much fuller treatment of terms and techniques and more detailed discussion of the implications of the various models introduced.

Neither of the above criticisms can be directed at *An Introduction to Spectral Analysis*. This excellently written monograph will be welcomed by students and teachers as both a classroom and a self-study text. The writer has spared no pains to help the beginning student feel his way over unfamiliar ground, the text being supported by good diagrams and exercises with complete solutions. Other valuable features include a definition list for all symbols appearing in the text, and a fifteen page bibliography with a partial cross-classification of bibliographic references by subject. The monograph has been developed from course material taught by the author and has clearly benefited from this.

The first chapter provides a brief historical introduction to the subject, and emphasizes the distinction between the discrete and the continuous spectrum. In Chapters Two and Three, the basic trigonometric functions and relationships are revised and the elementary process of Fourier or harmonic analysis is explained. This technique, however, is inadequate for most applied work where large quantities of data are involved. In Chapter Four, the complex number representation of the Fourier series is introduced and the operation of the fast Fourier transform is described in detail. The next three chapters deal with the problems involved in estimating spectral densities for nonperiodic data, and include brief discussions of filtering and the problem of aliasing. The remainder of the book is devoted to cross-spectral analysis, that is, to the relationships between two series, and to the application to two-dimensional data sequences.

The introduction of the fast Fourier transform algorithm by Cooley and Tukey in 1965 gave impetus to the application of spectral analysis in those fields where large bodies of data must be processed. Prior to this, excessive computing time had posed a severe problem, but by reducing the time required by a factor of one hundred in typical cases, the alogrithm has removed this restriction. Rayner's book comes as a timely and valuable introduction to the field and will be welcomed by students in geography and regional science as a bridge to the wide theoretical and applied literature being developed. The examples of applications to topographical smoothing and to the analysis of drainage patterns given in the last chapter serve to indicate the range of potential uses in spatial analysis.

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REFERENCES

[1] Carson, M. A. *The Mechanics of Erosion*. London: Pion, 1971.
[2] O'Riordan, T. *Perspectives on Resource Management*. London: Pion, 1971.

Combinatorial Programming, Spatial Analysis and Planning, by Allen J. Scott. London: Methuen, 1971, x + 204 pages.

It is not easy to devise a succinct definition of this book's material; like so many things it is best defined by the items within it. The title of the volume bears this out; only by combining three necessary conditions can it reach suffi-

ciency. Alternatives spring to mind, such as "spatially structured problems in operations research," but do not roll off the tongue.

A number of the management problems falling within the field of operations research can be structured spatially, and directed to the planning of location. Scott's book brings these problems together for the first time: the shortest path, travelling salesman, optimal network, transportation, location-allocation and many more. The solutions to all these problems of optimal spatial organization are limited by ingenuity and computer size and speed. As cleverer methods are devised, and bigger computers made available, solutions can be extended to larger and more complex problems. So the book is very much a review of the state of the art, defining the problems and assessing the power and limitations of the methods currently available for their solution.

Generalities do exist in this rather pragmatic field: there are several fundamental solution procedures which can be applied to appropriately structured problems. These are reviewed in the first few chapters. The discussion and exemplification are excellent. The book is not at all mathematical: although symbols appear, they are used only for definition and never manipulated.

The chapters on general solution procedures are followed by a review of specific problems. Two chapters are devoted to location-allocation systems, which have received a great deal of interest in recent years, and which really form a distinct set of uniquely spatial problems outside the mainstream of operations research.

The book is very readable. This is fascinating subject matter, and the prose is a masterpiece of clarity and completeness. It would be an ideal course text. While no prior familiarity with calculus or the principles of operations research need be assumed, a fairly advanced level course would seem most appropriate in view of the depth of discussion.

Some of the wider human issues surrounding this very technical subject are raised in the last chapter, but the most important one is not really answered. Combinatorial programming is at all times a compromise between the need to solve large scale planning problems, with real objectives on the one hand and computational costs and fast data storage limitations on the other. But the digital computer is notoriously inept in two-dimensional processing problems, and one is bound to ask whether the planner can be offered much net reduction on the cost of his own intuition. Schneider [1] has published the results of some experiments along these lines.

There is obviously no answer to the question, but three important arguments on the issue come out in the last chapter. First, the costs of the computation itself can be incorporated as an objective element of the larger problem, and the question of objectivity versus intuition evaluated objectively. Second, the present state of the art is indeed limited, but progress will be steady towards solutions to more and more complex problems. Third, any choice between objective and intuitive planning certainly should not be made on the basis of cost alone.

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