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Abstract

The purchasing process is the most important activity in a supply chain. Supplier selection is the basic decision in purchasing process management. The impact of qualified suppliers on the performance of an organization is undeniably vital. These days, various approaches have been studied for selecting the best supplier as an important factor in supply chain management. This paper employs a system dynamics approach for determining the impact of supplier selection on profitability and customer satisfaction. The criterion for evaluating suppliers in the current model is based upon three factors; cost, quality and delivery time.

In this model, the supplier delivers raw material with a specified quality, cost and delivery time. The level of raw material is determined according to the manufacturer's orders, and based upon demand forecasts. Demands can be determined using demand forecasts from customer satisfaction and prior sales. Shipment cost is treated as a factor that will affect manufacturing cost and lead to changes in price, revenue, customer satisfaction, and producer profit. The quality of raw material is considered as a cost that is effective on the performance of the production process, and this is a factor affecting the quality of the final product and the raw material received. This factor can affect the number of defective items produced and production operation. It may lead to changes in customer satisfaction too. Delivery time from the supplier of raw material can impact customer satisfaction, due to changing customer waiting time for goods, in general.

This paper is an attempt to help decision makers in using a system dynamics approach and its powerful computer simulation tool, enabling him/her to choose appropriate suppliers based upon customer satisfaction, profit levels and etc. For this purpose, the authors develop causal loop diagrams (CLD), in which dynamic relations are presented, and stock and flow diagrams (SFD) for quantitative simulation are demonstrated. The simulation results show that system dynamics can explain dynamic relationships for accessing the impact of supplier selection on profitability and customer satisfaction.

Key Words: System dynamics, supplier selection, profitability, customers satisfaction, simulation.

Abstract

In this paper, we endeavor to develop a hybrid problem of location, pricing and queuing in a network with M customer nodes and N potential server nodes. In fact, we propose a bi-objective model for the facility location problem subject to congestion and a pricing policy. The model is formulated by means of a queuing framework, in which each facility behaves as an M/M/m/k queuing system, where m is the number of servers in each facility and k is the queuing system capacity. We consider two simultaneous perspectives for this problem; (1) customers (desire to limit times of waiting for service) and (2) service provider (desire to increase profit). Our mathematical model contains two simultaneous objectives, including (I) maximizing profit and (II) minimizing the amount of waiting time in the whole network. In our model, we assume that different prices are provided at different facilities for services. Furthermore, capacity constraints are considered to bring the problem even closer to reality. This assumption is referred to as "mill pricing", and gas stations and parking places are examples of mill pricing. The proposed model belongs to a class of mixed-integer nonlinear programming models and the class of NP-hard problems. Therefore, we presented a multi-objective vibration damping optimization (MOVDO) algorithm to solve the mathematical model. Finally, the performance of the proposed algorithm is compared with the literature and different test problems are generated and analyzed.

Key Words: Facility location, queuing theory, pricing, multi-objective decision making, MOVDO.

LOCATION-ALLOCATION DECISIONS IN A MULTI-ECHELON SUPPLY CHAIN NETWORK WITH NET PRESENT VALUE

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Abstract

Supply chain management is a key issue and practical for sustainable economy, where its economic advantages can be shown in many papers. In order to remain competitive in the market, a supply chain must be efficient. One way to improve the efficiency is to maximize the total profit in the system. In this study, a mix-integer linear programming model is presented for location-allocation decisions in a four-echelon supply chain network. The first to the fourth echelon of the supply chain network includes suppliers, production plants, distribution centers, and customer zones, respectively. This paper amis to select the appropriate amount of loan and to adopt proper location-allocation decisions in all echelons of the chain in several periods, while maximizing the net present value.

the net present value. Location-allocation decisions include locating a number of plants among a finite set of potential sites and decisions relate to the flow of goods from suppliers to production plants, from plants to distribution centers and from distribution centers to customer zones in each period. The suppliers prepare a similar raw material and the production plants produce a similar product from the raw material. The mix-integer linear mathematical model of the location-allocation problem includes sale price, investment costs, raw material costs, production costs, setup costs, holding costs, shortage costs and transportation cost of goods. Setup costs of the factories involved in the network are obtained by an initial capital or funds borrowed from banks. Also, shortages are allowed and are considered to be lost sale. The proposed model maximizes the net present value of the profit after tax in different time periods using continuous compound interest rate. In order to demonstrate the applicability of the proposed formulation and to validate the results obtained, a numerical example is solved at the end using GAMS software. Finally, conclusion and future research recommendations come in the last section of paper.

