

## Optimization models with economic and game theoretic applications

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Optimization models have a wide range of applications in economics and game theory. This special issue of the *Annals of Operations Research* contains selected and refereed papers on the topic *optimization models with economic and game theoretic applications*. Most of the papers in this special issue were presented at the International Symposium on Applied Optimization and Game Theoretic Models (ISAOGTM13) held during January 9–11, 2013, at the Indian Statistical Institute, Delhi Centre. This International Symposium was designed to promote research and applications in applied optimization and game theory by bringing together leading experts and other specialists in the field around the world with young scholars. This symposium mainly focused on classical and modern optimization theory, algorithms (local and global aspects), stochastic optimization, structured optimization, as well as related topics in applied mathematics that contain applications of optimization models in economics and game theory. Around 120 participants including speakers participated in this symposium.

This symposium was an event under the project *optimization and reliability modeling* funded by the Indian Statistical Institute. Having broad international appeal it provided an excellent opportunity to disseminate the latest major achievements and to explore new directions and perspectives, dealing with topics of fundamental importance in applied optimization and other related sciences (economics, physics, engineering). A special session titled *Professor Santosh N. Kabadi Memorial Session* was organized on combinatorial optimization to recall the memory of our dear friend Professor Santosh N. Kabadi, University of New

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Brunswick, Canada, who was a frequent visitor to the Indian Statistical Institute Delhi Centre and who passed away in a tragic drowning accident in the River Ganga in Haridwar. In the Santosh N. Kabadi memorial session, R. Chandrasekaran (coauthor of his papers), R. B. Bapat, S. K. Neogy, and Prabha Sharma talked about their association with Professor S. N. Kabadi. The major invited talks covered a broad range of topics from optimization and game theory models.

The twenty-two papers in this special issue were selected from forty-two submitted manuscripts, following the standard, rigorous AOR review procedures. The content of the papers are given below.

Zdeněk Došál and Lukáš Pospíšil present results on the development of optimal algorithms for the minimization of a strictly convex quadratic function subject to separable convex inequality constraints and/or linear equality constraints and demonstrate the efficiency of their algorithms. The paper by Konstantin Avrachenkov, Ali Eshragh, and Jerzy A. Filar deals with some algebraic properties of a particular class of probability transition matrices, namely, Hamiltonian transition matrices. As an illustration of the analytical results, a new heuristic algorithm is developed to determine a non-Hamiltonicity of a given graph exploiting the results obtained in this paper. John Kleppe, Hans Reijnierse, and Peter Sudhölter consider axiomatizations of symmetrically weighted solutions. They show that if the excesses of the coalitions in a transferable utility game are weighted, then the arising weighted modifications of the well-known (pre)nucleolus and (pre)kernel satisfy the equal treatment property if and only if the weight system is symmetric in the sense that the weight of a subcoalition of a grand coalition may only depend on the grand coalition and the size of the subcoalition. Finally, Kleppe et al. generalize Sobolev's axiomatization of the prenucleolus and its modification for the nucleolus as well as Peleg's axiomatization of the prekernel to the symmetrically weighted versions. Dusan Ku and Tiru S. Arthanari consider double cycling concepts in container terminal operations. The main contribution of the paper is to highlight the flaws in a recent article formulating the multiple QC double cycle problem. In addition, this paper discusses the need for imposing constraints arising from real-world requirements to the formulations aiming at double cycling. The paper by Roy Cerquetti and Raffaella Copier studies the behavior of fiscal revenues in a fragmented country, where there is evasion and fiscal corruption. For this aim, a game model with incomplete information is developed and solved. To find an approximate solution to the fixed point problem for nonexpansive mappings, a number of techniques are proposed. The paper by Yasunori Kimura focuses on a shrinking projection method with errors. Nandyala Hemachandra, Kamma Sri Naga Rajesh, and Mohd. Abdul Qavi propose a model for interaction between a user-set (market) and a service-provider (firm) when the offered demand is sensitive to the offered Quality of Service, which in turn depends on the offered demand; and they show that, under fairly mild conditions, an equilibrium point or an equilibrium set exists. Jinbeom Kim and Tim Leung study the problem of pricing and trading of defaultable claims among investors with heterogeneous risk preferences and market views. Agnieszka Wiszniewska-Matyszek introduces the concept of belief distorted Nash equilibrium and studies this new concept of equilibrium for games in which players have incomplete, ambiguous, or distorted information about the game they play. René van den Brink, Anna Khmelnitskaya, and Gerard van der Laan introduce and study an Owen-type value for games with a two-level communication structure, which is a structure where the players are partitioned into a coalition structure such that there exists restricted communication between as well as within the a priori unions of the coalition structure.

