Abstracts of Papers in English

DEVELOPING AN INTEGRATED TWO-LAYERED SUPPLY CHAIN MODEL WITH DEFECTS IN PRODUCTION SYSTEM

A.R. Haji(corresponding author)
ahaji@sharif.edu
F. Rezaei Zeynali
rezaeizeynali_fardin@ie.sharif.edu
Dept. of Industrial Engineering
Sharif University of Technology
DOI:10.24200/J65.2021.52427.1951

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 3-10, Original Article

- Received 13 August 2019; received in revised form 20 February 2021; accepted 12 April 2021.

Abstract

In real production systems, the process is always bound to the production of faulty items and different approaches may be used for handling these low quality items according to the nature of the industry and product. Repairing, discarding, or selling items in a secondary market are some of the possible actions. We investigated the essentiality of coordinated decision-making between a supplier and a buyer in this environment, hence developing a model to minimize total costs of two parties with an attitude for improving quality of production system. In common two-layered supply chains, the buyer defines the Economic Order Quantity (EOQ) according to its own decision criteria. These order quantities may not favor the supplier and most probably cause an increase in its inventory costs. Joint economic lot sizing strategy has been practiced in the literature to minimize the total cost of the system and an attempt was made to add more real-world variables and coordinated strategies regarding quality to our model.

The examination level is assumed to be 100 percent with two types of examination errors. Type I error (defective recognition of good products) and Type II error (good recognition of defective products). All the imperfect items are returned to the supplier at the end of the examination cycle and are replaced by new items by supplier. These imperfect items are then sold in a secondary market with a lower price. Various costs are taken into account regarding the production of faulty items such as excess production costs, returning cost, the loss of credit cost, and the cost of storing faulty items at buyer's warehouse. We also considered an amount of joint investment

to be made on enhancing the quality of the production which can definitely favor both parties in the long term. Amount of this investment is a variable in the model.

Key Words: Production with faults, examination errors, coordinated decision making, joint investment on quality.

MULTI PRODUCT MEDIA ADVERTISING PLANNING CONSIDERING LIFE CYCLE STAGE, BCG MATRIX CLASS, COMPETITORS' REACTION AND BUDGET CONSTRAINT USING APPROXIMATE DYNAMIC PROGRAMMING ALGORITHM

M. Khalil Zadeh
majid.khalilzadeh@mail.um.ac.ir
H. Neghabi(corresponding author)
hosseinneghabi@um.ac.ir
Dept. of Industrial Engineering
Ferdowsi University of Mashhad
DOI:10.24200/J65.2020.54496.2054

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 11-22, Original Article

- Received 1 December 2019; received in revised form 20 June 2020; accepted 21 December 2020.

Abstract

In the new competitive world, companies use several types of tools and strategies to differentiate their products from competitors' products, one of which is promotional. Companies spend a large amount of their promotional budget on advertising. To increase the effectiveness of advertising budgeting, media planning must be properly developed and the manner allocation advertising be determined over a company's programming horizon. This paper investigates advertising media planning and budgeting for several products. Important aspects including life cycle stage, BCG matrix class, price, competitors' reaction, and budget constraint are considered in our model given uncertainty and with the aim of maximizing profits at the end of the time horizon. This problem is formulated as a stochastic dynamic program and Approximate Dynamic Programming (ADP) algorithm is utilized to overcome the huge dimensionality. The mentioned problem is subject to considerable uncertainties. Approximate Dynamic Planning (ADP) is a powerful technique for solving discrete time problems under multistage stochastic control processes. A numerical example was carried out on two products over the course of one year (12 monthly periods) with five different advertising packages. The results showed that 5 million iterations would be suitable for converging. Remaining budget analysis shows the percentage of selecting offensive packages in higher budgets for Product 2 and selection of such packages in the medium term for Product 1.The process of the life cycle shows that Product 1 does not most likely complete its life stages, while Product 2 completes its life cycle stages. Moreover, the BCG matrix confirms the results and Product 2 is in the final stages of dogs, while Product 1 is more likely in Cash Cows. Also, the total budget was examined in different quantities, which showed that as the amount of the budget increased, the target amount increased slowly. The presented model offers the opportunity to managers by which they are able to compare different media for making advertising decisions on various products in an uncertain environment with different budgets.

