Book Reviews

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BOOK REVIEWS — РЕЦЕНЗИИ

Bosák J.: GRAPH DECOMPOSITION (Slovak). Veda, Bratislava 1986, 256 pages.

The beginnings of graph decompositions can be traced back to various combinatorial problems originating in the 19th century. For example the problem of the fifteen schoolgirls and the related Steiner triple systems (investigated by T. P. Kirkman, J. Steiner, J. J. Sylvester, E. H. Moore, L. Heffter and others), the problem of nine stacled prisoners (H. E. Dudeney), the four colour problem (F. Guthrie, A. de Morgan, A. Cayley), the round robin tournamets (M. Reiss, E. Lucas) and others. However, the greatest growth starts at the second half of our century.

Despite their importance up to now there is no monograph on graph decompositions. There are only several books in which the special aspects of this theory are treated. The book by Bosák is the first monograph which summarizes the results achieved in this field of research. It consists of three main parts and 15 chapters.

Part I. Subgraphs, decompositions and colouring of graphs.

Chapter 1. Graphs, subgraphs, trails, diagramms and hypergraphs.

Chapter 2. Decompositions and colouring of graphs.

Chapter 3. Different generalizations of graph decompositions.

Part II. Relations between factors of graphs and graph decompositions.

Chapter 4. Nordhaus—Gaddum type theorems.

Chapter 5. Some relations between complementary graphs and graph decompositions.

Part III. Decompositions of graphs into isomorphic subgraphs.

Chapter 6. Necessary conditions for the existence of G-decompositions.

Chapter 7. Cyclic decompositions, vertex valuations and graceful graphs.

Chapter 8. Block designs and decompositions of graphs into isimorphic complete subgraphs.

Chapter 9. Decompositions into isomorphic subgraphs of small order, paths, trees, forsts, complete bipartite graphs andn-cubes.

Chapter 10. Decompositions into isomorphic cycles.

Chapter 11. Decompositions into hamiltonian cycles (hamiltonian paths) and graph operations.

Chapter 12. Kirkman's schoolgirl problem, block designs and decompositions of graphs.

Chapter 13. Decompositions by groups and by permutations.

Chapter 14. Selfcomplementary graphs and enumeration of decompositions.

Chapter 15. Sufficiency of divisor conditions.

An extensive bibliography contains about 800 items. Each chapter is equipped with exercises.

As to the reader, no special background is required. Only some elementary and basic knowledge of such disciplines as combinatorics, algebra, theory of numbers, analysis and set theory on the standard under graduate school level are needed. The book is designed mainly for scientific workers but it can be recommended also for graduate students as well. However, for any specialist in graph theory and combinatorics the present book will be a reliable and valuable source of information, results and methods. The monograph is translated into English and will be published by the Reidel Publ. Comp.

P. Tomasta, Bratislava

Fargó F.: NONCONVEX PROGRAMMING. Akadémiai Kiadó, Budapest 1988, 188 pages.

If we agree to associate the birth of mathematical programming with the discovery of the Simplex Method in 1947, then this discipline is in its fourth decennium. The first decennium has seen the development of linear programming and of the theoretical foundations of nonlinear programming. The second has seen the birth of the network theory, of integer programming and of nonconvex programming.

Though convex programming has been very successful in solving a host of practical problems in the last 30 years, there is a growing need for techniques capable of tackling problems where convexity cannot be assumed without making the model inadequate to represent the real situation. Nonconvex programming has been the subject of intensive research only in the past 15—20 years. The present book is based on the first part of the Hungarian "Nemkonvex és diszkrét programózás", Budapest. The author's aim is to provide an overview of the basic directions in which research is preceeding and thereby encouraging further investigations. Here is presented a wide range of methods regardless of current judgements about their effectiveness.

The best view on the contents of this book can be obtained from the following list of chapters.

Chapter 1. Kuhn—Tucker—Lagrange optimality conditions and nonlinear duality.

The Lagrangean theory of convex programming problems is very difficult to carry over to nonconvex programming. However, some of the results can either be generalized for the nonconvex case or can be used indirectly for constructing algorithms intended to solve special problems. The chapter contains some theorems in this direction.

Chapter 2. Convex and concave envelopes of function.

Chapter 3. Basic approaches to solving nonconvex programming problems.

In this chapter the author outlines some general properties of three basic approaches which play a fundamental role in most algorithms designed for solving nonconvex programming problems.

Chapter 4. Maximizing a (quasi)-convex function over a polytope.

The chapter mostly deals with programming problems where the feasible set is a polyhedron and nonconvexity is restricted to the objective function.

Chapter 5. Nonconvex problems with convex functions in the constraints.

Chapter 6. Continuous nonconvex programs.

The methods discussed here are realizations of the cutting-plane and the branch-and-bound approaches.

Chapter 7. Nonconvex quadratic programming.

