minated in two attempts. The program compiled in ten seconds, performed two sorts and one "look up" pass on three thousand 80-character items in about four minutes, and then proceeded to print the report at almost maximum printer speed. The last five programs that the author has written in the CRESTS language have all worked first time, all having been written in an afternoon.

Acknowledgements must be made to Honeywell software. The entire system of tape handling is under control of the tape control package—the speed of the system is due to its simple facilities for time sharing, and its flexibility has made it very easy to use in the design of the CRESTS system.

The system is operated through the Honeywell "MOD1" operating system, facilitating the use of other software (for example, the SORT function) within the system, and ensuring the compatibility with all standard forms of input/output.

Book Review

Mathematics and Computer Science in Biology and Medicine, edited by the Medical Research Council, 1965; 311 pages. (London: *Her Majesty's Stationery Office,* 60s.)

In recent years there has been tremendous activity all over the world in the application of computer techniques to medicine, and the only surprising thing about it, now that the various types of application are becoming apparent, is that it did not start sooner. Part of the reason is undoubtedly due to the fact that the medical profession is not very numerate in its training and outlook (though this is changing) and therefore there was little initiative from within; whilst part of the reason at the time was probably due to the fact that medicine is hallowed ground for most outsiders (though this is changing too). Anyhow the barriers have now been breached and there is an increasing interchange between doctors and computer scientists, which has already begun to produce useful medical computing procedures.

In view of this, the belated initiative of the *Medical Research Council,* in conjunction with the *Ministry of Health,* to hold a symposium on the subject at Oxford in July 1964 was salutary, and the *HMSO* publication fifteen months later at 60s. is an interesting and useful document, marking as it does the Establishment's official interest in these developments which other governments (notably American, Scandinavian and Japanese) have been financially supporting for some years. The symposium was opened auspiciously with Sir Harold Himsworth on behalf of the *MRC* saying that we were "entering a new era of feasibility," and Sir George Godber on behalf of the *Ministry of Health* remarking that "the possibilities are boundless."

The automatic data-processing of hospital medical records was the subject of a number of papers and it drew attention to the possibility of extracting better and more up-to-date information for medical management of hospital activity, as well as providing more informed criteria for allocating limited national resources, and also facilitating epidemiology and other researches into morbidity. There is no reason (other than lack of awareness) why all these useful applications could not have started ten years ago. Under the heading of records linkage the wider opportunities for integrating information on all citizens from birth, marriage and death records, general practitioner records, hospital and school health records, and so on, were discussed together with the numerous benefits that could accrue to health administration and research in many fields if this were accomplished.

Computer diagnostic procedures were discussed in another group of papers covering the various approaches through probability theory (the fashion, if not the justification always,

is Bayesian), numerical taxonomy and discriminant and multivariate analysis, though this subject still suffers from the tendency to find procedures which will enable the computer to compete with the clinician, rather than (more usefully) efficiently retrieve relevant syndromes and treatments which would enhance the basis on which (still) human decisions are based.

Pattern recognition procedures were discussed in the context of the computer analysis of continuously recorded data such as that provided by electrocardiographs and encephalographs (Byford's paper is of particular interest), and mention is made of its application in computer-assisted surgery. The computer undoubtedly has a very useful role to play in this area, particularly in detecting patterns and tendencies in data collected by patient-monitoring apparatus. At the present time there simply aren't sufficient nurses to provide the 24-hour surveillance of all those patients who require it, and if there were it would not be as economic or effective as computer-assisted surveillance.

Nevertheless this area of computer application made rather less impact than "two dimensional pattern recognition" of the type described in a most interesting paper by R. S. Ledley of America. He described the scanning of photomicrographs (of chromosomes) by a device which in $\frac{1}{4}$ second divided the picture up into 350,000 parts assigning a level of 1 in 7 to each. These "bits" of information are transferred to the computer store and then subjected to a procedure (pattern recognition program) which groups, counts (and eventually perhaps) detects abnormal chromosomes. This technique could be of tremendous benefit if it could be adapted to automating the cytological examination of cervical smears, but (although the *MRC* has decided to start with such a difficult task) it is most unlikely to succeed quickly or cheaply, if at all.

Other papers discuss computer-assisted calculations in the application of mathematics and statistics to epidemiological and therapeutic studies and to the study of biological structure and function.

Useful though this document is, it by no means reflects the work done in medical computing in this country, but this is remedied by another report (of 80 pages) entitled *Progress in Medical Computing 1965* which came out a month earlier than the *HMSO* report and describes a conference held in London in June 1965. Costing only 12s. 6d. (from the *Medical Automation Unit* at *University College Hospital, London*) it contains fourteen papers describing medical data-processing work undertaken by U.K. clinicians and medical scientists who presented the papers.

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