Abstracts of Papers in English

SUPPLIER SELECTION AND ORDER ALLOCATION MODEL WITH DISRUPTION RISKS AND BUSINESS VOLUME DISCOUNT _ RISK-NEUTRAL OR RISK-AVERSE

E. Maleki
elh.maleki@gmail.com
S.H. Zegordi(corresponding author)
zegordi@modares.ac.ir
Faculty of Industrial and Systems Engineering
Tarbiat Modares University
DOI:10.24200/J65.2022.58512.2239

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Abstract

In this research, a mathematical model of scenario-based mixed integer programming is presented to model the problem of supplier selection and order allocation considering Disruption Risk and Business Volume Discount in a centralized supply chain. The considered supply chain is Bi-Level and contains one manufacturer and several suppliers and as well as There are two categories of suppliers: main suppliers and backup suppliers. As is clear, it is assumed that the unit costs of the main suppliers are lower than those of the backup suppliers. Also, it is assumed that the backup supplier supports disruption conditions if the manufacturer meets the minimum value set by the supplier under normal conditions. Supplier Disruptions are random and independent. It is assumed that the disruption is not due to the lack of raw materials to suppliers. Demand is considered definitive and the model is a single-criteria with the criterion of reducing the cost of all members of the supply chain. Also in the presented model, a single-period multi-product supply chain is considered. Due to the importance of supplier selection and the high impact of the cost of purchasing raw materials on the total cost of the product and its aggravation in the event of disruption, this issue was investigated. Also, by calculating the C-VaR using GAMS and analyzing the sensitivity of the result, We examined the impact of the decision-making risk attitude on the total cost of the supply chain as well as the

costs of each member and found out that increasing the decision-makers sensitivity to risk generally increases the this costs. We also examined this effect on purchases from suppliers. The result was that as the sensitivity to risk increased, the quantities purchased from undisturbed suppliers, whether main or backup, increased, but the quantities purchased from disrupted suppliers decreased. Also, in order to evaluate the efficiency of the model, a case study was conducted in Sapco(Iran Khodro Engineering Design and Parts Supply Company).

Key Words: Supplier selection, order allocation, disruption risk, business volume discount, risk attitude.

AN INTEGRATED SOLUTION TO STORAGE SPACE ASSIGNMENT PROBLEMS, BERTH ALLOCATION PROBLEMS, AND YARD CRANE DEPLOYMENT PROBLEM

G. Soroushnia
g.soroushnia@in.iut.ac.ir
M. Alinaghian(corresponding author)
alinaghian@iut.ac.ir
Dept. of Industrial and Systems Engineering
Isfahan University of Technology
DOI:10.24200/J65.2023.59538.2272

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Abstract

Today, maritime transportation has grown due to decentralized production and increased communication between different countries. Container transportation has contributed a significant share of global transportation due to the possibility of moving a large volume of goods at a reasonable cost. With the expansion of container transportation, container terminals as a place to transport containers between land and sea play a pivotal role in the global transportation network. Container terminals are divided into seaside and landside. To better manage the terminals and reduce costs, the main problems at the seaside and the landside need to be addressed in an integrated manner. The literature review shows that despite the importance of the matter, the berth allocation problem, the storage space assignment problem, and the yard crane deployment problem have not been studied in an integrated manner.

In this research, an integrated mixed integer programming model has been provided to investigate the storage space assignment problem, the berth allocation problem, and the yard crane deployment with the traffic congestion at the passing lines consideration on the daily planning horizon. The objective function of this mathematical model includes minimizing the yard crane movement cost, the yard crane operating cost, the cost related to the route length of the container transportation between the berth and the yard, and the penalty cost caused by delaying the vessels. In the proposed model, the discrete berth layout has been considered. The movement capacity is determined to prevent traffic congestion in the passing lines. Also, 8 valid inequalities based on the concepts and assumptions of the problems are considered to improve the proposed integrated model. To validate the proposed model, 32 instances are generated based on the data production framework in the literature, and their results are presented. The results indicate the proper performance of the proposed integrated model.

Key Words: Container transportation, berth allocation problem, storage space assignment problem, mixed integer programming model.

