19[2.30, 7].—W. A. Beyer & M. S. Waterman, *Decimals and Partial Quotients of Euler's Constant and* ln 2, ms. of 28 computer sheets deposited in the UMT file.

Herein are tabulated Euler's constant γ and ln 2 to 7114D and 7121D, respectively, as well as the first 6922 and 6890 partial quotients of the corresponding simple continued fractions. Details of the calculations are presented in a paper [1] by the same authors in this issue.

It may be of interest to record here that in the first 6922 partial quotients for γ a total of nine exceed 1000; namely, $a_{528} = 2076$, $a_{1245} = 1168$, $a_{1273} = 1672$, $a_{1553} = 1925$, $a_{2286} = 1012$, $a_{3079} = 1002$, $a_{3751} = 1095$, $a_{4802} = 2254$, and $a_{5428} = 4351$. This count is in excellent agreement with the Gauss-Kuzmin law, which predicts for almost all real numbers a count of 10 such quotients for this sample size. On the other hand, of the first 6890 partial quotients for ln 2 only six exceed 1000; namely, $a_{501} = 3377$, $a_{1271} = 2745$, $a_{3137} = 1247$, $a_{3915} = 2158$, $a_{5262} = 2765$, and $a_{6803} = 1350$.

In [1] the authors tabulate the individual relative frequencies of those partial quotients among the first 3470 for γ that do not exceed 10 in magnitude.

J. W. W.

1. W. A. Beyer & M. S. Waterman, "Error analysis of a computation of Euler's constant," *Math. Comp.*, v. 28, 1974, pp. 599–604.

20[2.60].—Raymond E. Miller & James W. Thatcher, Editors, *Complexity of Computer Computations*, Plenum Publishing Corporation, New York, 1972, 225 pp., 25 cm. Price $16.50.

This book is the proceedings of a symposium held at the IBM Thomas J. Watson Research Center in March 1972. It contains the fourteen presented papers plus an account of the panel discussion session. There was considerable attention given in the panel discussion to the field of the symposium. There was no agreement on a suitable name although "computational complexity", "computability", "theory of algorithms" and "concrete computational complexity" were suggested. Neither was there good agreement on the content of the field, but the symposium (and this book) itself serve admirably to delineate the field. That is, the content of this field (whatever it is called) is that which the people in the field are doing.

There are two branches to the field, one numerical and the other combinatorial in nature. Space precludes presenting a review of each of the fourteen papers, but, since the nature of this field is a prime question at this time, a very short description is given for each paper. The order is that of the book.

Numerical Computations

1. V. Strassen. Analysis of the number of arithmetic operations required to evaluate a rational function.

2. M. O. Rubin. Analysis of the effort to solve a system of n linear equations using only scalar product computations. At least $n(n + 1)/2 - 1$ inner products must be used.

3. E. M. Reingold & A. I. Stocks. New and more elementary proofs of the lower bounds on the number of arithmetic operations required to evaluate a polynomial.

4. C. M. Fiduccia. An analysis of fast matrix multiplication algorithms which involves a new representation/interpretation of the situation.

5. M. S. Paterson. Applies ideas from the study of the efficiency of solving a nonlinear equation to the problem of evaluating an algebraic number (solving a polynomial equation).

6. S. Winograd. An analysis of the behavior of parallel algorithms for solving a nonlinear equation. Parallelism does not pay off.

7. R. Brent. Analysis of local iterative methods (which use no derivatives) for the solution of systems of nonlinear equations. A conjecture is made about the optimum efficiency.

8. M. Schultz. Demonstration that, in a certain reasonable sense, the numerical solution of an elliptic partial differential equation is as efficient as the tabulation of the solution from a known closed form formula.

Combinatorial Computations

9. R. M. Karp. Presentation of a systematic method of establishing the equivalence of problems in complexity. A large number are shown to be equivalent although their complexity is still unknown.

10. R. W. Floyd. Presents bounds on the work required to rearrange information (in pages and records) in a slow memory by bringing pairs of pages into a fast memory where records may be rearranged.

11. V. R. Pratt. Analysis of the effort in defining a computer library given the probability of accessing the ith program after the jth one. Results are given in some special cases.

12. D. C. VanVoorhis. Study of the smallest number of components required for constructing a sorting network.

13. J. E. Hopcroft & R. E. Tarjan. Presentation of an algorithm to determine if two planar graphs with n vertices are isomorphic. It uses $O(n \log n)$ operations.

14. M. J. Fisher. Proof of a new upper bound on the computation required to obtain the finest partition of a set consistent with a given set of equivalence relations.

The panel discussion centered on two questions: "Is there an emerging unity in this field?" and "Are real computations improved as a result of studies in this field?" There was some optimism and considerable doubt expressed about the unity of this field. The diversity in the field is underscored by the fact that few people will feel comfortable with all the papers presented. The case for stating that these studies have had an effect on real computation is weak. However, several people expressed the opinion that the effect will be felt in the future as this field provides the proper framework to think about computation. The reviewer agrees with this opinion and even with the one that this field and classical numerical analysis will merge at some future time.

In summary, this book provides a good snapshot of the "complexity of computer computations" field as of 1972. A number of significant research results are presented and the panel discussion transcript allows one to obtain a feel for the thinking of some of the leaders in this field. The book is overpriced in view of its length and the lack of typesetting or royalty expenses to the publisher.

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