to be expected from changing the job characteristic $\frac{m_0}{m_1}$: in particular cases it will be possible to predict how this changes with varying buffer sizes from a knowledge of device characteristics, and to use the simulator results to maximise throughput. Perhaps operating systems might be enhanced by the provision of facilities to permit tuning of this type to be performed by the system manager.

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Appendix 1 Timing characteristics of some movable disc head devices

	Average time in mSecs		*Transfer rate*
	Seek	*Rotational delay*	
(*a*) ICL-EDS/60	35	12·5	307000 ch/sec
(*b*) UNIVAC-8414	60	12·5	312000 ch/sec
(*c*) UNIVAC-8430	27	12·5	806000 ch/sec

If a 128 word buffer is used we have:
Transfer time for (*a*) is 1·67 mSecs i.e. 3% of the total
„ (*b*) is 2·46 mSecs i.e. 3% of the total
„ (*c*) is 0·95 mSecs i.e. 2% of the total

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Book reviews

Computers in Language Research, (Trends in Linguistics. Studies and Monographs, 5) by W. Sedelow, 1979; 223 pages. (*Mouton Publishers*, £19·10)

This volume, the fifth in an excellent and noteworthy series, is a collection of four papers on the subject of symbol recognition and generation—the fundamental tasks of language. The first of the papers, by W. S. and S. Y. Sedelow ('Graph theory, logic and formal languages in relation to language research'), is an introduction to the other offerings: it presents in a mainly clear and concise, though occasionally prosaically abstruse, fashion an overview of this field of research.

S. E. Goodman and S. T. Hedetniemi ('A descriptive introduction to graph theory and some of its applications') give a clear, thorough and self-contained exposition of this fundamentally important topic: Graph theory is crucial to the understanding of computers and language, since it provides what is perhaps the only presently feasible way to approach the symbolic structures involved in both.

The final two papers in this volume are, I feel, important pieces of work and, in a real sense, provide the 'meat' of this collection. D. B. Benson ('Formal languages vis-a-vis "natural" languages') offers us a study of, and clarification of the research done in, the theoretical issues implied by a formal approach to the analysis of language. The author concentrates his attention on 'natural' language understanding systems (by 'natural', he means that language which computer programs accept and which represents some portion of the natural language used as the command language). Graph theory is the foundation of Benson's arguments: certain forms of directed graph form the basis of rewriting systems which, in turn, are the basis for the grammars of formal languages. Benson leaves us with the conviction that context free grammars promise to be the most rewarding area for future study.

The final paper, by H. C. Bohnert and P. O. Backer ('Automatic English-to-logic translation in a simplified model. A study in the logic of grammar'), attempts, again, to show that symbolic logic is the most appropriate fundamental for the logico-semantic analysis of language and the authors present what some may see as a long-awaited scientifically adequate approach to the study of language. While simultaneously evaluating the role of computers in this field, Bohnert and Packer would appear to have discovered a language independent grammar (they assert that there exist for every language certain basic communicative tasks which are independent of any language in detail, but which each language must learn how to do): this grammar functions in a deep-to-surface mode—a model which is, I feel, for this reason against much current research. Like the other offerings in this collection, this paper benefits from a lucid and simple presentation.

On the whole, the collection is a valuable piece of work, but particular claim may be made for the final two papers, which, besides all else, serve the eminently notable purpose of showing up areas of research for the future. A further point in favour of this volume is that the last three papers end with ample bibliographies for work in each area of study. Perhaps the only problem which I encountered is that of the anticipated audience: it is most obviously a review of current research, not, apart from the paper by Goodman and Hedetniemi, an introduction to the methodology as such. Thus, I feel sure, while it contains much for those familiar with this area of study, the casual reader will experience difficulties with some of the detailed expositions. With this sole caveat, I have no hesitation in recommending this collection to all those involved in linguistic research of whatever kind.

IAN MARRIOTT (Oxford)

Digital Systems: Hardware Organisation Design by Frederick J. Hill and Gerald R. Peterson, 1978; 707 pages. (*John Wiley*. £15·75)

Despite the authors' appeal to computer scientists and systems programmers, this is a book for the serious student of computer engineering. As a comprehensive text supporting an integrated course of undergraduate lectures, seminars and laboratory experience, the book scores well. However, the practising engineer is likely to be confused by the detail and lose sight of the objective of such courses, which is to impart the fundamental principles of complex digital system design.

To strike a balance between the hardware and software components of computer systems, the authors have made extensive use of two instructional vehicles. The first, a simple computer based on the PDP-8, supports study of memory, registers, gates, busing and interfacing techniques. The second, A Hardware Programming Language (AHPL), based on Iverson's APL, supports study of register transfers and control sequences. Interestingly, this approach is extended to cover a wide variety of computer architectural techniques. Oddly, the text is further lengthened by a rather straightforward description of the Motorola 6800.

Before purchasing this book, the wise reader would balance the effort of a detailed study of the PDP-8 and APL programs against its value to a career in digital systems design. The more spendthrift reader may purchase the book as a rather out-of-date reference for those few times when such detail is helpful.

R. M. LEA (Uxbridge)