or your organisation/group, think of the information and arguments we have put forward in our consultation document.

We are seeking views on whether the Government has considered the relevant arguments; whether we have considered the arguments reasonably and whether there are other important arguments we have overlooked. Your views will contribute to the shaping of the policy on the future of civil nuclear power in the UK. They will help Government assess the arguments before it reaches its final decision on the future of new nuclear build.

You can take part in the consultation online at [http://www.direct.gov.uk/nuclearpower2007]. The online consultation has been designed to make it easy to submit responses to the questions we ask.

Please forward this information to colleagues and anyone else you think may be interested in taking part. The consultation closes on the 10 October 2007.

The responses we get are important to us. We will carefully consider them and this will enable us to take a decision later this year on the future of nuclear power in the UK. □

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Book reviews

An Introduction to Financial Option Valuation - Mathematics, Stochastics and Computation

Desmond J Higham
CAMBRIDGE UNIVERSITY PRESS 2004, 296 PAGES

For anyone interested in a gentle exploration of Option Valuation, after their dearth it has been piqued by Colin Turfus’ article in the April 2006 edition of Mathematics Today, they would be no better served than to explore this book. In 24 chapters, and staying at an undergraduate level, the mathematics behind Option Pricing is explained and models are developed to analyse European and other put and call options in the world’s option trading centres.

Chapters one to four assemble the definitions and theoretical mechanisms for the study of Option Valuation, covering European put and call options, payoff diagrams and the reasons that options are traded. Chapter two discusses compound interest, short selling, the no-arbitrage principle and put-call parity. Chapter three has a very brief overview of random variables, defining their means, expected value, variance and then describing the uniform and normal distributions and the Central Limit Theorem. Chapter four discusses randomness and computer-generated pseudo-randomness, and presents statistical tests for randomness and the use of kernel density estimates.

Chapters five, six and seven develop the asset pricing model, using close of day asset price data to illustrate discrete and continuous asset models leading to the evolutionary equation of the asset price S(t) over time as

\[ S(t) = S(0) e^{\mu t - \frac{\sigma^2 t}{2} + \sigma \int_0^t \int_0^t \frac{\sigma}{Z_i} - t\right)\]

Where Z_i is an independent, identically distributed Random Variable with a N(0,1) distribution. This equation is used in chapter seven to simulate asset prices numerically, and to show that the model is timescale invariant.

Chapter eight introduces the concepts of hedging and uses it to develop the Black-Scholes PDE for an option value V at any time t, and applies it to the European Call option. Hedging is further developed in chapter 9, while chapter 10 introduces the Greeks, widely used partial derivatives of the option value. Chapter 11 presents further analysis of the Black-Scholes PDE, and leads to the motivation for the introduction of Risk Neutrality in chapter 12.

Chapter 13 introduces the concepts of numerical analysis to solve non-linear equations, and then applies them to the

Volatility equation in chapter 14. Chapter 15 introduces the techniques for Monte Carlo approximation and applies it both to the European call option and the associated Greeks. The binomial method is introduced in chapter 16 and applied to the asset price model and the Black-Scholes PDE. Different option types are introduced in chapters 17, 18 and 19, while chapters 20–22 apply Monte Carlo estimation to Historical Volatility and Variance Reduction techniques. Chapter 23 branches into numerical analysis techniques to introduce numerical solution of the Black-Scholes PDE via finite difference methods, leading to the application of the Crank-Nicholson method.

This is a very readable book, while it depends on the theories of probability, statistics, numerical analysis and MATLAB coding, it gives sufficient pointers to where the results it needs can be found for anyone who needs more rigour. While the author points out that no background in probability, statistics or numerical analysis is required, students who have exposure to these subjects will find the book easier to use. At the end of each chapter is a pithy selection of quotes, again with references, which illuminate the ideas presented in the text. This is more than a book on Option Valuation, it is a well-presented tour through selected areas of applied mathematics.

A significant feature of the book is the inclusion and development of MATLAB code, reports and graphical output, which acts both as a primer to the application of MATLAB to numerical analysis, and as an excellent expository tool to clarify the ideas and results of the book. This book deserves to be used as either a textbook for a course on Option Valuation, or as a source of ideas and inspiration for the application of probabilistic modelling and numerical analysis.

For anyone interested in using this book, the website reference quoted on page six has been mis-printed by the publisher, and it should be as follows: http://www.maths.strath.ac.uk/~aaa6010/option_book.html, which can be found on Des Higham’s website. This contains reviews of the book from other sources, the MATLAB code mentioned in the book as well as solution hints to many of the exercises, and as a list of corrections.

I would like to thank OxfordMaths Inc for making available a copy of MATLAB to run the examples in the book. □

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