ABSTRACTS

Multi-Objective Operating Room Scheduling Using Simulation-based Optimization

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As the main source of income and expenses of hospitals, operating rooms (ORs) are the engines of hospitals' economics and they have a significant impact on public health. Many papers concerned regarding OR planning and scheduling problems, but they have not considerably applied the simulation-based optimization approach to solve the problems. In OR scheduling problems, there are a number of ORs and some surgeons with different specialties and each surgeon has a waiting list of some patients that each surgery should be planned and scheduled on the days when relevant surgeons are available. In this study, we consider two objectives: (1) minimizing the costs of overtime staffing and ORs' idle time, and (2) minimizing the number of waiting days for patients. The mathematical model of OR scheduling problem is developed and solved by both exact method and simulation-based optimization approach. The comparison of results obtained from exact method and simulation-based optimization approach indicates that the exact method is only able to solve the small-size problems in reasonable time, while simulation-based optimization approach find competitive solutions for both small-size and large-size problems and solve large-size problems in an acceptable time.

Keywords: Mathematical modeling, Operating room, Scheduling, Simulation-based optimization.

Coordination of a Two-echelon Supply Chain under Demand Uncertainty Using Revised Sales Rebate with Simultaneous Punishment and Rebate Approaches

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This paper investigates coordination of a decentralized two-echelon supply chain with a single supplier and retailer with uncertain market demand. The presented model pursuits to coordinate the decisions related to the retailer's order quantity that in addition to increasing the profit of the decentralized supply chain, grow the profit of both two members of the chain to the amount greater than the decentralized mode. The main purpose of the model is to achieve maximum profit of the whole supply chain, beside the provision of incentives to satisfy the chain members to withdraw the decentralized decisions and join the contract. Considering the studied supply chain features, a revised sales rebate contract is applied in which both punishment and rebate approaches have been adopted simultaneously. Furthermore, a new approach of determining the contract's parameters based on the retailer and supplier viewpoints is developed. Finally, some numerical studies are conducted and a sensitivity analysis is done on the parameter of demand variations. Results show that the presented model has the ability of coordinating the ordering quantity in the supply chain.

Keywords: Decentralized decision-making, Sales rebate and punishment, Supply chain coordination, Target value.

Dual-objective Preemptive Multi-mode Resource-Constrained Project Scheduling Problem Optimization Model

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The Multi-Mode Resource Constrains Project Scheduling Problem (MRCPSP) tries to find the best sequence of activities in a manner that involves more than one type of operating mode and in the presence of resource constraints, project's precedence constraints must be satisfied. In each execution mode, the amount of resources and execution time are specified and different. In The Preemptive multi-mode Resource Constraints Project Scheduling Problem (P-MRCPSP), each operating mode activity can be interrupted and restarted at any time without any extra cost. In this paper, minimizing the completion time along with maximizing the current net value of the project in the P-MRCPSP are considered. After solving the problem by using Epsilon limits method, according to NP-hard problem and multi-objective model, multi-objective particle swarm optimization (MOPSO) has been developed to achieve optimum scheduling. In order to evaluate the proposed method's efficiency, results have been compared to non-dominance genetic algorithm sorting (NSGAII) based on designed indicators. The Taguchi method has been used in experimental design, to adjust these two algorithms' parameters. The results of the model solution show the strength of MOPSO algorithm.

Keywords: Cessation of activities, Meta-heuristic methods, Multi-mode execution, Multi-objectives particle swarm algorithm, Resources-constrained project scheduling.

Presentation of a Tri-level Covering Fortification Model in Order to Protect Facility Against Disturbance in r-interdiction Median Problem with the Approach of Stackelberg Game

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In this paper, a tri-level defense facility location model for full coverage in r-interdiction median problem is delivered. The purpose of this model is to design a proper service system in a way that after a worst case scenario of disturbance, they can utilize their full capacity of providing services. Hence, we have considered the defense facilities to provide extra protection for service facilities, and the goal is to optimally locate these facilities. The tri-level model is proposed based on leader-follower games as defender-attacker-defender framework. After the disturbance caused by the attacker, with the purpose of ensuring the operation of service facilities, the defender tries to establish a number of defense facilities in potential locations. Locating these facilities is carried with respect to the establishment of fixed cost of facilities and system's current cost. It should be noted that each service facility must be at least within the coverage range of at least one defense facility (first level).So, system's current costs can be defined based on the worst-case scenario of disturbance caused by the attacker. The problem is modeled as a static Stackelberg game between the attacker (level 2) and defender (level 3). In order to solve the model, two approaches have been used. In the first approach, explicit enumeration method is used for the first and second levels and an exact approach is used for the third level. In the second approach, hybrid methods consisting of genetic algorithm, explicit exact enumeration and exact approach have been used to solve the problem in a reasonable time. Comparing the proposed meta-heuristic to the exact approach in some samples, the numerical results show a quite satisfactory of this algorithm.