Key Words: Approximate dynamic programming - media planning - resource constraints - markov decision process -advertising.

DESIGNING A SECOND GENERATION OF BIOFUEL SUPPLY CHAIN NETWORK BASED ON CARBON EMISSION REGULATIONS UNDER UNCERTAINTY

N. Zarrinpoor(corresponding author)
zarrinpoor@sutech.ac.ir
A. Khani
a.khani@sutech.ac.ir
Faculty of Industrial Engineering
Shiraz University of Technology
DOI:10.24200/J65.2020.54886.2076

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 23-38, Original Article

- Received 24 December 2019; received in revised form 31 August 2020; accepted 21 December 2020.

Abstract

Global warming and the detrimental impacts of fossil fuels on the environment and human life have led to greater concern and focus on producing sustainable energy resources for future. One of the renewable and sustainable energy resources is biofuel. Today, most of developed countries are focused on producing biofuels to improve economic and environmental opportunities. Because of carbon dioxide and other greenhouse

gases emissions during supply chain activities, a mathematical model has been presented for designing a second generation of sustainable multi-stage biofuel supply chain network, which contains agricultural zones, bio-refineries, and markets with the objective of maximizing the profit. Supply chain costs like growing, harvesting, collecting, and agricultural residual storage, transportation of agricultural residual from farms to bio-refineries, producing biofuel in bio-refineries, and transportation cost from bio-refineries to markets are also considered. Since a considerable amount of carbon dioxide is emitted during transporting agricultural residual from farms to bio-refineries and transporting biofuel from bio-refineries to markets, four different carbon emission regulations are considered in order to examine the environmental impacts including carbon cap, carbon tax, carbon cap-and-trade, and carbon offset. Based on the carbon-cap mechanism, the maximum amount of carbon emissions is limited. Under the carbon tax mechanism, for each unit of carbon emission, a tax must be given to the regulations. Regarding a carbon cap-and-trade policy, a carbon cap is imposed on supply chain operations and companies can trade their carbon allowances in the market. Considering a carbon offset mechanism, a company can purchase additional carbon allowances. According to uncertainties in real-world problems, the uncertain nature of parameters like selling revenue of biofuel, costs of growing, harvesting, collecting agricultural residual, transportation of agricultural residual and biofuel, biofuel production, carbon tax rate, and amount of carbon emissions are reflected. A chance-constrained fuzzy programming approach is used to deal with uncertain parameters. It is apparent through numerical results that the proposed model is so efficient and it can be used in the future to produce and develop second-generation biofuel a supply chain from agricultural residual by considering the carbon emission regulations.

Key Words: Supply chain, second generation of biofuel, agricultural residual, carbon emission regulations, chance constrained fuzzy programming.

THE EFFECTS OF ACCIDENTS AND WEATHER CONDITIONS ON TRAFFIC USING DECISION TREE (CASE STUDY: TEHRAN)

M. Karimi(corresponding author)
minakarimi@email.kntu.ac.ir
M.S. Mesgari
mesgari@kntu.ac.ir
Faculty of Geodesy and Geomatics Engineering
K.N.Toosi University of Technology
DOI:10.24200/J65.2020.54632.2066

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 39-53, Original Article

- Received 12 January 2020; received in revised form 30 June 2020; accepted 21 December 2020.