A NEW APPROACH TO TIME SERIES CLUSTERING BY COMBINATION OF SUB-SERIES

A. Ghorbanian
ali.ghorbanian@mail.um.ac.ir
H. Razavi(corresponding author)
h-razavi@um.ac.ir
Dept. of Industrial Engineering
Faculty of Engineering
Ferdowsi University of Mashhad
DOI:10.24200/J65.2022.60405.2303

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Abstract

Time series-clustering, defined as deriving trends and archetypes from sequential data, divides time series into groups considering their characteristics. Previous works mainly focused on distance criterion and clustering algorithm to cluster the time series so few researchers have investigated the similarities between the segments of a time series. To address this research gap, we propose a new two-step approach based on sub-time series and combination clustering. In the first step, a time series

data set is segmented using a fixed window size, and each segment is clustered by applying a hierarchical clustering algorithm and Euclidean distance. Also, we use a logarithmic relation based on the length of the time series data set to determine the number of components, selecting the best outcomes using various internal criteria including intergroup variance, Kalinsky-Harbaz, and Dunn index. In the second step, the results of the first stage are processed using ensemble clustering, and the final clustering label is obtained. We develop two novel algorithms based on different internal criteria for selecting the best segmentations: the first one in which we consider only one internal criterion and the second one in which we consider three internal criteria simultaneously. Moreover, we run various settings on 82 datasets with 10 replications for the two presented algorithms, checking the final precision using an external RAND index. Then, to identify the best settings for the proposed algorithms we applied Wilkinson statistical test. Statistical comparison of the results of the two new algorithms on 82 data sets with some algorithms in the related literature indicates significant improvement In terms of error rate and execution time. Finally, the findings acquired based on the best settings of the proposed algorithms indicate that the suggested method has the best RAND index among the previous algorithms in the literature for 32% of the dataset tiers.

Key Words: Time series, clustering, data mining, Sub-Series.

INVESTIGATING THE PROFITABILITY OF PAIRS TRADING USING MACHINE LEARNING AND GENETIC BASED ALGORITHMS IN TEHRAN STOCK EXCHANGE

B. Rezaei
behnaz_rezaei@modares.ac.ir
R. Baradaran Kazemzadeh(corresponding author)
rkazem@modares.ac.ir
M.A. Rastegar
ma_rastegar@modares.ac.ir
Dept. of Industrial and Systems Engineering
Tarbiat Modares University
DOI:10.24200/j65.2023.60603.2308

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Abstract

In this paper, the problem of finding profitable pairs by automatically limiting the search space of pairs using machine learning techniques and integrating an unsupervised learning algorithm, OPTICS, to pair identification and selection in pair trading is discussed. In addition, to optimize the portfolio consisting of pairs of assets and allocate optimal capital to them, a genetic-based algorithm to increase the Sharpe ratio is used. The proposed technique for automatic clustering is better than the conventional methods of searching for pairs of assets used by investors and leads to a higher average rate of return on investment and a higher Sharpe ratio for portfolios in trading using selected pairs of clusters. These calculated evaluation criteria for the portfolio were improved after using a bi-objective optimization genetic algorithm. This study was simulated using intraday price data of a group of stocks in the Tehran Stock Exchange between the years 2015 to 2020 and taking into account the transaction costs.

Key Words: Pairs trading, neutral market, machine learning, unsupervised learning, optimization genetic algorithm, transaction costs.

DESIGNING A FRAMEWORK OF RISK-AWARE PROCESS MANAGEMENT IN LENDING PROCESS IN BANKING INDUSTRY OF IRAN

M. Sadegh(corresponding author)
mohamad.sadeq92@gmail.com
M. Aghdasi
mohammad.aghdassi@gmail.com
M.A. Rastegar
ma_rastegar@modares.ac.ir
Faculty of Industrial and Systems Engineering
Tarbiat Modares University
DOI:10.24200/J65.2022.60441.2305

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Abstract

Business process management (BPM) and risk management (RM) are two essential concepts in the development of large businesses. These are considered key success factors for organizations. Risks are part of every

business activity. If a risk occurs it may threaten the organizational goals causing time delays, additional costs, loss of quality, having lower than anticipated profits, or experiencing a loss rather than taking a profit. A business process is a set of activities that are executed according to certain rules to achieve a predefined business goal. Thus, if risk occurs it may threaten the execution of business processes. In the past, these categories were considered separately, and each of them was able to address business problems partially as well. The new approach toward these two branches of science is integrative. Sometimes, the results and outcomes of these two management branches conflict with each other. However, integrating these two can also result in unique achievements that cannot be achieved by implementing them separately. In this paper, we focus on one of the most important processes in the banking industry in Iran called the lending process, and use the concept of risk-aware business process management (R-BPM) to present a framework for risk awareness of this process. The framework is presented in the form of a table to raise awareness about the risks of the process (operational risks). The columns of the table represent risk patterns for information systems extracted from the related literature and customized in the present study for the banking industry of Iran. On the other hand, the rows show the main sub-processes of lending in the industry. While the rows of the table can be utilized by people dealing with the sub-processes to raise their awareness about the risks related to each sub-process, the columns are beneficial for people who are not directly dealing with the sub-processes and view the whole banking industry with a risk-oriented approach.

