Generalized Nash Equilibrium Problems, Bilevel Programming and MPEC: Forum for Applied Operational Research

By Editors: Sorin-Mihai Grad, Daniel Ralph, and Athanasios Migdalas

Generalized Nash Equilibrium Problems (GNEPs), optimization problems in which each agent's objective function depends on the decisions of the other agents, and **Bilevel Programming (BLP)**, a special case of GNEP in which the objective function of one agent depends on the optimal solution of another agent's optimization problem, have attracted considerable interest in recent years due to their wide range of applications in economics, engineering, and other fields.

Generalized Nash Equilibrium Problems, Bilevel Programming and MPEC (Forum for Interdisciplinary Mathematics) by Spencer Apollonio

4.5 out of 5

Language	: English
File size	: 3096 KB
Print length	: 138 pages
Screen Reader	: Supported

This book brings together leading experts in the field to provide a comprehensive overview of the latest theoretical and algorithmic developments in GNEPs and BLP. The chapters cover a wide range of topics, including:

- The theory of GNEPs and BLP
- Algorithms for solving GNEPs and BLP
- Applications of GNEPs and BLP in economics, engineering, and other fields

This book is a valuable resource for researchers and practitioners working in GNEPs and BLP. It provides a comprehensive overview of the field, and it will help readers to understand the latest developments in theory and algorithms. The book will also be of interest to students who are interested in learning about GNEPs and BLP.

Table of Contents

GNEPs and BLP are optimization problems that arise in a wide range of applications in economics, engineering, and other fields. In a GNEP, each

agent's objective function depends on the decisions of the other agents. In a BLP, the objective function of one agent depends on the optimal solution of another agent's optimization problem.

GNEPs and BLP are both NP-hard problems, meaning that there is no known algorithm that can solve them in polynomial time. However, there are a number of algorithms that can be used to approximate the solution to a GNEP or BLP.

The Theory of Generalized Nash Equilibrium Problems

The theory of GNEPs is a well-developed field, with a number of important results. One of the most important results is the existence theorem, which states that every GNEP has at least one solution. Another important result is the uniqueness theorem, which states that under certain conditions, a GNEP has a unique solution.

The theory of GNEPs has been used to develop a number of algorithms for solving GNEPs. These algorithms are based on a variety of techniques, including fixed point iteration, variational inequality, and mathematical programming.

Algorithms for Solving Generalized Nash Equilibrium Problems

There are a number of algorithms that can be used to solve GNEPs. The most popular algorithms are based on fixed point iteration, variational inequality, and mathematical programming.

Fixed point iteration algorithms are based on the idea of iteratively updating the decision of each agent until a fixed point is reached. Variational inequality algorithms are based on the idea of finding a solution to a

variational inequality that is equivalent to the GNEP. Mathematical programming algorithms are based on the idea of formulating the GNEP as a mathematical programming problem and then solving the mathematical programming problem.

Applications of Generalized Nash Equilibrium Problems in Economics

GNEPs have a wide range of applications in economics, including:

- Oligopoly pricing
- Game theory
- Transportation planning
- Energy markets
- Telecommunications

GNEPs have been used to model a variety of economic phenomena, including competition, cooperation, and strategic behavior.

Applications of Generalized Nash Equilibrium Problems in Engineering

GNEPs also have a wide range of applications in engineering, including:

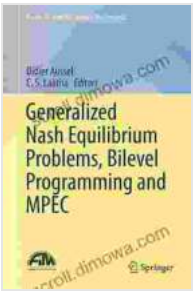
- Network design
- Resource allocation
- Traffic control
- Power systems
- Manufacturing

GNEPs have been used to model a variety of engineering problems, including congestion, competition, and strategic behavior.

Bilevel Programming: Theory and Algorithms

BLP is a special case of GNEP in which the objective function of one agent depends on the optimal solution of another agent's optimization problem. BLP problems arise in a variety of applications, including:

- Supply chain management
- Transportation planning



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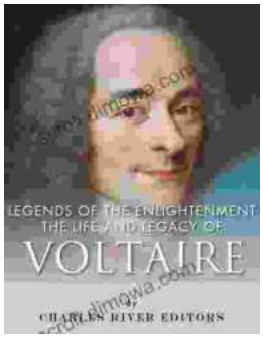

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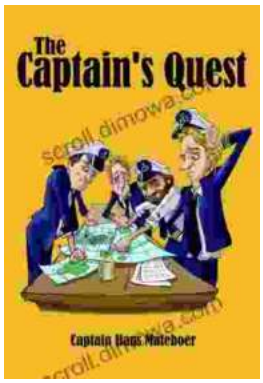

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