فصلنامه علمی – پژوهشی مطالعات مدیریت صنعتی – سال شانزدهم، شماره ۴۹، تابستان ۹۷
صفحات ۱۹۸-۱۷۳

مدل بهینه‌سازی مکانیابی-تخصیص تسهیلات قابل اطمینان تحت ریسک اختلال در تسهیلات

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تاریخ دریافت: ۹۵/۴/۲۰- تاریخ پذیرش: ۹۵/۱۱/۱۹

چکیده

در مدل‌های کلاسیک مکانیابی تسهیلات به طور ضمنی فرض می‌شود که تسهیلات انتخاب شده همواره طبق برنامه کار خواهند کرد، در حالی که، در دنیای واقعی تسهیلات همواره در معرض ریسک اختلال هستند و گاهی این اختلالات اثر بلند مدت روی شبکه زنجیره تأمین گذاشته و آن را با بحران مواجه می‌کند. در این مقاله، یک مدل برنامه ریزی عدد صحیح مختلط جهت تعیین نحوه خدمت رسانی به مشتریان در زمان اختلال مراکز توزیع در یک زنجیره تأمین دو سطحی شامل توزیع کنندگان و مشتریان ارائه شده است. این مدل مکان‌هایی را برای توزیع کننده‌ها انتخاب می‌کند که علاوه بر حداقل نمودن هزینه‌های معمول زنجیره تأمین، هزینه‌های حمل و نقل بعد از مختل شدن توزیع کننده‌ها نیز حداقل شوند. در واقع سعی می‌شود انتخاب محل توزیع کنندگان با کم ترین هزینه و بیشترین قابلیت اطمینان صورت گرفته و ضمناً تخصیص مشتریان به آنها انجام شود. با استفاده از رویکرد لاگرانژ مسأله آزاد سازی شده و به دو زیر مسئله تقسیم می‌شود. با بررسی شرایط بهینگی زیر مسئله‌ها، حل ابتکاری برای زیر مسأله اول و الگوریتم ژنتیک برای زیر مسأله دوم به منظور حل مسائل با ابعاد بزرگ استفاده شده است. در پایان، عملکرد و کارایی مدل و روش پیشنهادی در قالب مثال‌های عددی مورد بررسی قرار می‌گیرند.

کلمات کلیدی: مکانیابی- تخصیص، مدیریت زنجیره تأمین، اختلال، الگوریتم ژنتیک، آزاد سازی لاگرانژ

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Modeling Multi-Objective, Multi-Product and Multi-Period Supplier Selection Problem Considering Stochastic Demand

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Abstract: In this paper, a multi-objective, multi-period and multi-product mixed integer programming model for the supplier selection and quota allocation problem under an all-unit quantity discount policy, constrained storage space and stochastic demand is considered. Also, due to the stochastic status of the demand, we use the Chance Constrained Programming (CCP) in order to transform the inventory balance equation to a stochastic position. Since the discount policy encourages the buyer to buy more while the storage capacity restricts, we require to consider both in the supplier selection and quota allocation problem; furthermore, different priorities for the objectives should be considered. We use the LP-metric method, goal programming and the novel solution technique called multi-choice goal programming in order to model the multi-objective problem. Furthermore, a numerical example using three modeling approaches, considering the different scenarios are solved. The differences in the scenarios are the importance of the objective function in terms of the decision maker. Results show if an objective function is prioritized, that objective will be closer to its optimal value.

Keywords: Supply Chain, Supplier Selection, All-unit Discount, Stochastic Demand, Multi-choice Goal Programming

Introduction: The evaluation and selection of suppliers is one of the interesting topics for many researchers. Esfandiari and Seifbarghy (2013) classified the research in the field of evaluation and supplier selection as follows:

- The first class: mathematical programming models considering the cost objective function
- The second class: mathematical programming programming considering two objective functions including minimizing cost and maximizing utility function.
- The third class: mathematical programming considering at least three objective functions including minimizing cost, return items and delay in delivering products.
- The forth class: phase models that deal with phase and vague data input such as demand and capacity.
- The fifth class: models that consider different types of discount
- The sixth class: models that considering the uncertainties of demand, capacity and ... .

