Exclusive OR	EOR	YES	YES	D := D 'Exclusive or' A.
Load capability	LC	YES	NO	Capability Register D: loaded with the capability specified by A.
Store capability	SC	NO	NO	Capability Register D is stored in location A.
Call	CALL	NO	NO	Sub-routine call.
Return	RET	NO	NO	Return from subroutine.
Change process	CHP	YES	NO	Switches context by dumping the current contents of all registers, reloading them from the indicated block in store.
Load capability pointer	LDP	YES	NO	D := Pointer associated with A.

References

AGNEW, P. W., FORBES, R. E., and STIEGLITZ, C. B. (1967). An Approach to Self-Repairing Computers, *Digest of the First Annual IEEE Computer Conference*, Chicago, Illinois, Sept. 16-C-51, pp. 60-63.

BENNETTS, R. C., and LEWIN, D. W. (1971). Fault Diagnosis of Digital Systems—A Review, *The Computer Journal*, Vol. 14, No. 2, pp. 199-206.

CARTER, W. C., BOURICIUS, W. G., JESSEP, D. C., ROTH, J. P., SCHNEIDER, P. R., and WADIA, A. B. (1971). A Theory of Design of Fault-Tolerant Computers Using Standby Sparing, *International Symposium on Fault-Tolerant Computing*, IEEE Computer Society, March, 71C-6-C.

CHANG, H. Y., MANNING, E. G., and METZE, G. (1970). *Fault Diagnosis of Digital Systems*, New York: John Wiley & Sons.

HARDIE, F. H., and SUHOCKI, R. J. (1967). Design and Use of Fault Simulation for Saturn Computer Design, *IEEE Trans. on Electronic Computers*, Vol. EC-16, No. 4, pp. 412-429.

MANNING, E. G. (1966). On Computer Self Diagnosis, Pts. I and II, *IEEE Trans. on Electronic Computers*, Vol. EC-15, No. 6, pp. 873-890.

MANNING, E. G., and CHANG, H. Y. (1967). A Comparison of Fault Simulation Methods for Digital Systems. *Digest of the First Annual IEEE Computer Conference*, Chicago, Illinois, Sept. 16-C-51, pp. 10-13.

MARLETT, R. A. (1967). On the Design and Testing of Self-Diagnosable Computers. Digest of the First Annual IEEE Computer Conference, Chicago, Illinois, Sept. 16-C-51, pp. 14-15.

SESHU, S. (1965). On an Improved Diagnosis Program. *IEEE Transactions on Electronic Computers*, Vol. EC-14, No. 1. pp. 76-79

TOKUYAM, G., and HANMA, Y. (1970). Diagnosis in DEX 1 Central Control. *Review of Electrical Communications Laboratory*, Vol. 18, Nos. 9-10, pp. 712-719.

TSIANG, S. H., and ULRICH, W. (1962). Automatic Trouble Diagnosis of Complex Logic Circuits. *Bell System Technical Journal*, Vol. 41, No. 4, July, pp. 1177-1200.

WILKES, M. V. (1968). Time Sharing Computer Systems, London: Macdonald.

Book reviews

Iterative Methods for Nonlinear Optimisation Problems, by S. L. S. Jacoby, J. S. Kowalik, and J. T. Pizzo, 1972; 274 pages. (*Prentice-Hall Inc.*, £7·00)

Algorithms for Minimization without Derivatives, by Richard P. Brent, 1973; 195 pages. (*Prentice Hall Inc.*, £6·00)

Two recent books on optimisation are reviewed which have widely differing characteristics. The first by Jacoby *et al.* purports to cover the entire range of optimisation methods. Apart from introductory material, there are chapters on linear searches, direct search methods, descent techniques and methods for constrained problems, as well as two chapters on transformations, one of which includes penalty functions. Despite this wide coverage, topics like linear programming and minimising sums of squares, surely the most-solved types of problem, are only cursorily mentioned in an Appendix. Quadratic programming, the coming tool in nonlinear programming, is hardly mentioned. Many of the chapters include sections on available subroutines and packages. Whilst this is an excellent idea, I was disappointed that I could not find any reference to the many valuable routines in the Harwell Subroutine Library.

I did not like the style of the book very much. The theory given is cursory, and although for instance Kuhn-Tucker necessary conditions and Lagrangian functions are briefly described in the introduction, they do not seem to carry over into the discussion on the algorithms. My doubts are typified by the page which the authors feel worthwhile in describing the method AESOP. This tries *all* of nine methods: Sectioning, Adaptive creeping, Magnification, Steepest descent, Quadratic search, Variable metric, Pattern search, Random jumping, and Random direction stepping; in a way to be chosen by the user. Hardly elegant! Many algorithms are described and many more referenced, but there does not seem to be enough intuition there to influence one's selection. On the whole, it may be a useful cook-book to have around, but I wouldn't like to lecture from it.

The other book, by Brent, is restricted to problems in which derivatives are not available. The introductory material includes a useful five page summary and critique of the book, and there are sections on the convergence of successive interpolation, and on algorithms for (*a*) zeros and global minima of functions of one variable, and (*b*) local minima of functions of many variables. The material is relevant in the current state of the art, and I have only minor criticisms. One is that more than necessary is made of the fact that global minima of functions of many variables can be obtained by recursive application of such a procedure in one variable. The other is that I am not convinced that the modifications to Powell's method are the best. Use of eigenvector directions is not independent of scale changes to the variables, and the use of searches in random directions is hardly appealing. Nonetheless all the algorithms are demonstrated to be competitive by numerical examples.

The theoretical details of the algorithms are detailed, although not overpoweringly so, and the book is an excellent blend of practical algorithms, numerical evidence, relevant theory and informed comment. Detailed programs are also given, some in both ALGOL 60 and FORTRAN, and one in ALGOL W which could easily be translated into ALGOL 60. All or parts of the book would form an excellent basis for a course to final year or postgraduate students.

R. FLETCHER (Harwell)

Mathematical Models for the Growth of Human Populations, by J. H. Pollard, June 1973; 186 pages. (*Cambridge University Press*, £5·80)

This is an account of the theory of the demographic analysis of populations. In a real population, the numbers in the various age groups in the two sexes will tend to be decreased by deaths and emigration, and increased by births and immigration. All these processes will be subject to random fluctuations, which will be appreciable when the population size is small; and also to somewhat irregular variation with time. This book deals with various mathematical models of population which have been proposed. Relatively little is said about practical methods for dealing with actual data.

To be mathematically tractable, all models have to be simplified in some way; e.g. in the first few chapters, one sex only is considered (usually female) and random fluctuations are ignored, and birth and death rates are supposed constant in time. Later on, stochastic models and two-sex models are introduced. The Galton-Watson problem of the 'extinction of surnames' and hierarchical populations (e.g. promotion in business or university) are also discussed.

A knowledge of elementary matrices, probability theory and differential equations is assumed, but more advanced points are explained as they occur.

C. A. B. SMITH (London)