Key Words: Risk management, process management, risk-aware business process management, banking industry, lending process.

SERVICE LEVEL-COST TRADE-OFF USING MONTE CARLO SIMULATION AND GENETIC ALGORITHM APPROACH: A CASE STUDY OF A MEDICAL EQUIPMENT SUPPLY COMPANY

H. Khalili
h.khalili67@gmail.com
S. Alaei(corresponding author)
s.alaei@khatam.ac.ir
Dept. of Industrial Engineering
Faculty of Engineering
Khatam University

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Abstract

Today, for success in the competitive market, lead time is an important issue, and its control increases customer satisfaction and improves service levels. In the latency between the initiation and completion of orders, a series of activities are performed, such as order preparation, waiting time, combining orders, purchasing raw materials, setup time, assembling, packing, sending, etc. These activities are defined by characteristics such as precedence relationships, execution modes, and their corresponding time and cost. Each activity can be controlled at the expense of extra cost, which can lead to shortened lead time and increased service levels.

In this paper, we investigate the service level-cost trade-off where orders' entry, demand and execution times are assumed to be stochastic. The main goal is to determine activities' execution modes to simultaneously optimize the service level and costs. In this regard, the decision-maker's main questions are (a) what is the maximum reachable service level with a maximum of 10% increase in product cost? (b) to increase the service level to 70%, how much will the product cost increase?

We propose a hybrid approach of Monte Carlo simulation and Non-dominant Sorting Genetic Algorithm (NSGA II) to identify the Pareto solutions. The effectiveness of the proposed algorithm was shown by applying it to a medical equipment supplier company as a case study. After implementing the proposed algorithm, 9 Pareto solutions were identified for the problem. It was found that the maximum reachable service level is 66.7% with a 7.7% increase in product cost; and, to increase the service level to 70%, the product cost increases by 20.7%. The sensitivity analysis results showed that the service level is very sensitive to reducing the execution time of orders in the range 71 to 100, and the answers to research questions may undergo changes; therefore, the decision-maker can focus on reducing the execution time of this interval.

Key Words: Lead time, service level, monte carlo simulation, multi mode activities.

PROPOSING A TEAM FORMATION HYBRID APPROACH TO THE DESIGN OF THE SUPPLIER NETWORK IN TERMS OF MULTI-

OBJECTIVE MODEL, FUZZY SET, AND SOCIAL NETWORKS ANALYSIS

S.M. Sadjadiyan(corresponding author)
sajadiyan@pnu.ac.ir
Dept. of Industrial Engineering
Payame Noor Unvierstiy
R. Hosnavi
hosnavi@mut.ac.ir
M. Abbasi
mabbasi@mut.ac.ir
Faculty of Management and Industrial Engineering
Malek-Ashtar University of Technology
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Abstract

Faced with increasing threats and challenges of supply chains, it is necessary to redesign the supplier network based on hybrid approaches based on mathematical models and reliability. To solve the problem, this paper presents a new approach. Team formation, selection, design, and composition are still critical success or failure factors in any business within a company and organization. Criteria, parameters, various qualitative and quantitative methods, approaches, and techniques have been presented by several studies in TF so far. This study developed a hybrid approach to team formation (TF) and reliable supplier network design, focusing on a multi-objective model integrating fuzzy-set theory and social network analysis. Furthermore, this study addressed the relative importance value of precise relationships between members using fuzzy logic (expert workshop and fuzzy inference), backup team, capabilities (skills, expertise, or knowledge), capacity, and order allocation. It also carefully considers the relationships between team members using expert workshops and fuzzy inferences. Also, social network analysis metrics are used to suggest team leader(s). We used the augmented epsilon constraint (AUGMECON2) method to validate the model and solve small-scale problems with exact solutions. The model aimed to form a reliable team and supplier network with a maximum level of reliability, maximize the network weight of collaboration, and maximize the knowledge level of the main members(suppliers), simultaneously. The approach was evaluated through a numerical study of the actual data of the electro-optical camera for team formation, design and selection of a network of reliable suppliers, and order allocation. The results showed that the approach carefully selects the optimal supplier network and team based on all assumptions and suggests team leaders with social network analysis. One of the advantages of our model is simultaneously considering supplier network, reliability, FIS, and SNA in team formation. The use of uncertain data and combined methods and MADM for preselection can also be effective. The strategy of the optimal number of modules and product subsystems can also be included in the model. In future studies, other variables and parameters such as time, design phases, and the total cost can be considered. Also, because the problem is NP-hard; the use of meta-heuristic algorithms is suggested. Modeling a multi-product multi-period supply chain problem is suggested.

