Abstracts of Papers in English

PRESENTING A THREE-LEVEL LOCATION-INVENTORY MODEL FOR BLOOD SUPPLY CHAIN

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Abstract

Blood supply chain management is one of the important fields in the health care system. The blood supply chain consists of two components: donor blood collection and blood product supply. Human blood is a scarce resource. It is only produced by human beings and there are currently no other products or alternative chemical processes that can be used to generate blood. Blood supply chain is different from other supply chains because (a) supply of blood to donors and (b) one unit of blood being mechanically separated into five components. In this study, a two-stage stochastic model for location-inventory of blood, which is part of the supply chain of perishable goods, was studied. The proposed blood supply chain has three levels of blood donors, mobile and fixed centers and consumption centers. This study investigates platelet component which is a highly perishable component. The decision is made to determine the location of collection and distribute blood facility as well as the optimal inventory control policy such as identifying the optimal ordering for facing lack of blood, which is the main challenge based on perishable blood issuing policy which is FIFO. The objective function of the problem includes minimizing the cost of establishing

blood donation centers, the cost of allocating donors to fixed and mobile centers, the cost of transporting blood units along the supply chain network, the cost of ordering, inventory holding costs, and shortages and wasting blood in blood centers and hospitals. The efficiency in reducing network costs lies in making correct decisions on locating, allocation, and inventory. We preferred a three-level network with donors and collection station and demand points and presented a programing model for locating station and allocation donor to them and identifying inventory policy. Given NP-hardness of the model, two metaheuristic GA and PSO algorithms were employed.

Key Words: Blood supply chain, location- inventory, GA, PSO.

MSA-MADM COMBINATORIAL METHOD UNDER FUZZY CONDITIONS

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Abstract

Today, the quality of measurement data is more important than ever. It depends on the statistical characteristics of repeated measurements performed under stable conditions in a measurement system. In other words, the quality of the measurement system is of particular importance because it can even overshadow the fluctuations of the production process. If the quality of the measurement system and the resulting sampling figures are low, the process analysis will not be valid and the correct decision cannot be made to increase the quality. In this respect, the Multi-Attribute Decision Making (MADM) technique can be used to make proper decision along with using the new and hybrid method of analysis and guidance systems. One of the basic principles of any organization is to ensure that the data are obtained from measuring its products. If the quality of the measurement system is poor and, as a result, the quality of the resulting data is poor, the analysis of the process will not be valid and there may be incorrect decisions about whether or not to accept it and the costs involved will obviously be high. Numerous models have been developed to support decision-making processes over the years. As one of the research areas of operations research and management, Multi-Criteria Decision Making (MCDM) can be a solution for evaluating and ranking options from the best to the worst. The worst-case conditions under conflicting criteria with regard to decision-making priorities should be found. Decision-making is one of the key tasks of management. Comparison of different measurement systems can also be very helpful in selecting the contractor to reduce the risk of production or decision-making. For this purpose, various MCDM methods in the analysis of measurement systems have been used. The method of this research is descriptive-library type such that by developing basic models collected from articles and reference books, we present a new model and select the best option using MADM technique. These indices were obtained by CRITIC method and then, the options were ranked using fuzzy summing method.

Key Words: Measurement systems analysis (MSA), multi-criteria decision making (MCDM), uncertainty conditions, CRITIC technique, PAMSSEM technique.

MAINTENANCE SCHEDULING OF METRO TRAINS FOR MAXIMIZING THE AVAILABILITY OF TRAINS (CASE STUDY OF TEHRAN METRO LINE 2)

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Abstract

Maintenance scheduling of trains in the metro is of particular importance for the availability of more trains,

reducing train delays, and public satisfaction with the rail transportation system. The purpose of this study is to maximize the availability of trains. Also, for the research method, we use a linear scheduling model of the multi-objective mixed integer linear programming model to schedule the maintenance of Tehran's Metro Line 2 trains. The operational constraints of the model include the length of time it takes to carry out maintenance activities, the time cycles of maintenance activities, the capacity of the maintenance crew teams, and the minimum number of trains available on the line. The model consists of two objective functions, the first objective function tries to maximize the number of maintenance activities and the second objective function tries to send a smaller number of trains to the maintenance unit daily. In order to solve the problem of scheduling maintenance of Tehran's Metro Line 2 trains, we use the innovative backtracking algorithm. According to the presented results, a 21.42% improvement can be provided in Tehran's Metro Line 2, or in other words, the accessibility of trains can be increased by 21.42%.

