k := *sum* [*l*, *m*];
*q*1 := *sum* [*q*0, *times* [*e*, *k*]];
*q*0 := *times* [*f*, *k*]
end *next* 2 *remainder*;

If a quinary check polynomial of the form $X^2 + d$ is used the procedure can be simplified further. Then the next $q0 = f^*(q1 + m)$ and this can be found directly from the same type of 5 × 5 integer array as was used in the one digit case.

These methods can obviously be extended quite easily to three or more check digits.

11. Conclusion

Biquinary coding is a systematic method of constructing true decimal error detecting codes with as many check digits as may be required over integers of any length. The error detecting properties can be deduced from the method of formation of the check digits as a polynomial division process.

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Book reviews

Optimisation Techniques with FORTRAN, by J. L. Kuester and J. H. Mize, 1973; 500 pages. (*McGraw-Hill* (*UK*), £2·90)

This book covers a wide variety of optimisation techniques and would be useful for teaching purposes as a supplementary or reference text. Unfortunately, the description of each technique is absolutely minimal so a further text book on the subject would be essential. This lack of detail would also be a grave handicap for research workers and others who attempted to use it as a 'handy reference book', as suggested by the authors.

The book is divided into two parts: Part One—Special Purpose Methods—includes algorithms for linear programming, quadratic programming, geometric programming, dynamic programming and for problems whose objective functions are sums of squared terms; Part Two—Search Methods—deals with the general non-linear problem and is subdivided into chapters on single variable unconstrained, single variable constrained, multivariable unconstrained and multivariable constrained optimisation methods. Each technique is described in five sections, namely, Purpose, Method, Program description, Text problem and Program listings with example output; the programs are coded in ASA FORTRAN, apart from one subroutine in IBM 360 Assembler language.

To a certain extent, one of the main reasons given for writing the book—the difficulty of obtaining computer programs for optimisation techniques—is not valid in Great Britain, owing to the ready availability of copies of routines from the Harwell library, from the Numerical Analysis and Computing Division of the NPL, from the Hatfield Optimisation Centre and from the CERN library; in addition, many universities now have access to the NAG library. The latter, in particular, provides more efficient and up to date routines for many of the topics covered here (particularly those in Part Two) in place of the rather limited versions of some programs included in this text. Some of the programs given are very close to the original versions without any acknowledgement being given to the person who provided the original coding—the routines for Powell's sum of squares method, pages 258-269, even have the same variable names and statement numbers as the original Harwell versions, VA02A and VD01A, although some comments and additional statements have been added to the former.

The choice of algorithms does not always reflect those which are currently considered the best available, particularly in the case of non-linear techniques. It would appear that the authors are somewhat unfamiliar with this area—they describe the methods as being available for small problems with typical limits on equations and variables being less than one hundred—this is certainly not always the situation; for example, the Fletcher Reeves algorithm has been applied with success to problems having of the order of a thousand variables, and some recent programs developed by Murray and Gill at the National Physical Laboratory have also been applied to large scale problems.

To summarise, this book could be fairly useful for teaching purposes in that it provides readily available algorithms for course work use, but has only limited application for other purposes.

HEATHER M. LIDDELL (London)

Elementary Numerical Analysis, by Conte de Boor, second edition, 1973; 396 pages. (*McGraw-Hill*, hard cover £4·80, paperback £2·70)

The book gives an introduction to computer arithmetic, computational linear algebra, the solution of non-linear equations, interpolation and approximation and the numerical solution of initial and boundary value problems for ordinary differential equations. The approach is, as the title indicates, algorithmic. For each of the topics discussed algorithms are presented in an ALGOL-like language and FORTRAN listings are given. Where appropriate, flow diagrams are included. The algorithms are clearly explained and the discussion generally includes the background Mathematics necessary for an understanding of the construction and analysis of the algorithms. Thus, for example, the chapter dealing with the solution of linear equations contains an introduction to matrix algebra and matrix norms. The limitations of the algorithms described are generally indicated and reference made to more powerful algorithms.

Evidently the author's intention is to give the reader an understanding of the basic ideas and techniques of numerical methods, and the fact the methods described are not always the best currently available does not detract from what is certainly an excellent introduction.

M. J. M. BERNAL (London)

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