Key Words: Location-allocation problems; supply chain; net present value (NPV); mix-integer programming.

THE IMPACT OF SUPPLIER SELECTION ON PROFITABILITY AND CUSTOMER SATISFACTION IN A PRODUCTION UNIT: SYSTEM DYNAMICS APPROACH

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Abstract

The vehicle routing problem (VRP) plays a central role in the optimization of a distribution network. There is numerous research work considering several various assumptions and models of this problem. In most work published in this field, minimizing the total distance traveled by the vehicles or minimizing the total number of vehicles are the most popular goals. But, to the best of our knowledge, the way in which vehicles are procured, and its effect on overall cost and the routing design has not yet been investigated. This has an essential effect on overall costs and the routing design in practice. This is because making an optimal decision between purchasing or hiring a vehicle is dependent on the total distance to be traveled by the vehicle during the planning horizon. In this paper, we consider a capacitated vehicle routing problem (CVRP), in which capacitated vehicles start from a single depot simultaneously and deliver the demanded items of several customers, and where each costumer must be visited once. Each vehicle can be hired or purchased at different costs. Since aptimal vehicle procurement cost is a function of the total distance that the vehicle traveled during the planning horizon, the model is modified in such a way that the decision of purchasing or hiring of each vehicle is made simultaneously. Since some classical instances with a small number of nodes resist the best exact solution methods, most researchers concentrate on metaheuristic algorithms for solving real-life problems. Therefore, to solve the model in real-life dimensions, an electromagnetism algorithm is hybridized with a parallel simulated annealing algorithm and a hybrid solution algorithm is presented. Finally, to evaluate the efficiency of the presented algorithm, some test problems, randomly generated, are solved by the algorithm and the original simulated annealing algorithm. Experimental results show that the hybrid algorithm has far better efficiency than SA.

Key Words: Capacitated vehicle routing problem, hire, purchase, parallel simulated annealing, electromagnetism.

CLOSED-LOOP SUPPLY NETWORK DESIGN UNDER UNCERTAINTY IN RISK-POOLING

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Abstract

In recent years, the design of closed-loop supply chain networks has attracted more attention, according to commercial and environmental considerations. A forward and reverse supply chain network is proposed to replace integrated considerations, which also incorporates strategic network design decisions, along with a tactical network design, to avoid sub-optimalities resulting from separating the design in both parts. The forward chain network (including suppliers, distribution centers and customers) and the reverse supply chain (including collection centers, recovery centers, recycling centers and material customers) and customer demands are uncertain and they have a normal distribution. To deal with the uncertainty of customer demand, a risk-pooling strategy is used. Then, uncertainty in other parameters of the model is also considered. To solve the proposed possibilistic optimization model, we take advantage of the deterministic model using the Jimenez method as the defuzzification method in supply chain planning. Finally, the model is a nonlinear integer programming model that can be solved using GAMS.

Key Words: Closed-loop supply chain network design, risk-pooling, fuzzy mathematical programming.

OPTIMIZING A BI-OBJECTIVE PRICING-QUEUING-LOCATION PROBLEM

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network that efficiently moves the products from seller to buyer. But, due to increasing environmental concerns and reduction of resources, issues like reverse logistics, product recovery, remanufacturing and reusing have received growing attention. The design of a product recovery network is an important and challenging problem in the field of reverse logistics, and some models have been formatted by researchers under a deterministic environment .In this paper, we present a stochastic integer programming model for a reverse logistics network. In this network, it is assumed that demand and production rates of returned products are stochastic. In this network, different products are distributed through different stages of the supply chain. Each supply center has a specific capacity for each product. The objective function is cost minimization. To analyze this model, some test problems are designed and then solved using GAMS software. The numerical results show the performance of the model.

