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# Book Reviews

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***Studying Mathematics and its Applications*, Peter Kahn,  
Palgrave Publishing Ltd., October 2001, £10.99; ISBN 0-333-92279-4.**

**Reviewed by Laurence Nicholas  
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A past generation of undergraduate students studying Honours Mathematics would be highly able, competitive, enthusiastic, self-motivated and generally male, comprising a small fraction of the age group. There were also very few subject specific guides to help them. Today's students come from a much larger slice of the age cohort, are often unsure of what they want to study and many enter combined or joint courses. They seem much less mathematically prepared for the rigours of their courses and usually have at least as many females in their class as males. In addition to those on such courses, most undergraduates on a Business, Engineering or Science degree have to study some form of mathematics as part of their course. However, there are now a number of suitable study guides to help them. Thus Peter Kahn has written this text "to help you study mathematics and its applications as effectively as possible", where the "you" are such "undergraduate students".

After the usual Preface, list of Acknowledgements and a helpful Scene Setter concerned with the nature of the subject and how the reader currently approaches it, the text is divided into three main parts; Skills, Tasks and Study. Within each part, the chapters are prefaced by boxed Aims and then summarised with boxed Reflections appropriate to the material covered. Examples, important ideas and other bullet points are also liberally given the boxed treatment. But this is not just a read-only book since the many suitably scattered Exercises encourage participation and action by the reader.

The first part, 'Skills', introduces us to the language of mathematics and how to interpret, analyse and use it with appropriate rules. This is done through six short chapters on: Using Examples, Thinking Visually, Coping with Symbols, Taking Ideas Apart, Thinking Logically and Making Connections which culminates in the statement: Mathematics is the Study of Connections.

The second part, 'Tasks', covers Solving Problems, Applying Mathematics and Constructing Proofs. In the first section Polya's structural approach to problem solving is presented and illustrated and again various exercises are set. The next chapter seeks to motivate learning the ability to apply mathematics to real world problems through the use of modelling skills. This is concluded with the illustration by an (appropriate) case study of a lever in equilibrium. The last section of this part is concerned with constructing proofs and the author advocates understanding over memory in order to promote confidence in proving unseen results. He uses simple quadratic equations to illustrate his point. Proof by contradiction concludes the section.

The final part, headed 'Study', covers the chapters: Studying Actively, Using Technology and Succeeding in Assessment. They are slightly shorter than the earlier ones and cover the sort of material on study skills that

is available elsewhere already. Whether or not pre-undergraduates would have ready access to a computer as expected is not so clear. There are brief but helpful notes on Coursework, Reports and Essays, Oral Presentation and Examinations.

Basic manipulation is a skill many students seem to lack these days and the author has added an Appendix in which mental algebraic gymnastics (what the OU calls callisthenics) are encouraged. An extensive set of answers with helpful comments covering fifteen pages follow, and the text is concluded with a useful Bibliography although there are no references in it to Web-based materials.

The text is gender free and non-patronising and has been written with the learner clearly in mind.

This is a book that can be recommended to intending undergraduates who will be majoring in a Mathematical area and would provide them with a helpful bridge from school/college level to University level work. In addition those involved in Mathematics Education work would also find it useful.

The accent on the careful handling of details seems to be for the believer and perhaps he is preaching to the converted who are already aware of their shortcomings. I cannot see the average intending engineer wading through some 200 pages or getting any of the suggested texts but should they do so they would be considerably better prepared for their courses than they often are at the present. However, we can but hope and encourage them to buy and study a text such as this one.

My (proof) copy contained a few minor misprints and errors, which I hope, will have been corrected before publication.

**Stat Labs: Mathematical statistics through applications**  
by Deborah Nolan and Terry Speed  
Springer 2000, 282 pp., [www.stat.berkeley.edu/users/statlabs/](http://www.stat.berkeley.edu/users/statlabs/)

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Having heard enthusiastic reports of this book from two colleagues, I had already bought a copy for myself some 4 months before I was asked to review it, and had already enjoyed working through some of the examples. Thus my extra copy of the book can be donated, with my enthusiastic recommendation, to our graduate students' computing room.

The distinctive feature of this book is that each of its 12 chapters has a case-study as its centrepiece. These case studies are substantial, interesting and almost all are topical, but (I surmise) for the next few years at least, will not become obviously out of date. They include examples as diverse as Maternal Smoking and Infant Health, Minnesota Radon Levels, Patterns in DNA, and Voting Behaviour, to name only four topics. The book is the product of several years combined teaching experience, and therefore its examples have been well and truly 'test-driven' by several generations of students.

The Preface states that the book is 'intended for a course in mathematical statistics for juniors and seniors' and assumes that the 'students have had one year of calculus, including Taylor series, and a course in probability'. Thus it requires (modest) knowledge of calculus, but no matrix algebra. The authors do not assume any prior experience of statistical software, and assume that teaching students how to use such software is the task of the lecturer/demonstrator for this course. It is not explicitly referred to in the book. Apart from a brief note in the Preface to say that the authors used S-plus and R for their 'labs' with the students (and I certainly would do the same) there is very little reference to software in the book. This deliberate omission may have the effect of putting extra demands on the student/teacher who wants to work carefully through all the datasets. But there are other excellent text-books, for example those written by Bill Venables and Brian Ripley, which can help them get started with R or S-plus.

