Book Review

An Introduction to Mathematical Taxonomy. G. Dunn and B. S. Everitt. Cambridge University Press, Cambridge, 1982, ix + 152 pp., \$29.95 hardbound, \$11.95 paperbound.

This is an exceptionally clearly written book which combines readability and continuity of argument with an amount of detail impressive for its short length, and with only very minor reservations it can be strongly recommended as an introduction to mathematical taxonomy for readers with little mathematical background.

The book gives a very clear account of the reasons for using numerical, as opposed to traditional, methods of classification (with appropriate cautionary notes), and it sets out to describe the operational stages of quantitative taxonomy: (i) deciding what objects (called operational taxonomic units [OTUs]) to classify; (ii) selecting the characters by which the OTUs are to be described; (iii) computing a measure of similarity between every pair of OTUs; (iv) from the similarities, forming (generally hierarchical) groups or clusters of mutually related OTUs by one or another technique of cluster analysis. Although measures of similarity between OTUs have a central place in the subject, it will probably not be obvious to readers why the numerical taxonomic process has to go via the explicit computation of similarities, i.e., why there has to be a separate stage iii. A few words of explanation here would have been helpful.

The remaining chapters deal with taxonomic characters (their selection, types, and homology), the measurement of similarity, principal components analysis, multidimensional scaling, cluster analysis, identification, and the construction of evolutionary trees. This seems to be a very sensible choice of central topics. It is particularly useful that identification is well covered. This subject (the assignment of an unknown OTU to a group which may have been formed as a result of a prior cluster analysis) is, after all, perhaps the prime application of cluster

analysis. One small point: it is not clear from reading the book why the chapters on principal components analysis and multidimensional scaling come before the chapter on cluster analysis, thereby interrupting the sequence of the four stages of quantitative taxonomy mentioned above. Also, one regrettable omission is a short chapter on actual taxonomy computer program packages.

The descriptions of the methods and their motivations are very clear indeed. Special praise for clarity goes to the descriptions of principal components analysis, Bayes's formula for identification, discriminant analysis, and canonical variate analysis. The authors keep the mathematics to a bare minimum. Thus, even in the few places where matrix operations are used (for example, in canonical variate analysis), the drift of the argument can be followed without understanding the mathematical details, and those details are not required later in the book.

One particularly helpful aspect of the book is a description of the insight that can be obtained by using more than one method (for example, a two-dimensional canonical variate plot and a minimum spanning tree).

Occasionally the references are not as up to date as they might be (for instance, on the topic of comparing classifications), but on the whole the references have been well chosen to give readers an entry into the literature.

Overall, the book lives excellently up to its title, as an introduction to mathematical taxonomy. It does not pretend to cover the wealth of detail to be found, for example, in *Numerical Taxonomy* by P. H. A. Sneath and R. R. Sokal (1973) and the many subsequent papers on the subject.

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