Key Words: Reverse logistics, waste management, reverse logistics network, stochastic integer programming model.

ESTIMATING THE CHANGE POINT AND SLOPE OF A LINEAR TREND IN PHASE ONE RISK-ADJUSTED CONTROL CHARTS

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Abstract
Using risk adjusted control charts to monitor patients' surgical outcomes is now popular. Patients have different pre-operation conditions such as age, gender, hypertension -usually called potential risk factors- which form a heterogeneous population. Therefore, there is a need to adjust for patient risk to have homogenous outcomes. In literature, several risk adjustment methods have been applied, including the logistic regression and the Accelerated Failure Time (AFT) models. For the monitoring process, the patients risk adjusted post-surgery outcomes are plotted on an appropriate risk adjusted control chart. Finding the time point at which a change has occurred, provides useful information for the root-cause analysis of the problem, and helps managers to accomplish corrective or preventive actions. There are many articles in this context dealing with this problem in both phases one and two. Most of them, however, have focused on phase two. The risk adjusted Log-likelihood Ratio test (LRT) chart for phase one analysis of data is applied in this paper, to monitor the binary surgical outcomes. This chart is based on the likelihood ratio test derived from a change point model. As a risk adjustment model, logistic regression is used to adjust for patient heterogeneity. This chart is applied to find the time and size of change when a linear trend occurs in patients post-surgery mortality rates. The maximum likelihood estimator (MLE) is used to identify the change point. Knowing the change point, one may apply the Newton-Raphson's numerical method to find the ML estimate of the slope of the trend. A phase one surgery outcome dataset that is frequently used by other authors is considered for evaluating the proposed method. Simulation data are generated to confirm this approach. The results show that when the change is large, the ML estimation of change point time is more reasonably precise. In addition, the Newton-Raphson method efficiently estimates the slope of the trend.

Key Words: Risk factor, logistic regression, risk adjusted control chart, change point, maximum likelihood estimation method.

A HYBRID META-HEURISTIC APPROACH TO SOLVE CAPACITATED VEHICLE ROUTING PROBLEMS USING VEHICLE HIRE OR PURCHASE DECISIONS

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obtained by some standard maintenance policies, outline its good performance.

Key Words: Preventive maintenance, reliability, optimization, ant colony.

MULTI-OBJECTIVE LOCATION OF CONGESTED HUB AIRPORTS USING QUEUING SYSTEMS

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Abstract

In order to take advantage of economies of scale, most major airlines use hub-and-spoke networks in their flight programming. But, some hub airports are congested and their flight delays increase considerably because of flow concentration in these networks, especially during peak hours. Common capacitated hub location models cannot prevent this deficiency. In order to handle this problem, in the present study, each runway of an airport is considered as a M/G/1 queuing system, individually. Then, triple submodels for obtaining the optimal capacity of landing, takeoff, and hybrid runways are proposed, separately. These optimal capacities in the final model limit the probability of the presence of a determined number of planes on each runway. In the final proposed model, besides overcoming this deficiency, we have determined a procedure for allocating each kind of plane to each runway. On the other hand, the diversity of planes, as an influential factor in designing networks, has been also introduced in this study for the first time. A computational result on the US domestic air transportation network in 2004 during peak hours demonstrates that the proposed models in this study can ensure a more balanced workload among hubs.

Also, previous studies in the field of hub location problems have concentrated on flow and network construction costs. There are wide research gaps in this field, where the main challenges of real life are not modeled. Environmental impacts (such as air and noise pollution) and fuel shortage are important challenges in the air transportation industry. Considering the above mentioned objectives, we have proposed a new multi-objective model, based on three economic, environmental and energy criteria, to solve the capacitated multiple allocation hub location problem (CMAHLP). Efficient solutions are obtained using the ε -constraint method, while the grouping AHP approach is used for selecting the preferred solution. A computational result on the US domestic air transportation network is presented.

Key Words: Hub location problems, congestion, queuing system, multi-objective model, workload balance.