Abstract

These days, traffic is one of the biggest problems in metropolitan life. The heavy traffic, besides many problems for citizens, causes waste of resources such as energy and fuel. Many factors affect traffic in Tehran. Identification of these factors and their impact on traffic flow can help urban managers to prioritize and allocate resources to address their effects. The purpose of this study is to investigate the effect of two factors of driving accidents and atmospheric conditions on traffic congestion in the metropolitan Tehran and to model and predict the traffic length caused by these factors in different situations. The data of this research has been collected through the investigation of the database of the traffic control center of Tehran. For this purpose, firstly, statistical analysis and pre-processing operations have been performed on the data. Then, by using data mining methods such as clustering, classification, and categorization through the decision tree, two models for the effect of accidents and atmospheric conditions in different regions of Tehran have been obtained. Finally, the rules for each model are extracted. The results show that about 4% of traffic was caused by accidents and 1% due to atmospheric conditions. According to statistical analysis of linear regression, it is determined that the traffic length due to accident is a function of the accident severity, the area of the municipality of the accident site, and the number of involved equipment, while it doesn't have the effect of a typical day or holiday. Also, the traffic length caused by atmospheric conditions depends on the area of the municipality, the atmospheric conditions, and the day type of typical day or the holiday. The results show that the maximum length of traffic is related to the crashes with two vehicles involved in the accident or in rainy weather. It is also found that according to the results and extracted rules, the maximum traffic length in both models is 200-500 meters.

Key Words: Traffic, accident, atmospheric conditions, data mining, decision tree, geographic information system (GIS).

MODELING THE VARIABLE SIZE AND COST BIN PACKING PROBLEM IN AN ORDERING PROBLEM

S.M. Tahanian-Qomi
masoudtahanian66@gmail.com
M. Hamedi (corresponding author)
hamedi@pnu.ac.ir
Dept. of Industrial Engineering
Payame Noor University
R. Tavakkoli-Moghaddam
tavakoli@ut.ac.ir
Dept. of Industrial Engineering
University of Tehran
DOI:10.24200/J65.2021.55146.2085

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 55-65, Original Article

- Received 12 May 2020; received in revised form 6 July 2021; accepted 2 August 2021.

Abstract

In recent years, many studies have been presented on the interpretation and modeling of new problems by basic models. One of the most widely used of these basic models is the Bin packing problem. Over time, the importance and power of this issue in modeling new problems becomes clearer. This paper also attempts to interpret and model "An Ordering and assigning orders to supplier's problem" by using one of the generalizations of the bin packing problem. There are many generalizations about the bin packing problem. In this paper, for the first time, generalization of the bin packaging problem called "developed Variable size and cost bin packing problem" is modeled, which increases the flexibility of the model in solving current problems. Because the presented model is a bi-objective nonlinear programming type and NP-hard one to be solved in a reasonable time, a well-known multi-objective evolutionary algorithm, namely a Non-dominated Sorting Genetic Algorithm (NSGA-II), is proposed. To verify the obtained solution and evaluate the performance of the NSGA-II, the ε-constraint method is developed in solving small-sized problems. In large-sized problems, the test problems are solved by the proposed NSGA-II. Then, the Pareto-optimal solutions are evaluated by mean ideal distance, diversification, and time metrics.

Key Words: Developed variable size and cost bin packing problem, batch ordering, multi-level supply system.

AGENT-BASED SIMULATION OF IRANIAN ELECTRICITY MARKET BASED ON RISK AVERSE LEARNING AGENTS USING REINFORCEMENT LEARNING AND CONDITIONAL VALUE AT RISK (CASE STUDY: YAZD PROVINCE ELECTRICITY MARKET)

Y. Zare Mehrjerdi(corresponding author)
yzare@yazd.ac.ir
M.H. Rezaei Sadrabadi
rezaei.mh@gmail.com
M.S. Owlia
owliams@yazd.ac.ir
M.A. Vahdat
mvahdat@yazd.ac.ir
Dept. of Industrial Engineering
Yazd University
DOI:10.24200/J65.2021.56143.2137

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 67-78, Original Article

- Received 27 July 2020; received in revised form 5 July 2021; accepted 23 July 2021.

