FOR MONITORING PATIENTS' SURVIVAL TIME

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Abstract

In recent years, the development of control charts has attracted the attention of researchers in healthcare systems. The purpose of this paper is to design a risk-adjusted cumulative sum (CUSUM) control chart to monitor the survival time of patients after performing a surgical operation. In this control chart, risk adjustment is conducted to consider the impact of each patient's preoperative risks on survival times. It should be noted that the Parsonnet score has been calculated and recorded for each patient before undergoing a surgical operation. Moreover, a class of survival analysis regression models called accelerated failure time models has been employed for risk-adjustment. However, the implementation of the RACUSUM control chart requires determining the design parameters such as the lower control limit and coefficient for optimal design of CUSUM control chart. These parameters should be selected in an optimal way putting the desired statistical and economic considerations into service. To this end, a multi-objective model, including three objectives of cost, the in-control ARL and the inverse of out-of-control ARL, has been proposed and the model is solved with the help of a multi-stage algorithm based on the data envelopment analysis (DEA) method. Then, to show the performance of the proposed procedure, a real case study has been considered in the cardiac surgery center in Iran. Doing so, a special kind of operation called coronary artery bypass grafting (CABG) surgery was selected, and the information associated with 100 patients was collected over time. Finally, a comparison has been made between the multi-objective design model and a pure economic design model. The results clearly reveal that with a relatively small increase in the cost function, the multi-objective design of the RACUSUM chart has better statistical performance. Therefore, it is advisable to implement the proposed multi-objective model to design the risk-adjusted CUSUM control chart in healthcare systems.

Key Words: Cumulative sum control chart, risk adjustment, accelerate failure time model, economic-statistical design, data envelopment analysis.

integrated production-inventory system for a perishable product in a two-echelon supply chain, including a producer and multi-retailers, is considered. The quality of raw material and finished product varies at the holding interval and the price is an age-dependent function. Volume discounts are available. The shortage is not allowed. The rates of production and demand are considered determined and fixed. The numbers of deliveries to retailers are not essentially equal. The objective is to determine the number of raw material deliveries to the producer and the number of deliveries from the producer to each retailer in a production cycle in a way that total profit is maximized. This combination of assumptions has not been considered in the literature yet. A nonlinear mixed-integer programming model is developed for the problem. Because of the complexity of the problem, a metaheuristic algorithm is employed to solve the numerical examples. An example is solved and sensitivity analysis is done using a genetic algorithm. The results show that the optimal number of orders and also the economic order sizes change corresponding to the rate of deterioration such that the higher the rate of deterioration, the larger the number of orders and the lower the size of each order. The profit almost increases significantly in the presence of volume discounts in all cases and also increases when a different number of delivers per each cycle for different retailers is possible.

Key Words: Inventory control, supply chain, deteriorating product, quantity discount, mathematical modeling.

MODELING OF MULTI-PRODUCT ECONOMIC PRODUCTION QUANTITY PROBLEM WITH PARTIAL SHORTAGE AND CONSIDERING THE PRODUCTION SCREENING AND STOCHASTIC CONSTRAINTS: INTERIOR POINT AND SEQUENTIAL QUADRATIC PROGRAMMING ALGORITHMS

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Abstract
Economic Production Quantity Model (EPQ) is one of the classic models of inventory control and it has a very important and practical role in manufacturing industry. As the most important things to reduce these internal risks, an efficient inventory control management and production planning can be mentioned, then as results of them, the best service level, cost reduction and optimal use of available resources can be achieved. For this purpose, an EPQ model is developed according to real-world conditions in this research. Shortage in this model is considered a mixture of backordered demand and lost sales and also, the products are divided into two categories of perfectly hale products and non-repairable defective products that fall into the category of scrap. In the other words, the important indicators studied in proposed model are the partial shortage and scrap. Costs related to the backorder demand are taken as fixed and time-dependent. In the proposed model, Inventory cycle length, the length of positive inventory cycle and backordered demand rate are determined during the shortage period to minimizing the total cost of inventory, So that all the stochastic and deterministic constraints of the model including holding costs, lost sales, backorder, budget, screening of products, disposal of scraps, total number of productions and average shortage times should be satisfied. Hence, in proposed model, due to the uncertainty of the real world situation and uncertainty in the availability of resources, a stochastic approach has been used. The presented multi-product model is in form of a single-objective nonlinear programming problem. Then, to solve the proposed model two methods including sequential quadratic programming and interior point algorithm are used. Furthermore, twenty numerical examples are solved by these two methods and SAS software, and the performance of the solution methods are compared using the Tukey's hypothesis test in terms of objective functions, the number of iterations need to achieve the optimal answer and infeasibility. Finally, in this paper, choosing the best method is done by applying the TOPSIS test.

Key Words: Economic production quantity, partial shortage, scrap, interior point algorithm, sequential quadratic programming.

THE ECONOMIC-STATISTICAL DESIGN OF A CONTROL CHART

with a large number of projects). The results showed acceptable similarity of results (nearly 90% similarity), but the time taken to solve the proposed approach is far less than the optimization model. The proposed approach is able to solve small, medium, and large problems while it provides timely and reasonable solutions in a reliable manner.

Key Words: Project portfolio, value at risk, neural networks, monte carlo simulation, uncertainty.

