New Books

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Knihy došlé do redakce (Books received)

Nach-Chomskysche Linguistik — Neuere Arbeiten von Berliner Linguisten (*Thomas T. Bellmer, Roland Posner, Hg.*). Walter de Gruyter, Berlin—New York 1985. X + 500 Seiten; DM 220,—.

Geometric Theory of Nonlinear Control Systems — International Conference, Bierutowice, Poland, 18—21 IX 1984 (*B. Jakubczyk, W. Respondek, K. Tchoń, eds.*). Wydawnictwo Politechniki Wrocławskiej, Wrocław 1985. 278 pages; 300,— zł.

MICHAEL JUNGER

Polyhedral Combinatorics and the Acyclic Subdigraph Problem

Research and Exposition in Mathematics 7. Heldermann Verlag, Berlin 1985.
128 pages; DM 36,—.

Many extensively treated combinatorial optimization problems, such as the matching problem, the travelling salesman problem, packing and covering problems are known to be NP-complete. The class of NP-complete problems is characterized by two important properties:

— no problem of this class is known to be solvable by a polynomial time algorithm
— if we had a polynomial algorithm for one of the NP-complete problems, we could obtain polynomial time algorithm for all the NP-complete problems.

It is widely conjectured that no NP-complete problem can be solved by a polynomial time bounded algorithm and for this reason the NP-complete problems are considered to be computationally intractable.

The monograph under review deals with one of these NP-complete problems, the acyclic subdigraph problem (ASP), and it should be stated in advance that this book is undoubtedly one of the best, most complete and most precise treatments on this subject available today.

The acyclic subdigraph problem can be formulated as follows. Given a directed graph $G = (V, A)$ and a function w: $A \to Z$, determine an acyclic subgraph of G having maximum weight, more precisely, determine a set of arcs $B \subseteq A$ such that a digraph $G' = (V, B)$ contains no directed cycles and the sum of weights of the arcs contained in B has a maximum possible value over all feasible subsets $B \subseteq A$.

Although this problem is not so famous as the travelling salesman problem or the other combinatorial optimization problems, it has wide occurrence in economics, operations research, social sciences, archeology and even sports. The monograph is divided into six chapters. The first chapter provides a necessary mathematical background from the area of linear algebra, linear programming theory, graph theory, polyhedral theory and computational complexity theory. This survey is self-contained and enables the understanding of further treatise without any other sources. The second chapter is devoted to polyhedral combinatorics, which serves as a tool for attacking the ASP. In the third chapter the ASP is introduced in a graph theoretic formulation, its computational complexity is discussed and the equivalence to several combinatorial problems, such as the linear ordering problem, the triangulation problem, is shown.

The focus of the whole treatise lies in the fourth chapter, where the facial structure of a polytope associated with a digraph is studied and several classes of facets of this polytope are derived. This chapter, as well as the following one, devoted to a special class of digraphs — weakly acyclic digraphs — present new and very original results, which enable in this special case of the ASP a polynomial time bounded solvability. It must be appreciated that the author unifies in a very natural way an analytic approach with an algorithmic point of view.

The monograph is supplied with an extensive bibliography. Conclusion: The whole book is written in a clear and mathematically precise form and it can be recommended to research workers in the computer science area.

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