MULTI-PRODUCT, MULTI-LEVEL REVERSE LOGISTICS NETWORK MODEL IN A STOCHASTIC CONDITION

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Abstract

In recent years, the supply chain network (SCN) design problem has been gaining importance due to increasing competitiveness introduced by market globalization. One of the most important and strategic issues in supply chain management is configuration of the logistics network, which has a significant effect on the total performance of the supply chain. Nowadays, the emphasis on productivity and customer satisfaction leads firms to focus on the supply chain and logistics. Due to national and international rules, waste management, waste minimization, reuse, and material recycling have received increased attention over the last decade. Waste management is an important and rapidly growing industry for developing countries. Attention to reverse logistics networks has increased during the last decade, since their economic impact has become increasingly important and as environmental legislation has become stricter. It is necessary to design an effective product recovery network to minimize the total cost. Therefore, most companies only put their efforts into designing a logistics

Abstract

Optimal capital allocation in assets is an important issue facing investors. The first model of portfolio selection was proposed by Markowitz in 1952. This portfolio optimization model is also known as the mean-variance model and endeavors to minimize portfolio variance by considering only returns and budget constraints. Solving the Markowitz's quadratic model creates an investment efficient frontier as a solution set for investors, and selecting a portfolio from an efficient frontier depends on their risk-taking or risk aversion. In recent years, introduction of other practical constraints (e.g. short selling, floor and ceiling, cardinality constraints) has caused the development of the primary Markowitz model. Decision making regarding optimal portfolio formation under critical market conditions (i.e. reduction in asset prices) is an important issue leading investors into terms of justifiability short selling. Hence in this paper, we consider a fair model (for both call and short positions in the capital market) in the portfolio selection problem area that allows short selling under some capital market practical constraints. We propose a new mathematical model for the problem and explain its practical constraints. This proposed model has a mixed integer non-linear programming (MINLP) nature and, with respect to its computational complexity, standard mathematical tools (e.g. LINGO and GAMS) only enable it to solve very small sizes; it needs to use meta-heuristic algorithms for relatively large problem sizes. The continuity of the model solution space leads it to use a harmony search algorithm as an efficient and new algorithm in solving continuous problems. We explain the elements of the proposed harmony search algorithm, such as solution encoding, the fitness function, and its flowchart and parameters. For evaluation of the algorithm, we consider a real problem and solve it by the proposed algorithm and an exact method. The comparison of results indicates the good performance of the harmony search algorithm in solving the proposed model.

Key Words: Portfolio optimization, short selling, efficient frontier, harmony search algorithm.

MAXIMIZATION OF ELECTRIC POWER TRANSMISSION GRID RELIABILITY THROUGH MAINTENANCE SCHEDULING OPTIMIZATION USING AN ANT COLONY ALGORITHM

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Abstract

The problem faced by electric power utilities in developing countries today is that the power demand is increasing rapidly whereas supply growth is constrained by aging generating, transmitting and distributing assets, scarce resources for constructing new ones and other societal issues. This has resulted in the need to construct additional generating plants and for more economic ways to plan and maintain existing electric power transmission and distribution assets.

The goal of this study is to improve the average reliability of a system through optimization of its preventive maintenance policy. The evolution of system reliability depends on its structure as well as on the evolution of its components reliability. The latter is a function of component age during a system's operating life. Component aging is strongly affected by maintenance activities performed on the system.

We propose a novel methodology for preventive maintenance policy evaluation, based upon a reliability model, which allows the use of flexible intervals between maintenance interventions. Such innovative features represent an advantage over traditional methodologies, as they allow a continuous fitting of the schedules in order to better deal with the components failure rate.

Due to the large amount of parameters to be analyzed and their strong and non-linear interdependencies , the search for an optimum combination of these parameters is a very hard task when dealing with optimization schedules. For this reason, use of an ant colony (ACO) algorithm may be an appropriate optimization technique.

In order to demonstrate the effectiveness of the proposed method, it is applied to a typical electric power subtransmission substation.