Abstract

Restructuring and deregulation are one of the most significant developments in the world electricity market. In this market, Generation Companies (GenCos) in an oligopolistic game with incomplete information participate in a sealed auction and offer their bids in a certain period according to the market demand. Choosing the best bid to maximize profits and minimize risks in dynamic competition with other players is one of the most important issues for GenCos. The dynamic nature of this problem can help GenCos make the best decision based on learning from the past. Using reinforcement learning and considering risk aversity of the GenCos, this paper provides an agent-based simulation of the bidding behavior of Iran's electricity market. In this simulation, the GenCos optimize their bids using a learning process based on previous bids. Although a few studies have been conducted on the modeling of risk-averse behavior of GenCos under learning conditions, risk-averse analysis based on a history of profits and losses, or sever losses, has not been focused. Thus, in this paper, the learning behavior of the GenCos is modeled by the Q-learning reinforcement learning algorithm and their risk aversion behavior is modeled by the conditional value at risk measure and risk of missed opportunities in terms of the number of auction failures (missed auction opportunities). To validate the functionality of the proposed approach, it was applied to the real data of the electricity market of Yazd province, including five GenCos with the total nominal power of 2550 MW. The results were compared for different learning conditions, risk behaviors of companies, and pay as bid and uniform pricing. The results demonstrate that learning all GenCos leads

to increased competition and promoted social welfare. Also, the level of risk aversion of GenCos and the type of clearing mechanism have a direct effect on the GenCos profitability and social welfare. The results can help power plants determine the bidding strategy in competitive conditions by considering their risk level. Likewise, these results assist regulators in designing market rules in line with the actual behavior of GenCos.

Key Words: Bidding strategy optimization, reinforcement learning, Q-learning, conditional value at risk, risk of missed opportunities.

PERFORMANCE COMPARISON OF THE LONGEST COMMON SUBSEQUENCE AND DYNAMIC TIME WARPING IN TIME SERIES DATA MINING

Gh. Soleimani
gholam_soleimani@yahoo.com
M. Abessi (corresponding author)
mabessi@gmail.com
Faculty of Industrial Engineering
Faculty of Engineering
Yazd University
DOI:10.24200/J65.2021.55318.2100

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 79-90, Original Article

- Received 30 September 2020; received in revised form 26 April 2021; accepted 14 July 2021.

Abstract

Today, the use of data mining techniques such as classification, clustering, discover repetitive pattern and discover outliers in different domains including production, medicine, social, meteorology, stock exchange, sales, customer service and other areas are increasing. Data mining techniques are specifically designed for static data. Therefore, their use for time series data requires some modifications to their respective algorithms. One of these changes is the selection of the appropriate similarity measurement method, because similarity measurement methods are used in all data mining techniques. Therefore, in this research, we will evaluate and compare the effect of two commonly used and efficient methods of time series similarity measurement in data mining. This evaluation is done in relation to the effectiveness of these methods in achieving better results. These methods are the Longest Common Sub Sequence (LCSS) method and the Dynamic time Warping (DTW) method. The main purpose of this research is to compare the performance of these methods in time series data mining. The data mining techniques that used in this research are the nearest-neighbor technique and k-medoids clustering algorithm. The performance evaluation process is described in the text. This process uses the nearest-neighbor technique to calculate the accuracy of detection of right time series class, and uses the k-medoids clustering technique to calculate the clustering accuracy, the ability to correctly determine the number of clusters, and the ability to determine the better cluster representative. For this purpose, we use 63 time series data sets by random from a world-renowned database that named UCR collection. The results show that the effect of LCSS method is significantly better than the effect of DTW method on the correct detection accuracy of time series class and clustering accuracy by 99% and 92.5% confidence, respectively, but there is no significant difference between them in terms of their effect in determining the number of clusters and cluster representatives. The results of this research help to use these methods in appropriate data mining techniques in issues such as customer segmentation, workshop scheduling and the like more accurately.

Key Words: Time series data mining, clustering, nearest neighbor, longest common subsequence, dynamic time warping.

LOADING WITH SHAPE CHANGEABLE ITEMS AND ITS APPLICATION IN OPTIMIZING MILK-RUN LOGISTICS IN SAIPA GROUP AUTOMOTIVE COMPANY

M. Najafian
masoum.najafian@azad.ac.ir
Faculty of Industrial Engineering
South Tehran Branch, Islamic Azad University
A. Husseinzadeh Kashan(corresponding author)
a.kashan@modares.ac.ir
Faculty of Industrial and Systems Engineering
Tarbiat Modares University
A.A. Akbari
a_akbari@azad.ac.ir
D. Mohammaditabar
d_mohammaditabar@azad.ac.ir
Faculty of Industrial Engineering
South Tehran Branch, Islamic Azad University
DOI:10.24200/J65.2021.57401.2196

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 113-121, Original Article

- Received 14 March 2021; received in revised form 21 November 2021; accepted 23 November 2021.

