for the maximal number of elements of admissible sets of a cyclic group Z_m ($2 \nmid m$) relative to another set $\{z\}$ ($z \in Z_m$).

Instead of sequences of form (1) or (3) consisting of elements of a group it may be of interest to consider sequences built up by semigroup elements. One semigroup of special interest is the semigroup B_Ω of all binary relations on a finite set Ω. Schwarz (1970) considers the sequence

$$\delta, \delta^2, \delta^3, \ldots$$

where $\delta \in B_\Omega$ and denotes by $k = k(\delta)$ the least integer such that $\delta^k = \delta^l$ for some $l > k$. He has given the best possible upper bound for $k(\delta)$.

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Book review

Concepts and Methods in Discrete Event Digital Simulation, by G. S. Fishman, 1973; 385 pages. (*John Wiley and Sons*, £8·75)

All but the most elementary of university lecture courses in any subject are likely to display the prejudices and interests of the lecturer in his selection of the material to be presented. The author comments that modelling, programming languages and statistical considerations all represent essential features of discrete event simulation and that the widely differing backgrounds of those teaching the subject has led to considerable variability in the range and depth of knowledge of those who claimed to have studied such simulation. This book aims to go to some depth in each of the three areas mentioned, but, just as lecturers have their views on orders of importance of individual topics, so do authors and even reviewers. Professor Fishman readily admits that he has gone much deeper into discussion of the statistical matters than he has of the modelling or the programming, believing that the average user of simulation is likely to be much more able to build a model and to program the simulation competently than he is to be in command of the not always elementary statistical techniques necessary to make efficient or even valid inferences from his simulation runs. He is surely right and would perhaps be right also if he were to assert that the modelling and programming were usually done acceptably because of the all too obvious catastrophic consequences if they were not. Indeed, if one were forced to adopt an extreme view point in an argument with one's colleagues to edge them towards an acceptable balance for a course, I believe that one could make a fair case for the proposition that if the statistical matters were right a pedestrian approach to the other bits would suffice. There will be horror stories about wrong models and about man- or computer-time wasted on a profligate scale by inept programming or language selection, but even if these pitfalls have been avoided, sometimes quite subtle ones can remain. Computer simulation has not had such a lengthy history as some of the other fields of the applications of statistics and the ardent simulators have not beaten a path to the consultant statistician's door as other workers have painfully learnt to do—although the same needs exist. So, for one prejudiced reviewer at least, the author has got his priorities right. Nearly two thirds of the book is taken up with statistical matters, the remainder being shared between a description of different sorts of modelling and an outline of some of the widely used simulation languages. The remainder deals at some length with random number and variable generation and with estimation, analysis and design problems. The complexities attendant upon the dependence of so many of the observations from model runs are not shirked and the reader is presented for example with results from spectrum analysis and from auto-regressive and moving average models. The array of techniques described is intended to equip the advanced student sufficiently well to enable him to overcome the great majority of the difficulties with which he will be faced in performing simulations, and the author has gathered together in this book material that would probably appear intermittently in two or three full lecture series on stochastic processes and the design of experiments. Whether this is alone sufficient to enable the reader to become expert enough in statistics or whether it is more than necessary to give him an awareness of when he needs to seek professional help are matters of opinion. The chapter on the generation of random numbers quotes both theoretical and empirical results on a variety of generation methods, tells of the methods of testing for acceptability and seeks to place the simulator on his guard against using any old algorithm that happens to have been provided. If anything I feel that the author has soft-pedalled too much here; one or two more of the nasty examples that have been reported in recent years would have left the reader with the impression (a correct one too, I believe) that even after he has worked hard to ensure that his generator is free from the most obvious causes of embarrassment to him in his simulation, it will still contain some nastiness of an obscure sort that will show itself at some inconvenient moment. The production of variates from stated distributions occupies one of the longer chapters and gives only methods that are theoretically exact—a rather out of character restriction considering the practical approach in the remainder of the book. A little roughness here would save some machine time even if not much, gain some programming simplicity and surely not yield anything in accuracy that had not previously been sacrificed by the decision to simulate. I felt that a description of Butcher's generalisation of the acceptance/rejection procedure could have allowed several of the special cases treated to be left as examples. But this is mere quibbling; overall the book is a useful one and a welcome addition to the bookshelf. What a pity it is, however, that publishers will enshrine their authors' works in durable paper and high quality binding which will preserve the book long after so much of the material has been superseded in a rapidly developing subject. Could they not learn a little from Detroit or Coventry?

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