Key Words: Maintenance scheduling, Train maintenance, metro trains maintenance scheduling, optimization mathematical model.

A NOVEL MULTI-OBJECTIVE MODEL FOR SENSOR LOCATION PROBLEM TO RECOGNIZE TRAFFIC FLOW IN TRANSPORTATION NETWORKS

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Abstract

This paper addresses the problem of locating Vehicle-ID sensors on the arcs of the transportation network to recognize the traffic flows along a given set of routes. This problem has received great attention from researchers and existing studies can be partitioned into two categories, namely flow-observation and flow-estimation. In the first category, the location of sensors is determined so that the flow of all routes can be determined exactly while minimizing the number of sensors. The second category is used when the number of available sensors is limited and the aim is to maximize the number of routes whose flow can be determined uniquely.
Since the number of available sensors is usually limited, the amount of flow along some routes cannot be determined uniquely; further, the set of routes, covered by at least one sensor, is partitioned into some clusters where each cluster contains the routes with the same sensor pattern. Generally, the size of clusters obtained by current optimization models is very big; however, the smaller the size of clusters, the better the estimation of flow along the routes belonging to the same cluster. To overcome this shortcoming, we present a new multi-objective model in which every route is covered by at least one sensor and the objective functions are considered in the order of priority. Indeed, the first objective is to minimize the size of the largest cluster. Then, assuming that the optimal value of the size of the largest cluster is L , the second objective is to minimize the number of clusters with the size L ; the third objective is to minimize the number of clusters with the size L-1 ; and finally, the last objective is to minimize the number of clusters with the size 2. The evaluation of the proposed model on two real-world networks, taken from the literature, confirms its importance.

Key Words: Sensor location problem, Vehicle-ID sensor, recognizing the traffic flow, order of sensor observation.

A STATISTICAL-INTELLIGENT MODEL FOR DETECTING FAILURE POINTS IN PREDICTIVE MAINTENANCE

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Today, maintenance and repair have become very important in the manufacturing industry. An efficient solution to prevent downtime is to predict equipment failure. Therefore, accurate and correct prediction of breakdown events in the field of predictive maintenance can be very useful. In general, each prediction will be accompanied by a certain amount of error, which in various ways tries to control this error or limit it to a reasonable amount. In this thesis, a framework has been proposed that specifies when the system under review will need maintenance and repairs to prevent downtime as much as possible. Therefore, the main purpose of this thesis is to design and implement an efficient combination structure to accurately predict failure events using both standard statistical standard models and machine learning in predictive maintenance. The literature review results indicate that the use of these methods in recent years has led to extensive advances in the field of providing accurate forecasts and subsequently improved the level of decisions made by managers and decision-makers. The proposed model is used to predict failure events in benchmark data related to the truck air pressure system. Finally, the performance of the proposed model is compared with other data-driven techniques individually and in combination, which includes logit models, support vector machines, and multilayer perceptron neural networks. According to the numerical values obtained from the final analysis, the results indicate that the backup vector machine model has higher prediction accuracy than other single models, and also the results indicate the efficiency and effectiveness of the proposed parallel combination structure compared to the use of models individually and in series combination in modeling and forecasting issues. The parallel hybrid model improved the accuracy of predictions by an average of 11% in test data and 7% in training data. Therefore, due to the greater accuracy in combining classical statistical models and machine learning in parallel, the use of this combined method to improve the accuracy of predictions in the field of predictive maintenance is recommended for future studies.

Key Words: Predictive maintenance, forecasting, machine learning, combination structures.