Abstract

Milk-run logistics is a consolidation method in which vehicles are dispatched in specified time periods to collect orders from various suppliers and deliver them to assembly lines following predefined routes. Pallets of an order can sit in different arrangements in the vehicle and hence, their loading shape can be changeable. Choosing one of these shapes for the order and arranging its pallets in the vehicle as a unified cube can be handled by decision variables. The set of possible shapes for an order varies as the vehicle type changes and this imposes complexities for the case of heterogeneous fleet. Following such an observation, we introduce the idea of shape changeable loading/packing and the required set of constraints to attain a mixed integer linear formulation with the objective of minimizing total transportation costs. Besides loading issues, other considerations such as extra half cost for reverse distribution of empty pallets, order time windows, and heterogeneous fleet are considered. Given the grouping nature of the problem, a Grouping Evolution Strategy (GES) algorithm is proposed that utilizes an efficient constructive best-fit heuristic to ensure feasibility of routing and shape changeable 2D loading of orders into vehicles. Effectiveness of our approach is tested using real-world data obtained from SAIPA Group automotive company. Extensive computations signified the worth of milk-run logistics in comparison with direct shipping strategy followed by the SAIPA's logistics division. Our simulations approve that there exists a capacity for reducing the cost of direct shipment by average amount of 25% via employing milk-run strategy. Moreover, using the more complex shape changeable loading rationale can reduce the costs by 10% compared to a more straight loading method followed by SAIPA. The joint employment of milk-run logistics and shape changeable loading can result in a 32% reduction in costs on average, compared to the current shipment strategy followed by SAIPA.

Key Words: Milk-Run logistics; direct shipping; loading and packing; grouping evolution strategy.

LAGRANGE RELAXATION FOR FLEXIBLE FLOWSHOP SCHEDULING IN HETEROGENEOUS MULTI-FACTORY NETWORKS

E. Kalvandi
eladep208@gmail.com
J. Bahamian(corresponding author)
behnamian@basu.ac.ir
Dept. of Industrial Engineering
Bu Ali Sina University, Hamedan
DOI:10.24200/J65.2021.56538.2157

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 91-111, Original Article

- Received 1 November 2020; received in revised form 2 June 2021; accepted 14 July 2021.

Abstract

This paper deals with production scheduling in a flexible flowshop with several factories trying to satisfy market demand by creating a network through a distributed network. Although these factories have their own flowshop system consisting of stages with a number of parallel machines, each job must pass through these stages to be completed; in some cases, due to the long queues in one factory, some jobs are sent to other factories to reduce the overall completion time. In other words, in this system, it is assumed that each factory, after satisfying the demand of its region, can cooperate with other factories in order to provide economic benefits and increase sales as a result of greater profitability of the production network, which means that if for any reason in the process, the production of products is disrupted or the amount of load of factories is too much, in order to improve the overall objective function, it is possible that some jobs be sent to other factories for processing. Multi-factory production takes place in several factories, which may be geographically distributed in different locations, in order to comply with and to take advantage from the trend of globalization. This allows them to be closer to their customers, to employ professionals, to comply with local laws, to focus on a few product types, to produce and market their products more effectively, and respond to market changes more quickly. Here, after introducing a flexible flowshop in the distributed network structure, a model is proposed for the problem considering the holding costs in the buffers and heterogeneity of factories in the production network. Finally, after solving the model using GAMS software, the Lagrange relaxation algorithm has been developed for it. By comparing the GAMS and output results of the Lagrange relaxation algorithm, it is concluded that the proposed algorithm is of very high efficiency.

Key Words: Distributed scheduling, flexible flowshop, multi-factory network, lagrange relaxation.

