without having to recompile the outer blocks. (The only corrections to which this method can be applied involve no changes in declarations or labels, although labels can be accommodated by the suggestion above, of treating them like a switch list.)

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Book Review

Extended Mercury Autocode (EMA) for I.C.T. Atlas and Orion Computers, I.C.T. Ltd., 68 Newman Street, London, W.1 (199 + liv pages) 25s.

Readers and subscribers to this *Journal* who received the first two volumes will remember the original contributions by Mr. R. A. Brooker and others of Manchester University in 1957/59 to the development of autocodes for the Ferranti MK 1 and Mercury computers. Further contributions have been made by other Mercury users particularly at CERN Geneva, AERE Harwell, University of London, R.A.E. Farnborough, and the Ferranti programming development group taken over by I.C.T. in 1963. EMA is thus possibly in wider use in European scientific computing centres and industrial research establishments than many other programming languages. As a language which is problem-oriented it can be taught to G.C.E.-A level students in three days: programs are written in algebra, without the stilted English of certain other programming languages. It preserves sufficient contact with the organization of a computer with two-level store and magnetic-tape backing, to form a good fundamental course for selection of programmers to be trained in basic machine code, in which case the EMA course can usefully be extended to occupy five days with exercises.

Compilers are already available for Mercury, Orion, Atlas 1 and I.C.T. 1101/1301 computers and will be made available for the I.C.T. 1900 series: for the smaller machine configurations, facilities are restricted, but on the larger machines there is available 5/7-track paper-tape input and output, magnetic-tape backing store, lineprinter output and punched-card input. With a tape-editing set costing between £700 and £2500, any research, engineering or statistical department can prepare its own program and data tapes, hire time on an Atlas or Orion prepared to offer a 24-hour turnround, and receive back its results in tape form making multiple copies locally. Many such centres have Telex or other data-transmission facilities. Thus EMA is already a live and fully-developed European programming language, useful also for basic training in computer work. I.C.T. (the publishers) are prepared to offer the manual at a discount for use on approved programming courses.

The manual consists of seven sections. The first contains an introduction to digital computers, program layout, arith-

metic operations with floating-point variables and integers, jumps and loops, input and output orders, text output, and the use of subroutines. Section 2 deals with more advanced subroutines and routines containing several chapters, dumping of integers and variables in backing store, manipulation of characters and tables, selection and relinquishing of input/output channels on multi-programmed installations, and the use of magnetic tape. The third section deals with such specialized features as integration of differential equations, the more common matrix operations, generation of pseudo-random numbers (normal or rectangular distributions), complex arithmetic, double-precision arithmetic and logical operations (e.g. counting bits and masking out packed data).

Section 4 covers preparation and development of programs, layout of input documents and paper-tape input/output or line printer. The *load and go* and the *compiling/running* alternatives are outlined and the monitoring facilities are described: these are so extensive that a program usually runs at the second attempt if not the first, producing some results, even if these fall short of or exceed the programmers expectations! Query and trace printing are available for following the path of calculations which misfire.

Sections 5 and 6 are devoted to the use of Atlas and Orion, including the incorporation of basic machine-code routines and other facilities peculiar to each computer. The Autocode List Processing facilities, described by D. C. Cooper and H. Whitfield in 1962 for the CHLF 3 version of Mercury Autocode (*Computer Journal*, Vol. 5, pp. 28–32), are available on Atlas. On Orion, programs can be compiled in parts and extra chapters incorporated: this has been found to be a useful feature in certain statistical programs, e.g. regression analysis, where the development of a comprehensive procedure naturally falls into several stages (chapters).

Section 7 and the Appendices include an alphabetical check list of permissible order formats, summarised programming information and an index. At a time when there is so much ill-informed or misguided newspaper comment about software facilities not being available for British computers on time, it is pleasing to report that the compilers for EMA on the machines described in this manual are fully developed, subject only to minor diversions from mispunched tapes, which are being methodically cleared.

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