Rinnooy Kan. One of the most interesting results in this area is the fact that a very long list of classical combinatorial problems (including many which were born out of the management sciences) are reducible one to another, in that an algorithm for any of them which was efficient in a certain rigorously definable sense would make possible algorithms which were efficient for all of them. Research into questions of this nature is clearly very important to the production of effective computer programs for practical problems.

I imagine that most of the contributions to the study week were originally given in Dutch, but all the papers in the tract are in good readable English. The book is a trifle expensive for a softback. The individual O.R. practitioner is unlikely to want to buy it, but it would be a worthwhile acquisition for the departmental library.

R. A. CUNINGHAME-GREEN

Combinatorial Optimization

N. CHRISTOFIDES *et al.* (Editors)

Wiley, U.K., 1979. 425 *pp.* £18.50

"This book is based on a series of lectures given at the Summer School in Combinatorial Optimisation held in SOGESTA, Urbino, Italy, from 30th May to 11th June 1977."

As one would expect, the papers form a mixed bag both in quality and content. All the papers concern themselves almost exclusively with combinatorial optimisation problems which are NP-hard. Thus there are no papers dealing with problems such as assignment problems and spanning tree problems which are solvable by polynomial time algorithms, There are two papers on heuristics the rest being on branch and bound algorithms and/or the theory of cutting planes.

The first paper by R. S. Garfinkel is a reasonable survey on "Branch and Bound Methods for Integer Programming". There follows an excellent peper on "The Theory of Cutting Planes" by R. S. Jeroslow marred only by the fact that many important references are to research reports and thus not so easily obtainable. The next paper by C. Sandi on "Sub-gradient Optimisation" is very readable though short on references to recent attempts to improve the basic procedure.

We then find a short paper by P. L. Hammer and S. Nguyen on 0–1 programming. The idea is interesting but the notation used is rather cumbersome. We than have a good survey on the fast growing area of computational complexity and the analysis of heuristics by F. Maffioli.

The survey paper by N. Christofides on the travelling salesman problem is also good. We then find an excellent and extensive survey on the set partitioning problem by E. Balas and M. Padberg. The next paper by S. M. Korman on colouring the nodes of a graph is reasonable but would have been much improved by the inclusion of some discussion of heuristics.

The next paper by S. Martello and P. Toth is a thorough survey of the exact methods of solution to knapsack problems. We then have an interesting paper by G. Y. Handler on minimax network location. There is then a paper by N. Christofides *et al.* which is mainly concerned with heuristic methods for the vehicle routing problem. The next paper on loading problems is by the same authors. For their static problem they give a seemingly cumbersome algorithm for what could efficiently be solved as a generalised assignment problem.

There follows a nice paper on a 1-machine scheduling problem by B. Lageweg *et al.*, which shows the efficacy of a simple rule for "inverting" the problem. Finally we have papers on crew scheduling by F. Giannessi and B. Nicoletti and on crew scheduling and foreign exchange dealing by N. Christofides *et al.*

In summary, the book is worth ordering for a library but less so for personal use.

ALAN FRIESE