The contributions of this paper are as follows:

- Considering multi-period and multi-objective programming model for supplier selection and quota allocation problem under an all-unit quantity discount policy, constrained storage space and stochastic demand
- Considering different multi-objective modeling techniques in the field of supplier selection

Using the Chance Constrained Programming (CCP) in order to transform the inventory balance equation to a stochastic position.

Materials and Methods: In this paper, a multi-objective, multi-period and multi-product mixed integer programming model for the supplier selection and quota allocation problem under an all-unit quantity discount policy, constrained storage space and stochastic demand is proposed. The Chance Constrained Programming (CCP) in order to transform the inventory balance equation to a stochastic position is used. The assumptions of this paper are as follows: the demand for each product has a normal distribution with specific mean and variance. Inventory holding and shortage costs of each

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Analysing bullwhip effect in supply networks under information sharing and exogenous uncertainty

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Abstract: This paper analyses the bullwhip effect in single product supply network topologies, operated with linear and time-invariant inventory management policies and shared supply network information, considering exogenous uncertainty. Information sharing is determined as the degree of coordination across the supply network. Exogenous uncertainty (e.g., transportation delay) cannot be governed by any supply network members. We characterise the stream of orders placed at any stage of the network assuming the customer demand is ergodic. In fact, this paper gives exact formulae to predict the magnitude of bullwhip effect in any shared supply network information topologies. The mentioned formulae is explored by means of mathematical method called frequency domain analysis (FDA) and the relevant analyses are progressed by Fourier transform method. The main contribution of the present work is defined as considering information sharing and exogenous uncertainty simultaneously in supply networks and using Fourier transforms.

Keywords: bullwhip effect; BWE; supply networks; information sharing; frequency domain analysis; FDA; exogenous uncertainty.

Reference to this paper should be made as follows: Seifbarghy, M., Darvish, M. and Akbari, F. (2017) 'Analysing bullwhip effect in supply networks under information sharing and exogenous uncertainty', *Int. J. Industrial and Systems Engineering*, Vol. 26, No. 3, pp.291–317.

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A cooperative covering problem under disruption considering backup coverage

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Abstract: In this paper, we study the location of emergency centres considering cooperative and backup coverage while natural disasters occur which can result in facility disruption. In this regard, a reliable version of cooperative covering problem is presented considering two types of candidate sites, i.e., reliable and unreliable. To achieve a fortified system against disaster, reliable candidate sites are selected from areas which are far away from the disaster harms. Furthermore, backup coverage is considered to compensate unsatisfied coverage of the demand zones due to facility disruption. The performance of the model is investigated solving numerical examples with different approaches utilising commercial software. The results confirm accurate performance of the model. They also show that both facility failure and backup coverage considerations lead to a more efficient network by incurring some additional cost.

Keywords: backup coverage; cooperative covering; disruption; natural disaster; reliability.

Reference to this paper should be made as follows: Aşhtiani, L.H., Seifbarghy, M. and Bashiri, M. (2018) 'A cooperative covering problem under disruption considering backup coverage', *Int. J. Services and Operations Management*, Vol. 29, No. 2, pp.273–288.

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Scientia Iranica E (2016) 23(4), 1857–1868

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Solving a discrete congested multi-objective location problem by hybrid simulated annealing with customers' perspective

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Received 29 January 2014; received in revised form 1 October 2014; accepted 22 August 2015

KEYWORDS
Location-allocation;
Queuing;
Modeling;
Optimization;
VNS;
SA;
Multi-objective.

