

## **Game Theoretic Problems in Network Economics and Mechanism Design Solutions**

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With the advent of the Internet and other modern information and communication technologies, a magnificent opportunity has opened up for introducing new, innovative models of commerce, markets, and business. Creating these innovations calls for significant interdisciplinary interaction among researchers in computer science, communication networks, operations research, economics, mathematics, sociology, and management science. In the emerging era of new problems and challenges, one particular tool that has found widespread applications is mechanism design.

The focus of this monograph is to explore game theoretic modeling and mechanism design for problem solving in Internet and network economics. Application areas of relevance include: Internet advertising, spectrum and bandwidth trading, electronic procurement, logistics, supply chain management, grid computing, wireless networks, peer-to-peer networks, social networks, and many other emerging Internet-based applications.

The monograph is structured into two parts. The first part (Chapter 2) contains an overview of foundational concepts and key results in mechanism design. This chapter is intended as a self-sufficient introduction to mechanism design theory with the help of stylized examples from network economics. The second part of the monograph contains an exposition of representative game theoretic problems in three different network economics situations and a systematic exploration of mechanism design solutions to these problems. This part has three chapters: Chapter 3 deals with the sponsored search auction problem, Chapter 4 with the resource allocation problem in computational grids, and Chapter 5 with the robust broadcast protocol design problem in ad hoc networks. The monograph concludes with Chapter 6 where we provide several pointers to the relevant literature to facilitate a deeper and broader investigation of problem solving with mechanism design.

The monograph has been structured with the objective of providing a sound foundation of relevant concepts and theory to help apply mechanism design to problem solving in a rigorous way. At the end of a serious reading of this monograph, the readers should be able to model real-world situations using game theory, analyze the situations using game theoretic concepts, and design correct and robust solutions (mechanisms, algorithms, protocols) that would work for agents that are rational and intelligent.

### **Written For:**

- **Senior Undergraduate, Master's, and first year Graduate students in following departments**
  - Computer Science
  - Electrical Engineering, Communications
  - Economics
  - Industrial Engineering, Systems Engineering
  - Operations Research
  - Management Science and Business Schools
- **Academics and researchers working in following areas**
  - Electronic Commerce and Supply Chain Management
  - Auction Theory and Mechanism Design
  - Network and Internet Economics
  - Communication Networks
- **Industry professionals/researchers in following sectors**
  - Search Engines and e-commerce portals
  - Networking and Communications
  - E-procurement divisions in any company
  - Social Networking Portals

### **Keywords**

- Mechanism Design
- Game Theory
- Rational and Intelligent Agents
- Bayesian Games
- Nash Equilibrium
- Auctions
- Electronic Markets
- Incentives and Incentive Compatibility
- VCG (Vickrey-Clarke-Groves) Mechanisms
- Sponsored Search Auctions
- Ad Hoc Wireless Networks
- Grid Computing
- Electronic Commerce
- Network Economics
- Microeconomics
- Internet Analytics
- E-Procurement

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