tation fixed in an exchanging sequence and the EXCHANGE command was modified to allow this. As a result of the use of the system a significantly improved deterministic algorithm has been developed for the job-shop scheduling problem where the cost function is that of minimising the makespan of jobs upon machines. Interaction provided insight into the cost function and resulted in the discovery of improvements in lower bounds proposed by Lomnicki (1965) for a branch-and-bound approach. The lower bounds were strengthened and a slightly different branching mechanism, which exploited the structure of the problem, was adopted leading to a computationally feasible approach for moderately sized problems.

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Book reviews

Computer Programming in Algol, by J. D. Earnshaw and W. A. R. Blackford, 1970; 170 pages. (*Sir Isaac Pitman and Sons Ltd*, £1·40)

This is a Pitman Programmed Text, suitable for self instruction or for use as part of an elementary programming course for scientists at a college or technical school. The format of the book is the familiar format of a programmed text: some material is introduced; a question is asked on the material just introduced, or on earlier material; an answer is given. The validation report quoted in the introduction indicates that this text successfully fulfils its objective of teaching Elliott 903B ALGOL.

And this is my major criticism of the book. The authors admit that there are different implementations of ALGOL 60, and that their book attempts to teach the Elliott 903B implementation; but when the chosen implementation differs from the ALGOL of the Revised Report as widely as Elliott ALGOL does, there seems to be a good case for either teaching the language of the Report (or of one of the subsets defined in the document ISO 1538), or at least making very clear the points at which the language being taught departs from the standard.

To those people wishing to learn ALGOL for the 903B, this book can be recommended.

M. C. THOMAS (London)

The Settlement of Polynesia: A computer simulation, by M. Levison, R. Gerard Ward and J. W. Webb, 1973; 137 pages. (*Minnesota University Press; Oxford University Press*, London, £5·50)

The 'Polynesia problem', concerning the origins of the people of the Pacific islands and how they came to inhabit such a vast ocean area, has been a fruitful subject for academic speculation during the past 25 years. Information and ideas have been contributed by several disciplines, including archaeology, cultural and physical anthropology, botany and linguistics, but no general theory seems to offer the prospect of being adequately tested and so providing some resolution of the conflicting interpretations. In fact, one suspects that the fascination of these problems of early human history lies in the remoteness of any final answer.

In this book, two geographers and a computer scientist describe some work which, rather insensitively one suspects, attempts to answer one major question once and for all. It is unlikely that they will convince everyone, but they have obviously made a highly significant contribution to the general debate. Their question is, 'Could the Pacific Basin have been discovered and settled by drift voyaging, as some interpretations have suggested?' To supplement this, they also consider the likelihood of navigated voyages being responsible for the colonisation of some areas.

Their method is an ingeniously devised spatial simulation model of the geography and natural conditions of the Pacific. This takes into account the probability of drift voyagers experiencing different wind and current conditions at various times of the year, based on data for the last century; the likely speed capabilities of canoes and rafts under different conditions; the probability of survival over different lengths of time; and the conditions under which a destination island might be sighted and a successful landfall achieved. The computer simulation was used to reproduce more than 100,000 drifts from 62 starting locations, including some which were run in reverse from speculated landing points. A further 8,000 voyages were simulated which were assumed to have been intentionally guided according to fairly simple navigational rules. Thus the experiment had the advantage both of taking a synoptic view of an enormous area, and of reproducing a very large number of possible drift and navigated voyages. The results, of course, simply provide probabilities of contact between the island groups. In detail these are fascinating, and the general pattern which emerges is difficult to fault. Three regions can be identified; western Polynesia could have been occupied by island-hopping and drift voyages from the west, but much of the East Polynesia area of the central Pacific could not have been colonised in this way unless the eastern-most group, the Marquesas, was settled first. The outer arc of islands, including Hawaii, Easter Island and New Zealand, are most unlikely to have been settled by drift voyages. On the other hand, the simulations of navigated voyages confirm that purposeful crossings of all the major ocean stretches would have been possible with only limited degrees of navigational skill.

The construction of the model and its sources of data are lucidly explained in the text of the book, while useful appendices include computer-drawn microfilm maps of the 'drift fields' from different starting points and a a detailed listing of and commentary on the basic simulation program, which is in ICT Atlas ALGOL. The 'Polynesia problem', as the authors acknowledge, still includes many intractable questions, especially relating to the motivations of the voyagers in setting out. Nevertheless, the computer simulation has given us the first comprehensive view of what they were likely to encounter once the journey had got under way.

P. A. WOOD (London)