Abstract. In the current competitive market, obtaining a greater share of the market requires consideration of the customers' preferences and meticulous demands. This study addresses this issue with a queuing model that uses multi-objective set covering constraints. It considers facilities as potential locations with the objective of covering all customers with a minimum number of facilities. The model is designed based on the assumption that customers can meet their needs by a single facility. It also considers three objective functions, namely minimizing the total number of the assigned server, minimizing the total transportation and facility deployment costs, and maximizing the quality of service from the customers' point of view. The main constraint is that every center should have less than b numbers of people in line with a probability of at least α upon the arrival of a new customer. The feasibility of the approach is demonstrated by several examples which are designed and optimized by a proposed hybrid Simulated Annealing (SA) algorithm to evaluate the model's validity. Finally, the study compares the performance of the proposed algorithm with that of Variable Neighborhood Search (VNS) algorithm and concludes that it can arrive at an optimal solution in much less time than the VNS algorithm.

1. Introduction

In recent years, due to the growing demand to reduce the transportation costs, attempts to model and optimize locations of commercial facilities have significantly increased. In general, these types of modeling are called location-allocation modeling. Location-allocation is about finding the best possible sites for one or more facilities by examining their relationship and associated constraints with existing and potential centers with the intention of optimizing them for a specific purpose. The optimization objective can be transportation cost reduction, providing fair services to the clients, gaining a greater share of the market, and so on. In location-allocation models, in addition to selecting the right places for facilities, careful consideration of customer demands and preferences can be a step forwards for the facilities' growth. Some important factors to consider are travel time and waiting time. Oftentimes, customers are quite annoyed when they are kept waiting for a long time for the service. This paper employs queuing techniques to review and optimize such factors in the modeling process. Considering that optimal location-allocation has to deal with many factors, the

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Int J Adv Manuf Technol (2014) 72:881–893
DOI 10.1007/s00170-014-5696-8

ORIGINAL ARTICLE

CMS scheduling problem considering material handling and routing flexibility

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Received: 5 March 2012 / Accepted: 6 February 2014 / Published online: 1 March 2014

Abstract Cell manufacturing as an application of group technology increases the flexibility and efficiency of the production. Cell scheduling problem, one of the subjects in cell manufacturing, has not been widely studied by researchers compared with other problems in cell manufacturing. In spite of great importance of material handling in cell scheduling, it has not been paid enough attention by researches. In this paper, a new mathematical model for cell scheduling problem considering material handling time and routing flexibility is proposed. The proposed model belongs to the mixed-integer nonlinear programs (MINLP). A linearization procedure is proposed to convert the MINLP to an integer program (IP) in order to develop more powerful optimization tools. Furthermore, a simulated annealing-based heuristic is developed to solve the large-size problems.

Keywords Cell manufacturing · Routing flexibility · Material handling · Simulated annealing

1 Introduction

In the recent decades, production systems have changed over due to the increase of competition in markets. In the past, production volume and finished costs of goods were the two major determinant competitive factors; thus, the tendency to use flowshop production systems was pervasive among the companies. Nowadays, other factors such as variety in products and swift response to the market's demand are of higher importance. Consequently, production systems with higher level of flexibility have been developed and applied by both practitioners and academics. Job shop can be considered as a clear-cut example of such systems.

The aforementioned changes along with the development of new businesses have created a novel environment for manufacturing and competing in markets. In such an environment, reducing production costs and make-span, increasing flexibility, and precipitating reactions to the market's needs are turning into the critical competitive advantages of companies. In the 1970s, through highly competitive atmosphere among the companies in the US, a few modern management concepts such as just in time (JIT) and group technology (GT) came into existence. Cell manufacturing system (CMS) is considered as an application of GT, in which the whole machines are divided into a number of distinctive groups according to the similarities in processing the assigned parts. The groups are called cells. The set of parts processed in each cell is called a part family. Cell formation, cell layout, production planning, and cell scheduling are the major issues in CMS (Solimanpur et al. [25]). Unlike the cell formation problems, cell scheduling has not been widely studied by researchers. Moreover, in spite of the great importance of material handling issue, it has not been considered in the most of cell scheduling problems.

As Nomden and Van der Zee [19], routing flexibility provides the possibility to choose from among a number of machines to execute an operation. We consider routing flexibility in terms of alternative machines available for a product family. On the other hand, there will be alternative production routes per product family. This issue can increase the flexibility of a manufacturing system; however, it can increase the complexity of the problem.

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