Bibliographie

B. D. Craven: Fractional Programming, Heldermann Verlag, Berlin, 1988. (Sigma Series in Applied Mathematics; Vol. 4)

From preface of the book: A linear program optimizes a linear function of several variables, subject to linear constraints. Linear programming models have been extensively applied in management, industry, and economics. But, quite often, the function to be optimized is, instead, a ratio of two linear functions. The term fractional programming describes the larger class of optimization problems, where the objective function to be optimized is a ratio. The ratio form gives such problems additional properties, which not all nonlinear programming problems have.

This book describes fractional programming from the standpoints of applications (potential and actual), the mathematical theory (including duality and analysis of sensitivity to perturbations), and algorithms by which optima of fractional programs may be computed.

Chapter 1 surveys many applications proposed for fractional programs to problems of management, scheduling, and finance. Both linear fractional programs (with a ratio of linear functions), and nonlinear fractional programs (with a ratio of nonlinear functions), are considered.

Chapter 2 presents the theory of linear fractional programming, including duality, and equivalent programs.

Chapter 3 discusses nonlinear fractional programming, especially maximizing the ratio of a concave to a convex function.

Chapter 4 deals with various aspects of duality, sensitivity to perturbations, and recent improvements (invex functions, quasiduality) which extend results to more functions.

Chapter 5 surveys various algorithms, which can compute an optimum of a fractional program.

Chapter 6 outlines some further recent developments, including optimization with several objective functions.

Each chapter, after the first, includes a set of exercises. Each chapter includes a bibliography of references cited, from the very large literature.

The book is clearly written and may be recommended as a textbook for students in a lecture course on fractional programming.

J. Csirik

STACS 88, 5th Annual Symposium on Theoretical Aspects of Computer Science, Bordeaux, France, February 1988. Proceedings, Springer Lecture Notes in Computer Science Vol. 294. R. Cori, M. Wirsing (Eds.), IX, 404 pages. 1988.

The volume contains an invited paper and 34 contributed papers presented at the 5th STACS conference. STACS is a regular conference on theoretical computer science, held each year, alternately in France and West Germany.

The papers are classified according to their topic. In the algorithmic, complexity-theoretic direction the sections are Algorithms, Complexity, Distributed Algorithms and Geometrical Algorithms. In the algebraic, formal language-theoretic direction the sections are Formal Languages, Rewriting Systems and Abstract Data Types, Graph Grammars, Trace Languages and Semantics of Parallelism. The volume also contains short descriptions of the software systems presented at the conference.

The contributed papers and systems demonstrations come from 13 countries, with the largest number of papers from France and West Germany. The research interests are indicated by the following: 7 of the 9 papers with French authors are in the formal language sections and 8 of the 11 papers with West German authors are in the algorithms sections.

STACS is a well-established, high quality conference. The volume gives a good selection of current research topics in theoretical computer science and can be recommended to those who are interested in the state of the art of this field.

György Turán

M. Hofri: Probabilistic analysis of algorithms, (Texts and monographs in computer science), Springer-Verlag, 1987.

"Until quite recently, "analysis of algorithms" was nearly synonymous with determining the "Complexity class" of an algorithm. This has the objective, most often, of finding whether in all cases the running time (or storage requirements) of the algorithm operation is or is not bounded by some specified function of the size of a suitably devised representation of the problem. It usually boils down to the consideration of some extreme, especially crafted problem instances. The realization that there is more one could say to characterize the cost of using an algorithm is probably due to the influence of Knuth's series on "The Art of Computer Programming" which started out in 1968. There, clearly, the operation of algorithms was shown to be associated with probabilistic concepts and processes.

Random elements, and hence the call for stochastic analysis, may enter algorithms in essentially two ways. On the one hand, we find the so called "probabilistic algorithms", such that choose part of their actions on the basis of random elements, explicitly introduced into the algorithm specification (pseudo-random numbers, simulated coin flipping and the like). Numerous algorithms of this class where recently developed, some showing progress well beyond anything one has believed hitherto possible (primality testing algorithms provide a good example). On the other hand, we find the operation to deterministic algorithms on input data over wich some probability measure can be stipulated. While the sources of the randomness present a true dichotomy, the required analyses turn out typically to be of the same nature in both cases. Among the algorithms for which we provide detailed analyses, the reader will find examples of both varieties. While the analyses proper are similar, we show in Chapter 1 that the second type brings up methodological and conceptual problems that the first case need not entail. The difficulty there may be phrased as leading substance to the notation of two algorithms having the same complexity "on the average", or "in distribution". The problem may also be seen to reside in the attribution of a priori probability measures to the input instance space. At the time of writing there is no coherent accepted theory or even taxonomy for these vexing issues, comparable to standard complexity theory; we shall mostly skirt them, using reasonable — sometimes seemingly facile — assumptions, invoking naturalness as our guidline.

The probabilistic analysis of algorithms, as a discipline, draws on a fair number of branches of mathematics. Principally: probability theory (especially as applied to stochastic processes), graph theory, combinatorics, real and complex analysis, and occasionally algebra, number theory, computation theory, operational calculus and more. It was unreasonable to expect the students to have more than a cursory knowledge of most of the techniques we used, so much of the time was given over to introducing and exploring these methods as we went along. Arranging the text so it could be conveniently used both as a text and as a reference posed a problem which was solved by departing in the book version form the order of the class presentation to a large extent, collecting most of the methodological material in Chapter 2."

In next three Chapters some application areas are presented:

— in Chapter 3: Algorithms over Permutations (locating the largest Term in a Permutation; Representations of Permutations; Analysis of Sorting Algorithms),

— in Chapter 4: Algorithms for Communications Networks (The Efficiency of Multiple Connections; Collision Resolution Stack Algorithms),

— in Chapter 5: Bin Packing Algorithms (The Next—Fit Bin Packing Algorithm; The Next—Fit—Decreasing Bin Packing Algorithm).

This is a very well written book. It may be recommended for a large number of people from graduate students to researchers on given fields.

J. Csirik