By establishing the failure parameters which will be used, the fault tree is made. Analysis of the sample case fault tree resulted in some minimal cut-sets. Then, we proposed probabilistic modeling. Here, the ant colony modeling allows non constant intervals between maintenance, adapting them to the aging parameter of the Weibull distribution used. The results, when compared with those

addition, it gives managers an opportunity to evaluate the organization's unit from four viewpoints. By analyzing the result of the indicated model and identification of inefficient units, an organization's efficiency can be enhanced by corrective action. One of the advantages of the proposed model is evaluating and measuring the performance of all factors of DMUs using network data envelopment analysis. Therefore, managers do not need to select and substitute different policies or criteria to identify the best action for each index of performance. This advantage of the proposed model is the greatest difference between this and other models.

Key Words: Data envelopment analysis, network data envelopment analysis, balanced scorecard, performance measuring.

ECONOMIC DESIGN OF MODIFIED EWMA-3 CONTROL CHART FOR MONITORING SIMPLE LINEAR PROFILES USING THE MARKOV CHAIN APPROACH

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Abstract

In some statistical process control applications, the quality of a process or a product is characterized by the relationship between a response variable and one or more explanatory variables referred to as a profile by researchers. Simple linear profiles are a different type of profile which has many applications, especially in calibration. One of the most powerful methods in phase II monitoring of simple linear profiles is the EWMA-3 method proposed by Kim et al. (2003). In phase II, the aim is detecting assignable causes as soon as possible. The power of control charts in detecting assignable causes is usually measured by an average run length criterion. Kim et al. (2003) proposed a method in cases where there is only one response value at each level of explanatory variable. However, there are some situations in which there is more than one response value at each level of explanatory variable. In this paper, first, we modify the EWMA-3 method by Kim et al. (2003) for cases with more than one response value at each level of explanatory variable. Then, we present a Markov chain model to measure the ARL criterion of the modified EWMA-3 method. After that, we design the modified EWMA-3 control chart economically to account for the economic properties of the control chart. For this purpose, we use the Lorenzen and Vance cost model and optimize parameter sample size, sampling interval, smoothing parameters and the coefficients of control limits for three EWMA control charts, including the EWMA control charts for monitoring the intercept, the slope and the standard deviation. In addition, we use the idea of the Taguchi cost function in our proposed model. Finally, a genetic algorithm is used to solve the proposed model. The performance of the proposed economic model is evaluated through a numerical example. Then, a sensitivity analysis is undertaken to identify the effect of different parameters and the population size of the genetic algorithm on the economic and statistical properties of the modified EWMA-3 control charts.

Key Words: Economic design, EWMA-3 control chart, markov chain, simple linear profile.

SOLVING A PORTFOLIO SELECTION PROBLEM USING A HARMONY SEARCH ALGORITHM IN TERMS OF JUSTIFIABILITY SHORT SELLING

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Abstracts of Papers in English

A NEW PERFORMANCE MEASUREMENT APPROACH BY INTEGRATING NETWORK DATA ENVELOPMENT ANALYSIS AND BALANCED SCORECARD

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Abstract

Performance measurement with data envelopment analysis (DEA) is an approach that gives organizations the chance to detect their organizational problems and, if necessary, undertake appropriate actions for enhancement of their performance. DEA is a non-parametric technique used to measure the efficiency score of DMUs. In recent decades, management literature has paid added attention to measuring organizational performance. But, by the advent of the information age and the progress of science and technology, it is not possible to measure efficiency only by standard data envelopment analysis or by out of date approaches measuring efficiency. Recently, DEA has been extended to examine the efficiency of DMUs that have two-stage network structures or processes, where all the outputs from the first stage are intermediate measures that make up the inputs to the second stage. The resulting two-stage DEA model not only provides an overall efficiency score for the entire process, but also yields an efficiency score for each of the individual stages. The current paper develops a new method to measure the performance of each perspective of a balanced scorecard (finances, customers, internal processes, learning and growth). By integrating balanced scorecard (BSC) and network data envelopment analyses, the suggested model enables organization managers to optimize various section performances of their organization, regarding all necessary operational actions. In