Editorial

Soheil Sibdari

Department of Decision and Information Sciences,
Charlton College of Business,
University of Massachusetts,
285 Old Westport Road, MA 02747-2300,
North Dartmouth, USA
E-mail: ssibdari@umassd.edu

Biographical notes: Soheil Sibdari is an Assistant Professor at the Charlton College of Business, University of Massachusetts Dartmouth. He received his MS in Economics and PhD in Industrial Engineering both from Virginia Tech. His research interests include dynamic pricing, revenue management, game theory applications, and transportation planning.

Traditional research in operations research, especially in retail and service management, assumes that the agents behave according to an isolated system structure.

In reality, especially after the emergence of new technologies such as the internet, the markets are more dynamic with an environment managed by multiple agents whose behaviour influences each others' payoff.

Recently, the operations research literature has experienced a growing interest in using Game Theory tools to tackle incentive-related problems with multiple agents. Competitors, consumers, retailers, and suppliers are self-interest agents whose actions affect each other's benefits and optimal decisions. In such an environment, the decision of an agent affects other agents' payoff. Therefore, game-theoretic tools can interact with other optimisation models to address the problems with multiple agents.

Although game theory has been very well studied in economic literature, there are not many studies practicing supply chains using game theory. The goal of this special issue is to collect recent studies in service and supply chain management using game-theoretic models to address this gap. Topics that are covered in this special issue include

- Game-theoretic application in multi-echelon supply chains
- Bargaining in manufacturer–retailer systems
- Designing a procurement mechanism in a multi-agent environment
- Bundling of price and after-sale services
- Coordination in vendor–buyer inventory systems
- Decision-making process in a dynamic market with uncertainty
- Newsvendor competition.

The equilibrium in an assignment problem in a two-agent system has been addressed in the first paper. There are two agents with n tasks to be assigned in $2n$ machines where the cost of assigning task i to machine j is c_{ij}. All tasks have to be assigned and each agent's utility is inversely proportional to the sum of the agents' costs. *Felici, Mecoli, Mirchandani, and Pacifici* in their paper, 'Equilibrium in a two-agent Assignment Problem' analysed this situation as a bargaining problem. They provide a theoretical analysis of the bargaining set and define a particular Pareto optimal solution. This solution is found by solving a suitable integer linear program. The authors show that this problem is NP-hard. They provide the optimal solution to the linear relaxation of the integer linear program and argue that this solution is a very good approximation on the equilibrium solution.

The second paper considers a decentralised multi-echelon supply chain. It considers a situation where a Central Design Authority (CDA) chooses service providers for each echelon of the supply chain. Each echelon is managed by an autonomous entity that may or may not reveal its true cost to the CDA. The CDA's objective is to minimise the total delivery cost of the entire supply chain where each echelon maximises its own utility. This paper titled 'Incentive compatible mechanisms for decentralised Supply Chain Formation' by *Narahari, Hemachandra, Srivastava, Kulkarni, and Tew* provides a game-theoretic model between the managers of each echelon. They introduce a framework for the design of an incentive system under which the managers are encouraged to report their true cost to the CDA. This paper provides an interesting game-theoretic application in supply chain management.

In many industrial districts, firms share or compete over a common resource. In 'Computing the Nash solution for scheduling bargaining problems' by *Agnetis, de Pascale, and Pranzo*, a two-agent scheduling problem for a use of a single machine, which can only process one job at a time, has been discussed. The authors apply a discrete Nash bargaining solution concept and argue that the computation of the Nash bargaining schedule for the typical scheduling setting is NP-hard. However, for a realistic size problem, they provide an algorithm to efficiently compute the Nash bargaining solution. The authors also provide some experimental results to highlight the fact that the proposed algorithm finds a realistic solution in a reasonable time.

The problem of designing a procurement mechanism for a firm is the subject of our next paper. The firm is interested in procuring multiple units of a single item based on bids submitted by different suppliers and the objective is to minimise the total procurement cost. *Gautam, Hemachandra, Narahari, Prakash, Kulkarni, and Tew* in their paper 'Optimal auctions for multi-unit procurement with volume discount bids' consider two scenarios for this problem. In the first scenario, each supplier provides information about its capacity and the price per unit, and in the second scenario, each supplier specifies discounts based on the volume of supply. For each scenario, an optimal solution has been provided.

The paper by *Kameshwaran, Viswanadham, and Desai* titled as 'Bundling and pricing of product with after-sale services' deals with bundling of after-sale repair and maintenance service. The products are durable with an extended lifetime. The authors address the question of whether the product's manufacturer should offer a product and service package and at what price to offer them. The paper also distinguishes between two sales scenarios for bundles. The first scenario is 'pure bundling' where a customer has a choice of buying both the product and the service for one flat price, or buy nothing, and the second scenario is 'mixed bundling' where a customer is given the choice to buy the product only or buy the product and service package. The authors, first provide an optimisation model for the monopoly framework for the choice between the three selling strategies of 'product only', 'pure bundling', and 'mixed bundling'. They also provide a duopoly framework utilising a two-stage non-cooperative game model between the agents and customers.

The paper by *Viswanathan* titled as 'Coordination in vendor-buyer inventory systems: on price discounts, Stackelberg game and joint optimisation' deals with a vendor–buyer coordination problem. They consider a seller (leader) who sells a product to some retailers (followers) who sell the products to end-customers. The leader determines the unit price of the product based on which the followers make their pricing and inventory decisions. They develop a game-theoretic model for this problem and provide a conditional strategy under which a perfect coordination between the leader and follower can be achieved.

Decision-making process by two firms in a dynamic market with uncertainty is a well-known problem in supply chain management. *Fujita* in his paper 'A new formulation of strategic interactions in a fluctuating market' uses clothing market, which is dynamic and exhibits randomness. He considers a market where two clothing retailers interact with the rest of the retailers. This paper focuses on the behaviour of those two retailers and assumes that they manage the demand fluctuations. Fujita considers a leader–follower situation and derives the Nash equilibrium for the interaction between these two clothing retailers. He addresses the equilibrium properties and provides a list of situations where both firms introduce new items more frequently.

The last paper 'A contest among distributors over who is a better newsvendor' by *Azriel and Gerchak* discusses how to provide incentives to the distributors who manage inventories at different retailers. The problem is described within the framework of a diary firm that deploys distributors to manage inventory at different stores. The diary distributors visit the stores periodically, remove expired items, and stock the shelves with quantities of their choice. The distributors wish to have fewer overages (expired items) and fewer underage (lost sales due to shortages). This paper models the game between different distributors who provide service to a retailer. The introduction of a new class of game to the operations management literature is the main contribution of this paper.

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