Key Words: Team formation and design Supplier networking, reliable supplier selection and order allocation, social network analysis, fuzzy inference, relationship analysis, multi-objective optimization.

PATIENT ADMISSION AND ROUTING IN-HOME HEALTHCARE SERVICES CONSIDERING IN-PERSON AND REMOTE VISITS (CASE STUDY: MAXA CANCER CONTROL CENTER)

M. Tavakoli
mohsentavakoli@in.iut.ac.ir
M. Iranpoor
iranpoor@iut.ac.ir
M. Mahnam(corresponding author)
m.mahnam@iut.ac.ir
Dept. of Industrial and Systems Engineering
Isfahan University of Technology
DOI:10.24200/J65.2023.61158.2323

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Abstract

The aging of societies, social changes, medical advances, and high in-person treatment costs have increased the demand for home healthcare services. Additionally, the development of communication technology has led to the advent of remote health systems which have benefits for caregivers and patients. In this study, we propose an integrated approach to decide on patient admission, the service types (in-person or remote), patient assignment to treatment staff, and routing and scheduling of caregivers. It is assumed that, if a patient is admit-

ted, all their requested visits must be provided. During the planning horizon, patients can receive multiple visits for various types of services. However, during a single day, each patient can be visited at most once during their time window. Each treatment staff starts (ends) the routes from (to) the healthcare center, and the telehealth service is carried out from the center. Each caregiver has a specific work schedules and skills. The objective is to maximize the patients' preferences and efficiency of treatment staffs as well as minimizing the patients' dissatisfaction in terms of visit day and treatment staff changes. A three-phased algorithm is developed: First, a relaxed model decides on the patient admission, the service types, and assigning patients to treatment staffs. Second, an ant colony system (ACS) determines the routing and scheduling of the staffs based on the output of the first phase. Finally, a local search is used to improve the best-known plan. To evaluate the proposed method, we use the obtained upper bound of the first phase. The computational time is considered to be at most 10 minutes. Numerical results on benchmark data show that, for all instances, the average gap between the best-found solutions and their corresponding upper bounds is less than 10%. Finally, a case study on the Macsa healthcare center is presented. According to the results, the proposed plans can improve patient satisfaction and the efficiency of treatment staffs by about 31%.

Key Words: Home health care, treatment staff routing and scheduling, telehealth, ant colony optimization.

DETERMINING THE OPTIMAL HEDGE RATIO FOR THE EXCHANGE RATE (DOLLAR) USING GOLD FUTURES CONTRACT AND ITS PREDICTION: AN ARTIFICIAL NEURAL NETWORK MODELING APPROACH

N. Neshat
neshat@meybod.ac.ir
Dept. of Industrial Engineering
Meybod University
DOI:10.24200/J65.2023.61298.2327

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Abstract

Due to the high inflation in recent years in Iran, as well as the uncertainty in environmental conditions, the use of investment risk hedging tools in the capital market has received more attention. What is targeted in this study is to identify the best approach among the existing approaches in calculating and predicting the optimal ratio of risk coverage considering the dynamic nature of this ratio and also environmental uncertainties. Undoubtedly, the performance of approaches based on modeling (parametric) or simulation, such as artificial neural networks, which are formed based on learning as well as previous information, will be affected in a situation where political, economic, and social effects dominate a society. But what is targeted in this study is to compare the performance of existing approaches and use the superior approach to estimate this ratio and predict it with a non-parametric approach (an approach that works better in conditions of environmental uncertainty). In this research, determining and predicting the optimal dynamic hedge ratio of exchange rates using gold coin futures contracts in the Iran stock Market is discussed. The approach used in determining this ratio is the minimum variance and the comparison of different econometric models was used to optimize this ratio. By using the weekly data of the cash yield of the dollar and gold coin futures from the beginning of 2016 to August 8, 2020, the optimal risk coverage ratio for each model was calculated and by forming a portfolio and evaluating the variance, the effectiveness of the models was examined, the results of which show the superiority of the dynamic model was BEKK-GARCH. Based on the results obtained, a perceptron neural network model was used to predict this time series and it was concluded that the neural network model is a high-performance model in predicting this ratio based on asset returns.

Key Words: Optimal hedge ratio, cross-hedging foreign exchange rate risk, portfolio, artificial neural networks.

