mathematical models, discussing the interpretation of PK parameters. Compartment models and the distribution of drug concentration throughout the body are discussed in Chapter 5 and Chapter 6 briefly introduces pharmaco-dynamics (PD), the study of the effect of drugs, and PK–PD modelling, relating drug distribution to potency and toxicity.

A real example from AstraZeneca is used to illustrate some of the methods, and good use is made of synthetic examples to explain concepts. There is a dearth of references, which makes further reading difficult and makes the text appear to be a very personal view of the subject. On occasion, clinical or biological terms are used without a full definition. Overall, the book provides a good introduction to some of the problems in the area of PK modelling to which statistical methods are now being routinely applied.

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Time Series Analysis
H. MADSEN, 2008
Boca Raton, Chapman and Hall–CRC
396 pp., £79.95
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The book, with its 12 chapters, represents a valuable introduction to time series analysis in both the time domain and the frequency domain; and it varies between theory, methods and applications. It consists of the following chapters.

Chapter 1 gives some examples and applications of time series. Several statistical measures of multivariate random variables are investigated in Chapter 2. Chapter 3 discusses prediction of regression linear models with estimation to their parameters. Analysis of linear dynamic models in the time domain and frequency domain is proposed in Chapter 4, involving sampling of such models with continuous time and some useful transforms. Chapter 5 introduces a class of stochastic processes including auto-regressive moving average and auto-regressive integrated moving average time series models. Principles of building a model for time series data are established in Chapter 6 via identification of the model order, estimation of the model parameters and model checking. Chapter 7 analyses time series in the frequency domain via the spectrum and cross-spectrum, giving their non-parametric estimation and properties. Chapter 8 considers linear models where the input is a general stationary process that is not necessarily white noise. Analysis of multivariate time series is exhibited in Chapter 9, considering all

the issues discussed for univariate time series. Chapter 10 looks at the state space approach and Kalman filtering of dynamic models involving time series with some randomly missed values. Estimation methods for forecasting and control in the dynamic models are presented in Chapter 11 with recursive and adaptive estimation. The last chapter contains problems that were inspired by practical and real applications for time series. The book is ended by five appendices.

As already stated, the book analyses time series in both the time domain and the frequency domain. It proposes various dynamic models with estimation of their parameters for univariate and multivariate cases, including the state space approach for the analysis of such models. Also, it contains many illustrative examples, theorems with proofs, exercises at the end of most chapters and real life applications. The book material is invaluable and presented with clarity, but it has a few typographical errors. So, it is strongly recommended to libraries and all who are interested in time series analysis. A criticism of this book comes in not giving a hint about non-Gaussian time series (see, for example, Kedem and Fokianos (2002)) and not treating the case in which the probability of a given event equals 0 for conditional distributions although it arises in section 2.2 (see, for example, Krishnan (2006)). Continuous white noise on pages 111–113 should be replaced by white noise with continuous time. In equation (5.51) we should put the condition that the impulse response function is absolutely integrable. Also, on page 190 the expression ‘the estimator of the periodogram’ should be corrected to ‘the periodogram estimator’.

References

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Data Analysis and Graphics using R: an Example-based Approach, 2nd edn
J. MAINDONALD and W. J. BRAUN, 2007
Cambridge, Cambridge University Press
xxiv + 502 pp., £43

This book is an introductory text on statistical methods and their implementation in R. It describes a range of statistical tools and graphical techniques through real world examples based on data sets that have been collected from a wide variety of disciplines.
The book includes a thorough introduction to the R programming language and covers material on exploratory data analysis, statistical models, formal statistical inference, linear regression, generalized linear models and survival analysis, time series models, random-effects models, classification and regression trees, multivariate data exploration and discrimination, and principal components regression. The second edition differs from the first mainly in the inclusion of new material on survival analysis, mixed effects models and multivariate data analysis and the considerable revision of the R code that is used in examples.

The informal style of writing and the clear, step-by-step description of the methods in each chapter make easy reading. Data sets are used to illustrate the methods and to show the reader some of the issues that one may face when analysing a data set in practice. The use of graphical methods which are useful for gaining insight into the data before and after carrying out formal analyses are highlighted, with examples clearly demonstrating each approach. The inclusion of comprehensive R code ensures that all the examples are reproducible by the reader with minimal effort. Many of the examples are based on functions that were written by the authors and together with the data sets used are available in the DAAG package from the Comprehensive R Archive Network (http://cran.r-project.org/). In addition, solutions to selected exercises and R scripts of all the code that are featured in the book are available from the authors’ Web site.

The book is particularly aimed at scientists who wish to learn how to undertake their own analyses and, although it does not delve deeply into the methodological details, it should also prove a useful reference for those who are experienced in statistical methods as a guide to practical data analysis in R.

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Digital Dice: Computational Solutions to Practical Probability Problems
P. J. Nahin, 2008
Princeton, Princeton University Press
264 pp., £16.95

Digital Dice focuses on solving practical probability problems applied to real life situations, using numerical methods without the need to solve complex mathematical equations. It is aimed at both teachers and students of probability and to those looking for recreational mathematics. 20 problems are explored, covering a wide range of probability theory.

One problem asks the question ‘How many runners in a marathon?’. Here the aim is to estimate the size of a population, N, by taking a random sample from the population of objects labelled 1, 2, . . . , N. This is given a basis in real life by using examples of estimating the total number of runners in a marathon by using a sample of runners who pass at one particular point by recording their jersey numbers or estimating the total number of German tanks in World War Two by recording serial numbers.

The parallel parking problem first appeared as a challenge question in 1978 and looks at cars that are parked at parallel in a narrow car park. This is a geometry problem, where the cars can be thought of as points or nodes, and the car park is a line segment. Each point will have a nearest neighbour, which is the point to which it is closest in distance. This problem looks at the probability that a point (or car) that is picked at random is one of a pair of mutual nearest neighbours.

There are also several queuing theory problems such as the waiting for buses problem. Two buses are assumed to stop at a bus stop where the first bus stops every hour on the hour. The second bus also stops every hour but at x minutes past the hour. The question is to estimate the average waiting time until a bus arrives, for a person arriving at the bus stop at random.

The introduction covers some basic probability with no mention of statistics. Although the author states that this is not a book on probability theory he makes no apologies for using technical language with little or no explanation. Thorough solutions are given in a logical manner, with extensions to the basic problems considered. Algorithms written in MATLAB are explained line by line and, where appropriate, theoretical solutions are also discussed. The algorithms are easy to understand and translate into other programming languages.

The book provides statisticians with some interesting and thought-provoking applications of probability theory to real life. The author brings to the book his own experiences in teaching the problems that are presented. A nice aspect is the many historical facts given, as well as the mathematical history of many of the problems, e.g. the Gamow–Stern elevator problem originated in a puzzle book that was published in 1958. For recreational reading I found switching constantly between the problems and solutions sections awkward and footnotes at the end of sections irritating; but, overall, the book is engaging and very entertaining.

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