BEHAVIOR-BASED PRICING CONSIDERING COMPETITION IN RETAIL SYSTEMS

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Distribution systems are greatly vulnerable to demand fluctuations, price of products, and customer's behavior due the complex nature of these systems. Moreover, companies target price discrimination by applying the customer's geographical location, purchase history, and special interests. Thus, a few changes in each factor can result in considerable effects on total profit and system's market share in competitive markets. Hence, considering pricing concept in these systems and also supply chains will improve their capabilities toward competency, flexibility, and efficiency in addition to appropriate handling of total costs. Here, the issue of pricing is at focus considering customers' behavior and the competitive environment. A novel mathematical model is developed to represent competition among the main entities in distribution systems (wholesaler and retailer) considering customer's behavior. This paper seeks to find the optimal price of wholesaler and retailer and the optimal number of products transferred from each entity to another. The proposed model also aims to concentrate on profit maximization objective for the entities and utility maximization for the customers, simultaneously. In addition, customer's behavior is applied through this model by behavior-based price discrimination (BBPD) and utility function and the optimal competition equilibriums are obtained by defining the Stackelberg game (since the wholesaler is the leader and the retailers are the followers) in the form of bi-level programming. Finally, the model is solved using KKT optimality conditions. Using the associated equilibriums of the follower behavior-based pricing model and proving the level model convexity result in an integrated model for the second scenarios. Then, a linearization method is used to linearize the integrated model so that it can be solved by CPLEX solver in GAMS. The model is also validated by an experimental example and the sensitivity analyses were carried on the model to compare the defined scenarios and derive managerial insights and future research directions for further managers and practitioners.

Key Words: Behavior-Based price discrimination, competition, customer behavior, stackelberg, KKT optimality conditions.

RISK ASSESSMENT OF PUBLIC-PRIVATE PARTNERSHIP PROJECTS FOR WATER TRANSMISSION AND DISTRIBUTION USING ANFIS METHOD

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Abstract

The drought crisis has highlighted the importance of basic projects in various water areas. However, the government budget is insufficient to fund necessary infrastructure projects. To address this issue, public-private partnership (PPP) projects can be utilized to leverage private sector capital for infrastructure development. Given the high sensitivity of PPP projects, it is crucial to conduct a comprehensive identification and accurate assessment of risks associated with water transmission and distribution PPP projects. The primary objective of this research paper is to present a structured methodology for assessing risks affecting PPP projects in water transmission and distribution. To achieve this goal, 30 risk factors were identified through a thorough review of relevant literature and background information. The study involved distributing questionnaires to 80 experts, with three dimensions of effect severity, probability of occurrence, and probability of detection. A total of 60 valid questionnaires were collected and evaluated using the intelligent method of adaptive neural-fuzzy inference system (ANFIS). The results indicate that ANFIS is an efficient method for assessing and predicting the risk of PPP projects. The developed framework can assist managers in understanding and preparing for the occurrence of these risks.

Key Words: Risk assessment, public-private partnership, water transmission and distribution, adaptive neural-fuzzy inference system (ANFIS).

MODELING AND OPTIMIZATION OF LIGNOCELLULOSIC BIOMASS SUPPLY CHAIN UNDER UNCERTAINTY CONSIDERING THE HUB PROBLEM

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Abstract

Reducing dependence on fossil fuels and environmental pollution is one of the most important incentives to produce fuels from renewable energy. Nowadays, renewable resources are being considered for reasons such as economic and environmental benefits and easy access. They are used to generate electricity and clean fuels and heat. In recent years, biomass is considered as a renewable source, and its use is rapidly growing .Biofuels derived from biomass can play a key role nowadays as one of the main sources of renewable energies. Therefore, more and more researchers have been involved in modeling and optimizing biomass supply chains. Lignocellulosic biomass is a rich and renewable natural resource composed of cellulose, hemicellulose, and lignin. This source can replace fossil fuels to produce biofuels without compromising food security. Agricultural wastes are among the sustainable sources of lignocellulosic biomass, and a million tons of agricultural waste is produced, which is one of the major sources of biofuels. One of the obstacles to the use of these renewable sources is the cost associated with the supply chain such as transportation and production costs which are among the important costs in the supply chain. In this research, a single-objective, multi-level and multi-period linear programming under uncertainty with chance constraints is presented to maximize the profit, in which hub is used as

an intermediate level. Hub facilitates the transmission of biomass between supply chain levels. In the proposed mathematical model, lignocellulosic biomass was used to generate bioethanol and lignin. Sales of lignin as by-products and multimodal transportation represent other ways to reduce costs. After sensitivity analysis, the results showed that increasing the sales price more than reducing transportation costs and increasing demand had a positive effect on the profitability of the entire supply chain and the proposed model was economically justifiable.