The paper by Lu Gao, Kanshukan Rajaratnam, and Peter Beling explores the case of a consumer loan portfolio manager incorporating the output of a multinomial classifier in the

acquisition decision process. For such a case, the authors show that an efficient policy may be achieved through transforming the score and applying a single cutoff-score strategy on the new score. Reshma Khemchandani, Avikant Bhardwaj, and Suresh Chandra develop optimal trading strategies for the risk averse investor by minimizing the expected cost and the risk of execution. They present a quadratic programming formulation that includes stochastic dominance constraints. J. Tao, I. Jeyaraman, and G. Ravindran make a further study of the concept of the column sufficiency property in Euclidean Jordan algebras considered earlier by Qin, Kong, and Han and prove numerous results relating column sufficiency with the Z and Lupaunov-like properties. Fu and Markham observe that if a Hermitian matrix satisfies certain conditions, then the matrix must be block-diagonal. Bo Zhong, Yongqiang Chen, and J. Tao extend this result to the setting of simple Euclidean Jordan algebras by using the Cauchy interlacing theorem and the Schur complement. S. K. Mishra, Vinay Singh, and Vivek Laha formulate and study Wolfe and Mond-Weir type dual models for mathematical programs with vanishing constraints. They establish the weak, strong, converse, restricted converse, and strict converse duality results under the assumptions of convexity and strict convexity between the primal mathematical program with vanishing constraints and the corresponding Wolfe type dual. Stock exchanges may be tested for market efficiency by using tests for assessing random number generators (RNG). The paper by Michael A. Noakes and Kanshukan Rajaratnam uses such a test to assess the efficiency of Small, Mid, and Large Cap Indices on the Johannesburg Stock Exchange (JSE), while making adjustments for thin trading that occurs during the sample period. Fariba Soleimani, Alireza Arshadi Khamseh, and Bahman Naderi study the pricing strategies in centralized and decentralized dual-channel supply chains. A game-theoretical method is proposed in this paper to drive optimal wholesale and retail pricing for manufacturer and retailer under these disruptions. Krishna Prasad and Bani Mukherjee study a deterministic inventory model for deteriorating items having stock and time dependent demand under the effect of deterioration and obtain a necessary and sufficient condition for the existence and uniqueness of the optimal solutions that could minimize the retailer's total cost per unit time. The paper by A. K. Bhurjee and G. Panda addresses the duality theory of a nonlinear optimization model whose objective function and constraints are interval valued functions. Three type dual problems are introduced and relations between the primal and different dual problems are derived. Sujeet Kumar Singh and Shiv Prasad Yadav formulate a transportation problem in which costs are triangular intuitionistic fuzzy numbers and propose ordering of triangular intuitionistic fuzzy numbers using an accuracy function. R. B. Bapat and S. K. Neogy consider the problem of finding the maximum of  $x^T D x$  subject to  $x$  being a nonnegative vector with sum 1 which occurs in many different contexts and show that the problem can be converted into a strictly convex quadratic programming problem that is solvable in polynomial time. A. K. Das studies properties of some matrix classes using a principal pivot transform (PPT) and introduces some more PPT based matrix classes that are useful in linear complementarity theory and various other applications.

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