

Bernhard Korte László Lovász
Rainer Schrader

Greedoids

With 17 Figures



Springer-Verlag Berlin
Heidelberg GmbH

Bernhard Korte
Rainer Schrader
Research Institute for Discrete Mathematics/
Institute of Operations Research
University of Bonn
Nassestraße 2
W-5300 Bonn
Fed. Rep. of Germany

László Lovász
Department of Computer Science
Eötvös Loránd University
Múzeum krt. 6–8
H-1088 Budapest
Hungary

Mathematics Subject Classification (1980):
05B35, 05C65, 06A10, 90C10, 90C35

ISBN 978-3-642-63499-4 ISBN 978-3-642-58191-5 (eBook)
DOI 10.1007/978-3-642-58191-5

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in other ways, and storage in data banks. Duplication on this publication or parts thereof is only permitted under the provisions of the German Copyright Law of September 9, 1965, in its current version, and a copyright fee must always be paid. Violations fall under the prosecution act of the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1991

Originally published by Springer-Verlag Berlin Heidelberg New York in 1991
Softcover reprint of the hardcover 1st edition 1991

Typesetting: Data conversion by Springer-Verlag and typesetting output by Universitätsdruckerei H. Stürtz AG, Würzburg
41/3140-543210 – Printed on acid-free paper

Table of Contents

Chapter I. Introduction	1
1. Set Systems and Languages	5
2. Graphs, Partially Ordered Sets and Lattices	6
Chapter II. Abstract Linear Dependence – Matroids	9
1. Matroid Axiomatizations	9
2. Matroids and Optimization	14
3. Operations on Matroids	15
4. Submodular Functions and Polymatroids	17
Chapter III. Abstract Convexity – Antimatroids	19
1. Convex Geometries and Shelling Processes	20
2. Examples of Antimatroids	24
3. Circuits and Paths	27
4. Helly’s Theorem and Relatives	33
5. Ramsey-type Results	36
6. Representations of Antimatroids	39
Chapter IV. General Exchange Structures – Greedoids	45
1. Basic Facts	45
2. Examples of Greedoids	49
Chapter V. Structural Properties	57
1. Rank Function	57
2. Closure Operators	59
3. Rank and Closure Feasibility	64
4. Minors and Extensions	67
5. Interval Greedoids	71
Chapter VI. Further Structural Properties	77
1. Lattices Associated with Greedoids	77
2. Connectivity in Greedoids	80

Chapter VII. Local Poset Greedoids	89
1. Polymatroid Greedoids	89
2. Local Properties of Local Poset Greedoids	95
3. Excluded Minors for Local Posets	98
4. Paths in Local Poset Greedoids	100
5. Excluded Minors for Undirected Branchings Greedoids	102
Chapter VIII. Greedoids on Partially Ordered Sets	107
1. Supermatroids	107
2. Ordered Geometries	110
3. Characterization of Ordered Geometries	111
4. Minimal and Maximal Ordered Geometries	114
Chapter IX. Intersection, Slimming and Trimming	119
1. Intersections of Greedoids and Antimatroids	120
2. The Meet of a Matroid and an Antimatroid	123
3. Balanced Interval Greedoids	131
4. Exchange Systems and Gauss Greedoids	134
Chapter X. Transposition Greedoids	141
1. The Transposition Property	141
2. Applications of the Transposition Property	144
3. Simplicial Elimination	144
Chapter XI. Optimization in Greedoids	153
1. General Objective Functions	154
2. Linear Functions	158
3. Polyhedral Descriptions	163
4. Transversals and Partial Transversals	174
5. Intersection of Supermatroids	177
Chapter XII. Topological Results for Greedoids	183
1. A Brief Review of Topological Prerequisites	183
2. Shellability of Greedoids and the Partial Tutte Polynomial	187
3. Homotopy Properties of Greedoids	193
References	197
Notation Index	203
Author Index	205
Subject Index	207
Inclusion Chart (inside the back cover)	