software packages. The book has to be read from cover to cover for a thorough appreciation of cluster analysis, but it is written in a manner which makes this a pleasure rather than a chore.

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Nonlinear Programming: Theory and Algorithms (2nd Edition)
MOKHTAR S. BAZARAA, HANIF D. SHERALI and C. M. SHETTY
Wiley, New York, 1993. xiii + 638 pp. £18.95
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This comprehensive and well organized book is for the mathematically mature student interested in the developments made in non-linear optimization during the past three decades.

The book is divided into three parts. The first is dedicated to convex analysis, the second to optimality conditions and duality, and the third to algorithms and their convergence. The first two parts are aimed at undergraduate students of applied mathematics interested in the foundations of optimization. The third part is aimed at graduate students interested in algorithms for the efficient solution of non-linear optimization problems.

The book has two appendices. The first reviews notation, basic definitions, and the results of linear algebra and real analysis that are used throughout the book. The second gives a summary of the relevant results presented in the first two parts of the book. It is intended to provide the minimal background needed to understand the third part of the book. An extensive bibliography which includes recent publications is provided. The book also provides a topical index for the benefit of practitioners who want to use the book for reference purposes.

Each chapter begins with an outline of its contents. This and the effective use of various fonts help guide the reader. Examples and graphs are used to clarify concepts, results and algorithms.

Each chapter contains a large number of exercises. They range from the relatively simple numerical examples which illustrate and reinforce the topics discussed, to those which introduce new material and are therefore suited to more advanced students.

The notes and references included at the end of each chapter provide sufficient information for those who would like to pursue, in more depth, some of the topics presented. Unfortunately, some of these references are either missing in the bibliography or are slightly incorrect. There are several typographical errors, most of which may be due to the use of incompatible word processors.

The book is mathematical in character and offers detailed and rigorous proofs. Unfortunately, there are a few occasions when the meaning and significance of important mathematical results are not made sufficiently explicit. Whenever this happens, the impression given is of an aimless succession of definitions, lemmas, theorems and corollaries.

The book offers a comprehensive and balanced selection of optimization methods. These include the simplex method, a polynomial-time algorithm for linear programming, a method for the solution of quadratic programming problems, Newton and Quasi-Newton methods, conjugate gradient methods, successive linear programming, successive quadratic programming, penalty and barrier function methods, gradient projection methods and reduced gradient methods. Each of these methods is summarized in the form of an algorithm followed by a discussion of its convergence properties. Not surprisingly, because of the large number of algorithms presented, it is no easy task for the reader to compare their performance and computational complexity. A chapter exclusively dedicated to doing this would have been helpful. Fortunately, several references to material which draws such comparisons have been included in the bibliography.

Although some determination and patience are required to understand fully some parts of this book, those seriously interested in non-linear optimization will be more than compensated for their efforts.

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