Keywords: Full coverage, Probabilistic protection, r-interdiction median problem, Stackelberg game, Tri-level programming.

A Decision Making Framework for Evaluating Suppliers of Automotive Parts Industry Based on Cognitive Map

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Evaluating the suppliers and selecting an appropriate set of them are one of the fundamental strategies to enhancing the product/service quality, and the reputation of the organization. Hence, identifying criteria for suppliers' evaluation, determining how important they are, and providing a framework for using them in evaluation process, play an important role in the success of an organization. As the evaluation criteria in the real world influence on each other, the actual weights of criteria in this study is achieved by considering both the relations among these criteria and expert's opinion. Thus, cognitive maps method is used to determine the weight of evaluation criteria with causal relationships between them in the automotive industry. Then, a framework for the evaluation and gradation of suppliers based on the weighted criteria is presented. This framework was implemented in one of the active company in automotive spare parts industry, according to the role of the automotive industry in GDP.

Keywords: Automotive parts industry, Cognitive map, Evaluation criteria, Supplier evaluation and selection.

Selecting Product Configuration Using a Combination of Fuzzy-ANP and ELECTRE-TOPSIS Approaches

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Product selection is done according to its specifications. In modern competitive markets, product survival refers back to its appropriate price, quality, and innovations in accordance with customers' needs. In order to increase customers' satisfaction, the quality of products and services should be improved. In this study, we evaluated different configurations of laptops using Multi-criteria Decision Making (MCDM) approaches. First, we employed a structured questionnaire to collect important features about laptop selection from customers' viewpoints, and the customers scored the features based on their own opinions. Then, in solving the problem, it was used fuzzy Analytical Hierarchy Process (AHP) to weigh criteria such as product weight, price and time spending for full battery charge. Afterwards, TOPSIS-ELECTRE approach was used to rank laptop alternatives to propose the best one. Based on the results, good price and having main features at a desirable level were identified as main factors to improve configuration and customer satisfaction.

Keywords: Evaluation of product, Fuzzy ANP, Product configuration, TOPSIS-ELECTRE approach.

Applying the Modified Base Stock Policy in a Two–echelon Inventory System Including Stockroom and Retailers

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In base stock policy, a new order is done immediately when a sale occurs. However, in modified base stock policy, doing a new order is delayed. In this paper, for the first time a two-echelon inventory system is studied which consists of one central storeroom and a number of identical, independent retailers

which apply continuous review and modified base stock policy by imposing delay between placement of successive orders. Unsatisfied demands are backordered at the warehouse while become lost at the retailers. The performance of modified base stock policy is evaluated through simulation and its total cost is compared with that of standard base stock policy. Simulation show that in modified policy, while the delays before the new orders are the same, the total cost reduces much.

Keywords: Backorder, Base stock, Continuous review, Lost demand, Multi echelon inventory system, Supply chain.

A Hybrid Metaheuristic Method for Two-Echelon Location-Routing Problem with Pickup and Delivery

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Integrated optimization approach in supply chain has become one of the most important and interesting subjects for researchers in recent years. In this paper, a mathematical model is presented for two-echelon location-routing problem with simultaneous pickup and delivery, so that a layer of facilities with the name of "middle warehouse" are located between main distribution centers and customers. Each customer has demands for commodity reception and delivery simultaneously. In this paper, first a two-echelon integer programming mathematical model, which central/middle storerooms capacities are considered limited, is presented. Then, using genetic and simulated annealing algorithms, a hybrid metaheuristic method is delivered for solving the model. Numerical results of solving sample instances in different sizes confirm the good performance of our approach.

Keywords: Genetic algorithm, Location-routing problem, Simulated annealing algorithm, Simultaneous pickup and delivery, Two-echelon.

Automatic Reverse Warehousing System: Principal Concepts, Modeling and Optimizing of Shelving and Routing Problems

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Warehouses and distribution centers are essential components in supply chain and their management has a particular importance. In the traditional approach for collecting the items of orders in warehouses, operators walk or drive toward the shelves and collect the ordered items. However, since 2006 a new system has been deployed in some large distributing warehouses like Amazon Inc., in which shelves are mounted on mobile platforms and are carried by small mobile robots toward operators who pick the ordered items. Advantages of this system compared to traditional system are increased flexibility, accuracy, and speed of preparing the received orders. On the other hand, the mathematical model of this system –which we call it 'Automatic Reverse Warehousing System (ARWS)'– is introduces as a trade solution, and no research papers have been published about it. In this paper, this system will be studied from the viewpoint of industrial engineering. Then, its components and their relationship with each other and their two major subproblems, namely, allocation and routing will be identified, and their interrelations will be investigated. The model is solved for minimizing the overall cost and finding the best paths of shelves through a Genetic Algorithm and maximum flow approach.

Keywords: Genetic algorithm, Mathematical modeling, Mobile shelf, Reverse warehousing with movable shelves, Robotic, Routing problem, Shelving problem.