Mathematical Statistics with Mathematica
by Colin Rose and Murray D. Smith

This book is unusual and impressive! The material incorporates an add-on to the symbolic algebra package Mathematica, called mathStatica, which was written by the authors and is packaged in a CD-ROM together with the book. To use and appreciate the book it is essential that the reader be armed with a copy of Mathematica and important that the texts by Hogg and Craig (1995) and by Stuart and Ord (1994) be close at hand.

Broadly the book provides a fascinating, illustrative tour through the theory of mathematical statistics. The material is well-organized and follows roughly the structure of Hogg and Craig in developing continuous and discrete distributions, transformations of variables, multivariate distributions, asymptotic theory, statistical decision theory and maximum likelihood estimation. Concepts are presented succinctly and well with a few carefully chosen theorems accompanied by outline proofs. The interested reader is referred to other texts for more detail. The main emphasis of the book is on exploring an array of distributional properties through Mathematica and mathStatica. Numerous examples drawn from areas such as statistical physics and mathematical finance are presented. These demonstrate the power of Mathematica, together with the 100 or so new commands in mathStatica, to produce powerful results from a few lines of code.

Chapter 2 handles the basics of continuous distributions and, in order to convey the flavour of the book, is discussed in a little more detail here. The basic notions of pdf's, cdf's and mgf's are introduced and illustrated by standard distributions and by less well-known distributions such as the Reflected Gamma, the Lindley and the Birnbaum-Saunders distributions. The power of characteristic functions is also demonstrated and there is an excellent section on the handling and interrelation of moments and cumulants. The final section of the chapter is devoted to the generation of pseudo-random numbers. In particular the inverse transform technique and the rejection method are presented for distributions such as the Levy and the half-Halo. The remainder of the book is packed with delights ranging from neat ways of transforming variables to mixing distributions, copulae, the Fisher information and maximum likelihood. Examples (chosen by me at random) include the Maxwell-Bolzmann distribution, the Ehrenfest urn model, Robin Hood shooting arrows at a target and the Black-Scholes model for option pricing!

In summary the book provides a fascinating account of mathematical statistics that will appeal to professional statisticians and research students working with distributions. In particular it provides a bridge between the solid foundations of Hogg and Craig (1995) and the more sophisticated realms of Stuart and Ord (1994) and

Johnson, Kotz and Balakrishnan (1994, 1995 and 1997). The book could certainly be used in teaching as a companion text for courses ranging from second-year to Honours level in South Africa. In particular it would be ideal for an Honours level course on distributional theory but I am not sure whether any of our universities offer such courses. Certainly the book would be guaranteed to make such a course come alive! It is an excellent and intriguing text.

Linda Haines