

The Mind-Blowing Technique That Changed the World of Optimization: Disjunctive Programming Egon Balas

We live in a world full of complex problems. From managing global supply chains to optimizing transportation networks, finding the best solutions can be a daunting task. However, thanks to the groundbreaking work of Egon Balas, a Hungarian-born mathematician and computer scientist, a remarkable technique known as disjunctive programming has emerged as a powerful tool in the field of optimization.

What is Disjunctive Programming?

Disjunctive programming is a mathematical programming technique that allows for the representation and solution of complex decision-making problems involving multiple constraints and alternatives. It deals with situations where constraints and choices are disjunctive, meaning that only one constraint or choice can be active at a time.

This approach was first introduced by Egon Balas in the 1960s as an extension of linear programming, a widely used technique for solving optimization problems. Balas realized that many real-world problems could not be effectively modeled using linear programming alone, as they required the consideration of disjunctive or mutually exclusive constraints.

Disjunctive Programming

by Egon Balas (1st ed. 2018 Edition, Kindle Edition)

★★★★★ 5 out of 5

Language : English

File size : 4731 KB

Disjunctive Program

Relaxation

$j A x \leq b_j$

$$\sum_{j=1}^q \lambda_j \sum_{i=1}^n a_{ij} x_i \leq b_j$$

Constraints

0-1 disjunction

OR $(x_i, 1)$

conditions

actions

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The Genius of Egon Balas

While disjunctive programming may seem like a straightforward concept, it was Egon Balas' ingenuity and insight that made it a revolutionary technique in the field of optimization. Balas developed efficient algorithms and computational methods to solve disjunctive programming problems, making it possible to address a wide range of real-world problems.

One of Balas' most significant contributions to disjunctive programming was the development of the widely used "Balas Disjunctive Cuts" algorithm. This algorithm efficiently finds strong valid inequalities to strengthen the linear programming relaxation of a disjunctive programming problem, improving the overall solution quality.

Furthermore, Balas' work also led to the development of the "Balas Additive Algorithm" and the "Balas Intersection Algorithm," both of which provided efficient techniques for solving disjunctive programming problems with additional structure and characteristics.

Applications of Disjunctive Programming

Disjunctive programming has found numerous applications across various industries and fields. It has been successfully applied in supply chain management, scheduling problems, resource allocation, network design, and more.

For example, in supply chain management, disjunctive programming can be used to optimize the flow of goods and resources across multiple stages while considering factors such as production capabilities, transportation costs, and demand fluctuations.

In scheduling problems, disjunctive programming provides a powerful approach for optimizing the allocation of tasks to available resources, taking into account various constraints such as task dependencies, resource availability, and time limitations.

Disjunctive programming is also extensively used in network design problems, where the goal is to find the optimal configuration of a network, such as a telecommunication or transportation network, given constraints on resource availability, costs, and performance requirements.

Egon Balas' pioneering work on disjunctive programming has revolutionized the field of optimization, providing a powerful tool to solve complex decision-making problems. By developing efficient algorithms and computational methods, Balas enabled the successful application of disjunctive programming in various industries and fields.

Today, disjunctive programming continues to evolve and find new applications, unlocking solutions to previously unsolvable problems. As we strive to navigate the complexities of our world, we can thank Egon Balas for his brilliant contributions to this remarkable technique.

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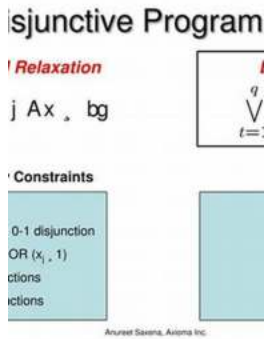
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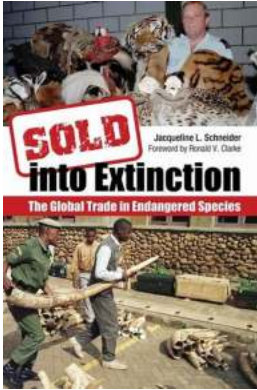
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Disjunctive Programming is a technique and a discipline initiated by the author in the early 1970's, which has become a central tool for solving nonconvex optimization problems like pure or mixed integer programs, through convexification (cutting plane) procedures combined with enumeration. It has played a major role in the revolution in the state of the art of Integer Programming that took place roughly during the period 1990-2010.

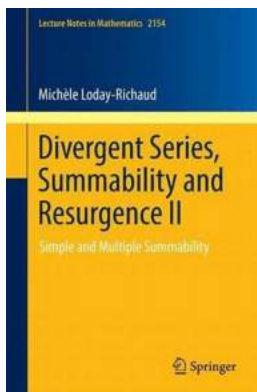
The main benefit that the reader may acquire from reading this book is a deeper understanding of the theoretical underpinnings and of the applications potential of disjunctive programming, which range from more efficient problem formulation to enhanced modeling capability and improved solution methods for integer and combinatorial optimization.

Egon Balas is University Professor and Lord Professor of Operations Research at Carnegie Mellon University's Tepper School of Business.



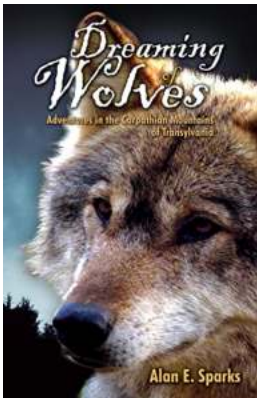
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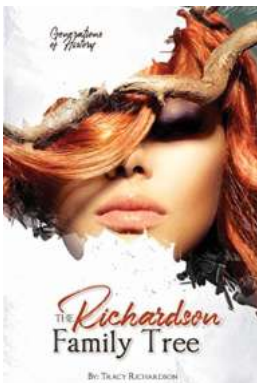
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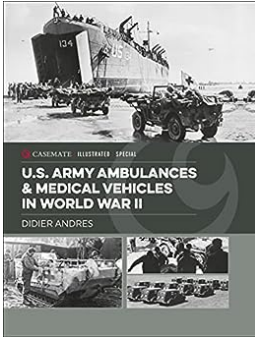
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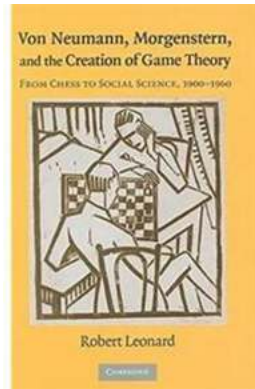
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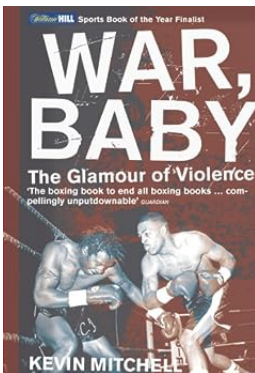
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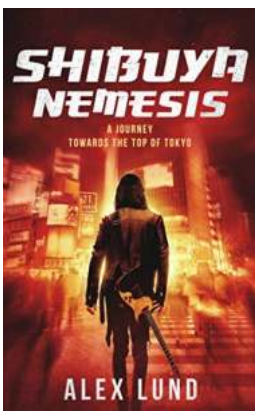
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