Briefly, the paper defines a matrix where the rows represent system features and the columns, users' criteria. Two appendices accompany the paper and each appendix gives a brief explanation on each feature or criterion, respectively. The matrix is a ternary-value matrix where each element is either positive (+), negative (—) or zero (.), depending on whether the possession of a particular feature has an adverse, beneficial or null affect on the corresponding criterion.

Attempts to attach quantitative values to the individual elements of the matrix were abandoned as being too controversial, but the user is encouraged to attempt his own quantitative assessment if he so desires.

Conclusion

Those most immediately concerned with the development of computer languages are, of course, the major commercial users like the government who have a large number of programs distributed across a wide variety of machines and are faced with the problem of transferring these programs from one machine to another, but there are a large number of other users who have been content to stand on the side lines and watch the progress of these languages while taking little active part in their development.

This is a perfectly understandable attitude to take while the situation remains comparatively fluid, but there comes a stage, which has now been reached, when most of the major ground-work has been completed and further development can only come from widespread field trials. It would be encouraging if, in the future, users were prepared to lend support to these techniques which can only be to their eventual benefit.

Reference

Requirements for Programming Languages (1964) ECMA/TC2/64/11. (Obtainable from E.C.M.A., Rue d'Italie 11, Geneva, Switzerland.)

Book Reviews

Progress in Operations Research, Vol. II, edited by DAVID B. HERTZ and ROGER T. EDDISON, 1964; 455 pages. (London and New York: *John Wiley and Sons*, 84s.)

One would not expect this to be a treatise on computers, and yet there are so many points of contact between the worlds of Operational Research and computers that it is surprising to find only infrequent examples referred to. For a student of computer applications, however, these accounts of O.R. in all the major areas of business management and industry have a great deal to offer, not so much because O.R. is itself demanding more and more from computers, but because their use in business can be relatively ineffectual without the O.R. approach to management problems.

Not unexpectedly, simulation by computer appears in several contexts, and is clearly responsible for much of the contact between O.R. practitioners and computers. Unlike the first volume in this series, however, this is not a book on techniques, and the substantial variations which exist among simulation techniques and procedures are not discussed here.

The editors, prominent in O.R. on either side of the Atlantic, present in this volume contributions from the United States, United Kingdom, France and Canada. The early chapters deal with several classes of problem which arise in most organizations, while the remainder of the survey is of applications of O.R. in Government and in several industrial groupings. Inevitably, some authors have found it difficult to produce an international balance in the content of their papers, but there are extensive bibliographies.

Those not already familiar with Operational Research in this country should not assume too readily that the counterpart of all the American work that is mentioned can be found here in Britain, nor *vice versa*. In particular, it is distressing to find in one contribution from the U.S. a tribute to managements who use inventory simulations to "make their inventories a truly effective competitive weapon against labor, vendors, and other industries." Fortunately, evidence abounds elsewhere that O.R. is playing a more responsible role than that.

D. G. OWEN

Perspectives in Programming, edited by R. T. FILEP, 1963; 324 pages. (London: *Collier-Macmillan Ltd.*, 45s.)

This book is a collection of papers presented at seminars in American Universities during 1962. Despite this, the material has been collected together in a commendable way by Mr. Filep so that it falls naturally into sections, and consequently it is possible to read the text more as a book than as isolated descriptions of various aspects.

The first reading of the book left me with a considerable appreciation of the enormous amounts of money and resources which must be ploughed back into education both in the technologically advanced and in the emerging nations (an excellent contribution by Komoski). Any educationally viable system which can increase productivity in education must be welcomed; and it is hard to understand much of the opposition in this country to programmed learning in general, and teaching machines in particular, which appears to be based on very flimsy knowledge. Whilst there is no panacea for this demand for education, anything which can contribute towards its satisfaction is worthy of consideration, and this book can be used to introduce many people to this type of instruction.