Key Words: Renewable energy, biomass supply chain, uncertainty, optimization, hub.

A NEW INVERSE DEA MODEL FOR UNITS RESTRUCTURING: A CASE STUDY OF COMMERCIAL BANKS MEMBERS OF THE PERSIAN GULF CORPORATION COUNCIL (GCC)

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Abstract

A mathematical programming based non-parametric technique for the performance assessment of decision-making-units (DMUs) with multiple inputs and outputs is considered in a general framework called data envelopment analysis (DEA). DEA models have been utilized for estimating the efficiency scores of the DMUs with certain input-output levels. However, in the last two decades, various studies have been concentrated on the inverse DEA as an analytical framework of DEA to find the required inputs and outputs levels for achieving a predetermined efficiency target. The main aim in the inverse DEA is to estimate the inputs and/or outputs for a special DMU to attain a given efficiency target while evaluating the performance of a specific DMU is the main objective in the DEA analysis. Inverse DEA has been studied from both theoretical and practical aspects including sensitivity analysis, resource allocation, preserving or improving efficiency scores, and merging DMUs to achieve the predetermined efficiency target. Also, inverse DEA has been employed for modeling generalized restructuring DMUs. In a generalized restructuring a set of pre-restructuring DMUs through consolidation/split to create synergy/reverse synergy, proceed with a restructuring to produce a new set of post-restructuring DMUs to achieve predefined efficiency targets.

This paper deals with the problem of units' restructuring using inverse data envelopment analysis (DEA). A generalized restructuring refers that a set of decision-making units based on synergies through mergers/acquisitions or reverse synergies through split, proceed with a restructuring to produce a new set of post-restructuring entities to improve efficiency. The problem of units' restructuring is investigated in this paper, and to achieve a pre-specified efficiency level for each post-restructuring decision-making units, models for estimating inputs (outputs) have been proposed. The most important advantages of the proposed models, compared to other the provided models, as follows: i) Due to the use of multi-objective programming (MOP) tools, allows the decision maker to pursue multiple goals in the problem of restructuring units. ii) The proposed method has less computational complexity because the number of variables is greatly reduced. In addition, a numerical example with real data is employed to evaluate the performance of the proposed models.

Key Words: Data envelopment analysis (DEA), inverse DEA, units restructuring, efficiency, multi-objective programming (MOP).

A MULTI-OBJECTIVE TOUR ROUTING PROBLEM CONSIDERING THE TIME WINDOW AND TOURIST UTILITY

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Abstract

This paper optimizes a tour route for tourists in groups considering time windows and tourist fatigue. It is based on points of interests, which are grouped in clusters and is a branch of an orienteering problem, known as a Tourist Trip Design Problem with clustered points of interests. There are a variety of transportation modes for trips, in which all the tourists in a group can choose one respecting some constraints, such as time, distance, and possibility of using a specific vehicle. Each point of view has starting and finishing service times for tourists. Therefore, each point of interest can be visited only in a special time window. In such problems, human health and energy should be noticed so that tourists can enjoy most of the tour and the total utility is increased. One of important factors in human health and energy is fatigue. To apply the factor into the problem and express it implicitly, points of interests are grouped into three clusters based on activities that tourists do in each kind of point of views: tourist attractions, shopping malls, and resting places. In each route, tourists must visit at least one place of each cluster so that fatigue can be relieved. A mixed-integer linear programming model with two objective functions is proposed. The model is verified and assessed through five numerical examples that is designed for a hypothetical tourist area. The example is solved by GAMS software using the CPLEX solver. Also, the sensitivity analysis based on each objective function separately is performed on some of the parameters, such as visiting costs and time windows. Therefore, both tourists and managers with certain points of interests can plan and change them to decrease the cost and increase the utility and visits.

Key Words: Orienteering problem, clustering of points of interests, time window, tourist fatigue, weighted goal programming.