as well as pairs of independent points, the equations resulting from almost all of his class membership or class separation criteria would have simplified enormously and been capable of *simple explicit solution.* As it is, they are hanging on the brink of multiple degeneracy and, presumably, numerical instability. This applies particularly to the transformation for improving the separation of two classes (pages 40–42), which is left to be determined by the numerical solution of the eigenvector problem for a matrix pair.

These same Chapters 2 and 3 are, furthermore, sprinkled with a number of false statements, whose nature indicates that the author simply had not assimilated all he had crammed from some algebra text. In at least one place (middle of page 46) he finds himself in a bind and resorts to sheer bluff.

Unfortunately, there is not room enough in a review such as this to present all the evidence to support the preceding comments. To do so properly would involve rewriting the two chapters in question. This really should have been done, with competent coaching, of course, before the book was accepted for publication. To the prospective user of this book the reviewer's advice is, "Caveat emptor!"

On the conceptual side, there is a point which should be brought out: in setting up his class membership and class separation criteria, the author has made use of only a small part of the information about a set of points which is contained in the covariance matrix associated with the set, namely, the trace of this matrix, which is the variance of the set. There are N-1 other parameters, the remaining coefficients of the characteristic equation, which also have geometrical interpretations as mean-square areas of triangles formed by three points, mean-square volumes of tetrahedra formed by four points, and so on. Alternatively, there are N eigenvalues whose sum is the variance of the set. Certain well-known symmetric functions of these are again the coefficients of the characteristic equation. Surely, the information contained in these other parameters ought to be usable in building sharper criteria for determining class membership.

An interested reader will probably find, as the reviewer did, that studying this book is a rewarding experience. Perhaps its greatest contribution lies in the stimulation of further research.

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92[Z].—Thomas C. Bartee, Irwin L. Lebow, & Irving S. Reed, *Theory and Design of Digital Machines*, McGraw-Hill Book Company, Inc., New York, 1962, ix + 324 p., 23 cm. Price $11.50.

This is a senior or first-year graduate level introductory text on the logic design of digital machines. It does not cover electronic circuit design, components, programming, or arithmetic algorithms, and it discusses numerical representations only briefly in an appendix.

For the purposes of this book, a digital machine is viewed as a system of registers that store binary scalars or vectors and associated combinational switching circuits that produce binary scalar or vector functions of the contents of registers. The basic process is the transfer of the contents or a function of a register into another register. Functionally the machine is completely described by a list of all possible transfers, with the timing and control signals on which they occur. "The design process is then divided into three phases: (1) the system design, which sketches in the general configuration of the machine and specifies the general class of hardware to be used; (2) the structural design, which describes the system in terms of transfer relations; and (3) the logic design, which realizes the transfer relations by means of Boolean equations." This design method is developed largely by examples in five chapters, which include descriptions of a simple general-purpose computer, a radar data digitizer, and a digital differential analyzer.

Five chapters comprise an introduction to switching theory. One introduces Boolean algebra informally by the method of perfect induction, while another develops it axiomatically via Boolean rings and fields. One on minimization techniques describes the Quine-McCluskey method and extends it to multiple output networks. Sequential machines of the Moore and Meahly types are described by flow tables and state diagrams. In the last chapter, flow tables are reduced by merging equivalent or compatible states and a final section is devoted to Turing machines.

At the end of each chapter is a set of problems and a usually extensive bibliography that will lead the reader on to topics not covered in the book.

This very readable book presents probably as uniform and systematic a technique as has been devised for the design of digital machines; though, of course, a host of system design considerations lie outside the scope of the method.

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93[Z].—Bernard A. Galler, *The Language of Computers*, McGraw-Hill Book Company, Inc., New York, 1962, x + 244 p., 23 cm., Price $8.95.

The reviewer must confess to a certain excitement as he first opened this book. What could be *the* language of computers? As it turns out, the choice of the title can only be laid to literary license, perhaps with the marketplace in view. How else could one account for the page headings opposite one another on pages 196–197: "The Language of Computers"—"Other Computer Languages"? So let us be honest at the outset and recognize that this is a book written to promote a particular computer language, namely, MAD.

The author has written "for the person who is interested in learning how problems are solved on electronic computers." To achieve his purpose, he has organized the body of the book into cycles consisting of the formulation of a problem, the development of an algorithm for solving the problem, discussion of the special linguistic requirements imposed by the algorithm on the programming language that is being used (essentially MAD), and finally, as the culminating phase, the display of a program in MAD that effects the desired solution. By this procedure the introduction of the various features of the language takes place in a natural and persuasive manner, and the student gains practice in the mode of thinking that one must adopt in order best to exploit the contribution of the computer.

Somewhat different critical standards must be used to measure those portions