FUZZY MATHEMATICAL PLANNING MODEL FOR PROJECT PORTFOLIO SELECTION CONSIDERING PROJECT INTERDEPENDENCIES

A. Bozorgi Amiri(corresponding author)
alibozorgi@ut.ac.ir
School of Industrial Engineering
College of Engineering
University of Tehran

A.R. Adibi
alireza.adibi@ut.ac.ir
School of Industrial Engineering
Alborz Campus, University of Tehran
H.R. Adibi
std_adibi@khu.ac.ir
School of MBA
Dept. of Management
Kharazmi University
DOI:10.24200/J65.2023.58393.2227

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Abstract

Projects are used in most organizational structures including strong matrix, weak matrix, balance matrix, project-oriented, virtual, hybrid, and project management office to achieve the goals of the organization. Many organizations consider their successful projects as a competitive advantage and use a comprehensive portfolio management system to manage projects, plans, and operations to achieve their organizational goals. As project management has become more professional, the focus of organizations has shifted from management to one or more complex projects separately and to the management of an interconnected set of projects. Therefore, a formal portfolio management process is a requirement for integrated implementation and the use of a portfolio system to manage projects to achieve the goals and strategies of the organization based on the desired criteria of management, is necessary. Income sources in almost all of the project-based companies, especially in IT Industry, are highly dependent on the company's project revenue, so Project Portfolio Selection has always been one of their managers' main concerns. To maximize their business value and profitability, these companies define appropriate projects in specific time horizons. Because the projects compete for resources, the interdependence between an organization's projects and their potential and actual impact on the portfolio selection has become particularly important to managers. Applying Analytical Hierarchy Process (AHP) technique and the Fuzzy Inference System (FIS), this paper presents a hybrid model of Fuzzy Mathematical Programming that seeks to select projects in a portfolio by creating maximum synergies between them in the presence of uncertainty. In the proposed model, the concept of synergy is used in such a way that time constraints, costs, and interactions between them are satisfied, and decision-makers have the opportunity to evaluate different selection modes. We used the fuzzy conditional programming approach in the objective function and the Jimenez method in constraints to defuzzify the problem. In order to express the effectiveness of the proposed model, it is applied in the telecom industry as a case study.

Key Words: Project portfolio selection, projects interdependency, fuzzy mathematical planning, fuzzy inference system, analytical hierarchy process.

MATHEMATICAL OPTIMIZATION MODEL FOR DESIGNING A SUSTAINABLE BLOOD SUPPLY CHAIN NETWORK UNDER UNCERTAIN CONDITIONS

N. Zarrinpoor(corresponding author)
zarrinpoor@sutech.ac.ir
S.M. Alizadeh
mohsen.alizade44@yahoo.com
Faculty of Industrial Engineering
Shiraz University of Technology
DOI:10.24200/j65.2023.59545.2271

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Abstract

Adequate blood supply plays an essential role in the management of health systems, and the cost of blood supply and its derivatives is an important part of community health expenditures. Due to the lack of alternatives to blood, its production only by humans, and its non-production by chemical processes, designing an efficient and effective blood supply chain seems necessary. In this paper, a multi-level and multi-period mixed integer programming model is provided for designing the blood supply chain considering donors, hospitals, temporary centers, and laboratories. In mathematical modeling, the goals of sustainable development are considered to minimize supply chain costs, minimize greenhouse gas emissions, and maximize job opportunities created by the establishment of facilities. Using the proposed model, several decisions are made including the location of facilities, the blood flow between different levels of the supply chain, inventory level, deficiency, and the number of donors according to restrictions related to coverage radius, budget, and the expiration of blood. Due to the uncertain nature of the parameters in the real world, the uncertainty of the key parameters of the blood supply chain such as blood demand, costs of systems, wastes,

and budget are considered. To deal with the uncertainty, the chance-constrained fuzzy programming approach is used. Ultimately, a case study is presented to show the effectiveness of the model. The proposed model can provide a suitable tool for health department managers in making operational and strategic decisions on blood supply chain levels by optimizing all three dimensions of sustainability. Numerical results confirm the effectiveness of the proposed model and show that the uncertain nature of the parameters of the proposed model cannot be ignored because the costs of the system, the harmful environmental effects, and the positive social effects are significantly affected by the uncertainty. Also, the results obtained from solving the mathematical model show that when the level of uncertainty is increased, to meet the demand, it is necessary to establish more temporary facilities to increase blood supply and reduce its shortage.

Key Words: Blood supply chain, sustainable development goals, chance constrained fuzzy programming, location-allocation.