The Preface gives the following list of the main statistical topics covered in the book: descriptive statistics, quantile plots, normal approximation, simple random sampling, confidence intervals, stratified sampling, parametric bootstrap, allocation, estimation and testing, goodness-of-fit tests, information, asymptotic variance, contingency tables, experimental design, Poisson counts and rates, Mantel-Haenszel test, regression, prediction, simple linear model, replicate measurements, transformations, inverse regression, ecological regression, weighted regression, multiple linear regression, model checking, projections, analysis of variance, unbalanced designs, indicator variables, response surface analysis, factorial design.

So, this includes many topics which are important for the applied statistician, but not topics such as the Neyman—Pearson Lemma, sufficient statistics, the Cramer—Rao lower bound: these would not be in keeping with the style of this particular book.

As the Preface says, this book teaches mathematical statistics 'through in-depth case studies', with each case study being 'the centerpiece of each chapter'. This is a somewhat unusual approach, particularly for those of us more accustomed to teaching a course with the emphasis on the 'mathematical statistics' part of the title (with its old echoes of Definition, Lemma, Theorem, Proof, and perhaps a few small-scale practical examples as illustration). The wealth of interesting examples are carefully, interestingly and sensitively presented. Some mathematics undergraduates may find the sheer detail given on the scientific background is rather too demanding on their reading skills, particularly if English is not their first language. For example there are 10 pages of introductory text that provide the (very interesting) starting point for Chapter 6, 'HIV Infection in Hemophiliacs'.

There is an excellent webpage associated with this book: this includes an FAQ page for each of the Labs, and tips on specific R commands. It is very easy to download datasets and try things out for yourself. As alluded to above, reference to computer software and to mathematics are kept to a minimum. The mathematics exercises are clear and fairly simple, e.g. suitable for a UK undergraduate first-year statistics course. Some of the data sets would be very good as projects for graduate students, using the appropriate Nolan and Speed chapter, and its dataset, as a starting-off point. Appendix A shows you how to write a Lab Report: this is excellent, synthesizing material from other sources, in particular "Encouraging Student Writing" by S.Tollefson of the University of California. Appendix B 'Probability' gives the reader all the basic theory, including some Limit Theorems, that (s)he needs to know, in under 10 pages, which is no mean feat. Finally, Appendix C gives a nicely presented set of statistical tables.

This is a very good book of its kind, and represents a great deal of useful modern classroom experience.

**Reference** Venables, W.N and Ripley, B.D. (1999) *Modern Applied Statistics with S-PLUS*. New York: Springer-Verlag.

**Chance Encounters: A First Course in Data Analysis and Inference**  
 by Christopher J Wild and George A F Seber  
 2000, John Wiley & Sons Inc. Hard-bound, xviii + 612 pp ISBN 0-471-32936-3

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This book, with just over 600 pages, is both long and physically heavy, two factors which have contributed to a lengthy time lag between receiving the book for review and writing this. The content of the book is far from heavy, however, and I have enjoyed reading it and have made use of it in my teaching.

The 12 chapters in the book take us in turn through a discussion of what statistics is, tools for exploring univariate data and relationships, probability, discrete and continuous random variables, sampling distributions, confidence intervals and significance testing, tables of counts, and regression and correlation. Two further chapters on control charts and time series are available from web sites. It was written as a one-semester pre-calculus text but the authors realise that instructors might need to select topics. No prior knowledge of statistics is assumed.

In addition to the two extra chapters there are a number of other resources including chapter supplements, data files, additional exercises, Powerpoint slides, and a solutions manual. Some of these are only for adopters of the book but some are publicly available from Chris Wild's site (start with <http://www.stat.auckland.ac.nz/PEOPLE>) or the Wiley site (<http://jws-edcv.wiley.com/college>). I found Chris' site far easier to use than Wiley's. Resources in the book itself include quizzes for sections, answers to selected problems, and useful chapter summaries.

According to the preface the book is distinctive as it is an "intuitive, data-oriented, graphical, and computer-oriented introduction to making sense of the world through statistics". By an intuitive approach the authors appear to mean that concepts are explained with words and graphics as much as possible. The book is certainly high on words and relatively low on mathematical symbols, and this should appeal to less numerate students who are frightened of mathematics, whilst not deterring the more mathematically inclined. Diagrams are used to good effect. I agree that the book is data-oriented,

with real and interesting examples from many disciplines used both in the text and in the many exercises for the reader. It is not obviously a computer-oriented book, but it contains a sprinkling of computer output, mainly from Minitab and Excel, and an indication of how to obtain this. The authors say that they did not want to turn the text into a tutorial manual for a particular software package, and given the rate at which packages change, I think their approach was wise.

The authors are renowned statisticians and experienced teachers. Stage 1 statistics at their university (Auckland) involves approximately 2500 students (Wild 1995) and Chris Wild is the president-elect of the International Association for Statistical Education, IASE. We can therefore be confident that the book is reliable and is based on good teaching principles and practice. Parts I particularly like are: the chapter on probability where the presentation is based on two-way tables, and the careful discussion of significance tests and the difference between them and confidence intervals in chapter 9. The book includes matters that are glossed over in many texts, for example a short section on how many significant figures to quote, and a section on the comparison of proportions where three sampling situations are covered. I highly recommend it. Obtain a copy for yourself, even if you are unable at present to use it with a group of students.

#### Reference:

C.J.Wild (1995) *Continuous improvement of teaching: a case study in a large statistics class*. International Statistical Review, 63, 1, 49-68.