The book starts with four papers setting out the basic facts and arguments concerning programmed instruction—and anyone who has never even heard of Pressey or Skinner can start quite happily at the beginning of the book. The

(*Continued on page 20*)

```
    if x > y then x := y else go to BETA2;
    if p[i] = 0 then begin im := j; jm := i; go to
      BETA2; end
    im := i; jm := j;
BETA2: end k
d[jm] := x; p[jm] := im;
end
```

This procedure is computationally less efficient than the method for directed networks because the whole array $r[k]$ must be scanned for each node labelling.

Memory requirements

We shall now give the memory requirements for networks which have n nodes and m arcs. We shall also give the approximate storage needs for such road nets where there are, on average, four two-way roads on each intersection, the number of nodes being n. We suppose that we are using a variable word-length machine where lengths of $r[i]$ and $d[i]$ are R and D, respectively, the length of the indices being X. Then the storage requirements, in characters, are:

General networks

Method (a): $(D + 2X)n + (R + X)m$
Method (b): $(D + X)n + (R + X)m$

Road networks

Method (a): $(D + 4R + 6X)n$
Method (*b*): $(D + 2R + 3X)n$.

If for example $D = 6$, $R = 4$ and $X = 3$, the storage requirement for road nets would be, for Method (b), approximately $23n$ characters. Consequently we can handle, for example, in a 12K IBM 1401, without difficulty, a road network with 300 nodes.

Reference

DANTZIG, G. B. (1963). *Linear Programming and Extensions*, Princeton University Press.

Book Reviews (*Continued from page* 12)

second section will interest those engaged on programming, and is notable for a paper by Crowder. The third section deals with the impact on schools, and is of interest to educationalists. The fourth section includes a curious mixture of technology in education, education of technologists, and the market for teaching machines. It is in this section, in a paper by Finn, that the only direct reference is made to computer-based teaching-machine systems. The last section deals with an assessment of the situation as it stands, and a review of research and development.

In short then, I like this book for the many facts (one or two seem very surprising) it contains and for the most readable presentation; it is recommended for anyone wishing to become acquainted with programmed instruction. For the computer man, however, there is very little, unless, of course, he is also concerned with teaching. And is there not a field which must be explored very, very soon in this country for the adequate and substantial use of programmed instruction for instructing programmers?

O. B. CHEDZOY

Principles of Tunnel Diode Circuits, by W. F. CHOW, 1964; 387 pages. (London and New York: *John Wiley and Sons*, 94s.)

The tunnel diode was first introduced about six years ago, and has now had time to find its place amongst other devices available to the engineer. This fact is reflected by the careful way the content of this excellent book has been considered. The author has applied his wide experience of circuits and semiconductors to give a comprehensive and authoritative description of the principles of tunnel diode operation, and of its uses in both linear and non-linear circuits. It is written in a lucid style which makes it understandable to the newcomer to the field, yet each topic is treated thoroughly, and to a depth which should interest the more advanced reader.

After the first two chapters, which deal with the physics of the device and with its electrical characterization by equivalent circuits, the book divides roughly into two sections. The first section deals with the application of tunnel diodes in amplifiers, converters, detectors and oscillators, and the second with digital applications. Particular stress is laid on the noise properties in the section on amplifiers, since it is as a low noise microwave amplifier that the device finds a major application. Other particular subjects of interest include stability criteria for various forms of amplifier. The treatment is mainly theoretical, but the topics covered relate to considerations which arise from standard circuit arrangements, of which many examples are given.

About half the book is devoted to high-speed switching applications of tunnel diodes. The basic switching dynamics are explained in terms of a piecewise-linear equivalent circuit, which allows the switching cycle to be split into several sections, the effect of circuit parameters in each section being readily calculable. For instance, it is easy to calculate the effect of trigger magnitude and duration on the rise time of a circuit by this means. Many examples are described of systems of logic, etc., using tunnel diodes as the only active element, and the effects of parameter tolerances and the limitations imposed by the bilateral nature of the device are analyzed in some detail. There is also a chapter on hybrid circuits which use transistors as isolating and amplifying units, and others which use charge-storage diodes.

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