Chapter 8. The fixed charge problem.

A special class of nonconvex problems, where discontinuities along the border of the feasible region may occur is investigated.

Chapter 9. Reducing constrained problems to nonconstrained ones.

Here are discussed a few aspects of the relation of global maximization to nonconvex programming.

Chapter 10. Decomposing of nonconvex programs.

The chapter discusses a procedure, originally developed by Benders and generalized by Goeffrion, which splits the programming problem into two parts.

The author focuses his attention primarily on methods. Theory is restricted to what is necessary to understand the numerical procedure. The methods are illustrated by small numerical examples. However, it must be kept in mind that no conclusion as to numerical efficiency can be drawn from these examples. They serve solely for a better understanding. The bibliography contains more than one hundred items.

The presented book is mainly addressed to mathematicians, operation researchers, computer scientists as well as university students interested in mathematical programming on an advanced level. To understand the book prior knowledge of the elementary calculus, linear algebra, and familiarity with a basic text on mathematical programming are required. Readers with practical interest in current methods of nonconvex programming will benefit from this book.

P. Tomasta, Bratislava

Kubáček L.: FOUNDATIONS OF ESTIMATION THEORY. Fundamental Studies in Engineering 9, Elsevier, Amsterdam 1988, vi + 328 pages.

There is no doubt that estimation theory and testing hypotheses belong to the most important branches of mathematical statistics. It can be seen from text-books and monographs that testing statistical hypotheses is a relatively unified theory. It may be caused by the fact that the Neyman—Pearson lemma is an elementary tool giving in many cases the definite answer when one looks for the best tests.

The situation in estimation theory is quite different. For example, the maximum likelihood method sometimes yields a result which cannot be considered as an estimator, since it is not a statistic (see p. 131). It was necessary to settle the problem of superefficiency. The moment method can give estimators having a low efficiency, the estimators in linear models need special theorems concerning the generalized inverse matrices, derived quite recently. As a matter of fact, papers giving a unified view on selected topics in estimation theory appear only recently.

One such publication is the book under review, which is an updated translation of the Slovak version "Základy teórie odhadu" published a few years ago. After a short introduction it contains selected assertions from the matrix theory, reproducing the kernel Hilbert space and the probability theory. The part concerning matrices is especially valuable, because it gives a nice survey of necessary theorems about generalized inverse matrices including proofs. This field is usually neglected in our publications. The explanation of estimation theory begins in the third chapter. It starts with the description of sufficient statistics and inequalities related to regular systems of probability measures, in particular the Rao—Cramér inequality. Then the estimators in the case of large samples are treated. They include the moment method and the maximum likelihood method.

The kernel of the book is undoubtedly the next part, in which the author deals with the linear and quadratic estimators in linear models. After all, it is his favourite subject, where he has derived and published some results. One can find here theorems concerning the best linear unbiased estimators of regression parameters, a method for estimating the parameter σ^2 and estimators for variance components. The estimation of nonlinear functions of parameters and some related problems are treated under the normality assumption.

The last chapter reviews some other methods of estimation. The author describes the Wald approach, ridge estimators and robust estimators.

The book is written very carefully. The author takes advantage of his long pedagogical and scientific experience. Also his remarks pointing to pitfalls of the presented methods (for example in the part devoted to the maximum likelihood method) are very valuable. The book can be also used for references, its introductory part as well as some assertions in text (for example, formulas for the covariance of quadratic forms on p. 168). It is one of the few publications which treats the variance components in detail; it is shown on an example how to reach this model.

The book contains a list of basic symbols which are used in the next. However, I do not think it is necessary to point out explicitly that u $\perp$ v means that u and v are orthogonal. One the other hand, one would rather appreciate if the symbols ⋈ ⋈ (p. 51), ▯, ↑, □ (p. 199) were introduced here. The symbols should be complemented not only by their verbal description but also by information about the page with their definition. I must mention that the book contains neither numerical examples nor unsolved problems.

The book is written in a concise form. The reader gains profit from it only in the case when the book is really studied. It is not sufficient to read it only. Its orientation is determined by the fact that it contains methods used in estimation theory and their mathematical background but not explicit instructions for solving practical problems.

I can recommend the publication as a good contribution to statistical literature.

J. Anděl, Praha

Znám et al.: FROM THE HISTORY OF MATHEMATICS (Slovak), ALFA, Bratislava — SNTL Praha 1986, 239 pages.

The book introduces the reader to some periods and developments in the history of mathematics. It contains 6 chapters written in essay form. The first chapter covers the period from the very outset of mathematics up to Euclid. The second chapter is devoted to the development of medieval mathematics and the next to the discovery of the infinitesimal calculus. The fourth chapter deals with "Two crises in mathematics", the fifth with the history of computational devices and computers. The book ends with a short history of mathematics in Slovakia.

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