

with its own 1 μ sec memory. Finally, the book concludes with Chapter 17, a discussion of non-arithmetic data processing, i.e., byte streaming through the table look-up, statistical aid, and adjustment units of the 7951 auxiliary computer to the 7030 STRETCH. With tape units furnishing up to 140,000 64-bit words per second, a rate of approximately 3.3 million bytes per second is achieved for merging, sorting, searching, or file maintenance.

In summary, a wealth of information, a candid view of practical solutions to grand concepts, and an insight into the philosophy of large computing machine design are all to be found herein. It is a readable and highly worth-while book for those whose interest in computers extends beyond the "where" and "when" to the "how" and "why" they are what they are!

HERBERT M. ERNST

Applied Mathematics Laboratory
David Taylor Model Basin
Washington, D. C. 20007

89[Z].—S. WINOGRAD & J. D. COWAN, *Reliable Computation in the Presence of Noise*, M. I. T. Press, Cambridge, Massachusetts, 1963, xiv + 112 p., 24 cm. Price \$5.00.

Reliable computation in the presence of noise, meaning errors in the machine, is a problem of increasing interest as we come to depend more and more upon computers which we are not in a position to repair immediately.

The authors consider not only the construction of reliable machines from unreliable components, but also the effects of errors in the basic wiring. The treatment is mathematical and reasonably precise as opposed to past speculations by philosophers on these matters.

Behind all the search for a theory to enable us to construct reliable machines is the fascinating fact that we ourselves seem to be constructed with an unreliable nervous system whose individual components seem to die at a surprisingly high rate. We are each of us apparently a living proof that reliable large scale operation can be achieved from unreliable components, and it naturally is of considerable interest to us to learn about possible models of how we might be constructed. The authors wisely refrain from too much premature speculation in this area, but almost every reader will do his own anyway.

R. W. HAMMING

Bell Telephone Laboratories
Murray Hill, New Jersey