AN IMPROVED EFFICIENT COMBINED ALGORITHM FOR LARGE-SCALE MULTIPLE TRAVELING SALESMEN PROBLEM

S.H. Mirmohammadi
h_mirmohammadi@iut.ac.ir

S. Amiripebdani
eng.amiri940@gmail.com
P. Feizollahy(corresponding author)
parisafeizollahy@in.iut.ac.ir
Dept. of Industrial and Systems Engineering
Isfahan University of Technology
DOI:10.24200/J65.2021.55500.2109

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 123-133, Research Note

- Received 20 June 2020; received in revised form 13 February 2021; accepted 14 July 2021.

Abstract

The Multiple Traveling Salesmen Problem (MTSP) is a generalized Traveling Salesmen Problem (TSP). The difference with the traveling salesmen problem is that all cities are visited by multiple salesmen, and each salesman from the city that initiated the move must go back to the same city, which is, in fact, suitable for modeling practical problems in real life than TSP. To solve MTSP with a few starting points, you need the minimum and maximum number of cities each salesman should visit. The total number of cities that salesmen go through should be equal to all cities. In this article, The hybrid Algorithm (IAC-PGA), which combines Parteno Genetic Algorithms (PGA) and Ant Colony (ACO) and uses the 2-opt local search method to improve the algorithm. This method provides full double displacement to improve the response. The main idea in this article is to use the PGA algorithm to search for the best number of cities visited as well as to obtain the starting point of each salesman using the genetic algorithm, and then to use the ACO algorithm to accurately determine the cities visited and the best tour for each salesman. The objective function for this problem is to minimize the distance traveled by all salesmen. For the purpose of analysis, the parameters of each algorithm are selected according to the number of experimental samples in the most appropriate case, and then the results of the algorithm are compared with other algorithms including PGA, Improved PGA (IPGA), Two-part Wolf Pack Search (TWPS), Artificial Bee Colony (ABC), and Invasive Weed Optimization (IWO). Statistics show the algorithm improvement for problem solving. The results of comparative experiments show that the proposed IAC-PGA algorithm is sufficiently effective in solving large-scale MTSP and is not worse than other algorithms on a small scale and performs better than the existing algorithms.

Key Words: Parteno genetic algorithm, ant colony algorithm, multi traveling salesmen problem with improved hybrid algorithm, 2-opt local search method.

THE BULLWHIP EFFECT ON THE DRUG SUPPLY CHAIN CONSIDERING INTERNATIONAL SANCTIONS WITH A DYNAMIC SYSTEM APPROACH

M. Nakhaeinejad(corresponding author)
m.nakhaeinejad@yazd.ac.ir
Dept. of Industrial Engineering
Faculty of Engineering, Yazd University
A.H. Farokhzad
amirhassanfarokhzad@gmail.com
A. Akhavan
akhavan@sau.ac.ir
Dept. of Industrial Engineering
Faculty of Engineering, Science and Arts University, Yazd
Y. Zare Mehrjardi
yzare@yazd.ac.ir
Dept. of Industrial Engineering
Faculty of Engineering, Yazd University
DOI:10.24200/J65.2021.55544.2114

Sharif Industrial Engineering and Management Journal
Volume 37, Issue 2, Page 135-147, Research Note

- Received 6 July 2020; received in revised form 27 December 2020; accepted 18 January 2021.

Abstract

The Bullwhip effect phenomenon as one of the main causes of reducing the efficiency of supply chain performance occurs when changes in demand fluctuate widely during the supply chain. In the present study, it has been shown that the continuation of the sanctions process in Iran can strengthen the sector of domestic production, but with the reduction of drug imports and the lack of technology and sufficient capacity in the production of Desferrioxamine, the country will face a drug crisis. And people and patients' satisfaction will be greatly reduced. Therefore, in order to improve the situation of drugs and reduce the whip effect in the drug supply chain, four government protection policies for consumers and producers were directly and indirectly examined. The data were evaluated with the help of Wensum software and the results revealed, lowering the price of medicine, increasing the level of people's satisfaction, reducing the whip effect, increasing the profit of supplier, distributor and overall profit of the drug supply chain as policies for improving the current situation.

Key Words: Supply chain, dynamic system, sanctions, drugs.