DEVELOPMENT OF A DECISION SUPPORT SYSTEM FRAMEWORK AND PROJECT RISK ASSESSMENT WITH A COMBINED MULTI-CRITERIA DECISION-MAKING AND SIMULATION APPROACH IN A FUZZY ENVIRONMENT (CASE STUDY)

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Abstract

Today, risk management in various fields has been considered by managers.The interactions of risks have created complexities in the selection of risk response actions. In order to risk reduction, selecting of the suitable actions can be an effective decision-making tool in risk management.Therefore, to achieve this goal, in this paper, we develop a decision support framework considering the risk identification and assessment with a hybrid approach of simulation and Fuzzy Multi-Criteria Decision-Making in the dams of Shahid Hasheminejad Gas Refinery. This framework can be used as a proposed plan for DSS designer in the field of risk management decision making. This paper has performed qualitative risk assessment first by fuzzy Failure Modes and Effects Analysis method and then by combining fuzzy DEMATEL method and developed fuzzy hierarchical analysis, so that the interactions and intensity of dependencies are calculated and Monte Carlo simulations has been used for quantitative assessment considering the relationship between risks. The evaluation of nine identified risk with simulation shows that the risk of closing the overflow pipe, which was ranked fourth in the qualitative analysis, has the highest rank.

Key Words: Risk assessment, decision support system, fuzzy DEMATEL, risk interaction, monte carlo simulation.

AN INTEGRATED PRODUCTION-INVENTORY POLICY IN A TWO-LAYER SUPPLY CHAIN FOR A DETERIORATING ITEM WITH QUANTITY DISCOUNT

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Abstract

Effective coordination in a supply chain plays a vital role in improving its efficiency. This becomes more critical when it comes to deteriorating materials and products in order to reduce a huge amount of waste or demand fluctuations. Integrated management can effectively reduce the total cost including waste costs, holding costs, shipping, and delivering costs and increase the income, especially when the price or even the demand is affected by the freshness. In this article, an

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Abstract

Statistical Process Monitoring (SPM) and maintenance are two major concepts to decrease the number of non-conforming products. In this regard, an integrated model of SPM and maintenance for imperfect high-quality processes is presented. Furthermore, in studies that consider these two concepts simultaneously, it is assumed that there is only one assignable cause in the production process. This simplifying assumption is unlikely to occur in real production processes due to the usual complexity of manufacturing systems. It may lead to a poor performance in both economic and statistical criteria if the assignable cause originating the shift is different from the one anticipated at the design of the chart. To make the model more adapted to real manufacturing situations, the process under consideration can turn into an out-of-control state due to several types of assignable causes. The particle swarm optimization algorithm is used to maximize the expected profit per time unit, subject to statistical quality constraints. Then, the effects of parameters λ_{in} (the event occurrence rate when the process is in the in-control state), A_{in} (the false alarm cost), A_{out}(the search and repair cost), V_{in} (the profit per time unit when the process is in-control state), V_{out} (the profit per time unit when the process is out-of-control state), and C_e (the cost incurred by the occurrence of the event) on the profit per time unit are investigated. Finally, to show the effectiveness of the suggested approach, two comparative studies are presented. In the first comparative study, the integrated model is compared to a similar model without maintenance activities. The results confirm that implementation of maintenance activities leads to a significant increase in the manufacturer's profit. In the second comparative study, the presented model is compared to a similar model in which statistical constraints are eliminated. The results indicate that the proposed model extremely improves average time to signal in both in-control and out-of-control states while the profit per time unit decreases slightly.

Key Words: Maintenance, economic-statistical design, multiple assignable causes, time to event, statistical process monitoring.

DESIGNING AN INTELLIGENT SYSTEM FOR PROJECT PORTFOLIO SELECTION CONSIDERING VAR

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Abstract

Project portfolio selection problem has been investigated by many researchers over the decades. This paper presents a method for project selection problem that is able to integrate the evaluation of individual projects by considering their interactions on portfolio of company projects. Moreover, since experts and their knowledge is one of the primary and valuable resources of an organization which evolves over time, the proposed system utilizes an artificial neural network approach to discover the experts' knowledge. This system has been used in a pilot organization in an organization while the output is close to the portfolio of projects considered by the managers of the organization and has also contributed to the project portfolio risk balancing. In order to validate the proposed method, an optimization model similar to the problem has been developed. The proposed approach has obtained similar results to the optimization and also needs much less time to solve large-sized problems using the proposed approach. This study tried to consider the interactions of projects when they are selected simultaneously in the portfolio of projects as well as the use of expert opinions and technical knowledge and experience of the organization in project portfolio selection. The proposed approach has been implemented in a project-oriented organization with varying levels of the number and complexity of the projects that have achieved acceptable results. In order to validate the proposed approach, an optimization model is developed and implemented on three problems (two problems of the case study organization and one instance problem

proposed in which the starting and ending times of activities are determined so that in addition to minimizing the variations of resource utilization, total costs related to the material ordering problem (sum of ordering costs as well as holding and purchase costs) are minimized. It is assumed that the intensity of the variable execution directly affects the progress of activities. Also, the duration of activities is considered flexible. Numerical results confirm a tradeoff between material ordering and resource leveling costs. Finally, GAMS software as well as genetic algorithm are used to solve different-sized test problems, and results are discussed.

Key Words: Resource constrained project scheduling, resource levelling, material ordering, variable execution intensities, all-unit discount.

A BI-OBJECTIVE MATHEMATICAL MODEL FOR NURSE SCHEDULING PROBLEM CONSIDERING NURSE'S PREFERENCES BASED ON DEA APPROACH

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Abstract

The nurse scheduling in a hospital is a complex and time-consuming problem which considers assigning nurses to shifts for each day of a planning horizon while ensuring meeting the demand of hospital units. In developing countries, there is usually a shortage of nursing staff in health centers' therefore, the nurse scheduling problem is one of the most important issues in human resource management in clinical units. In this research, a mathematical model is developed so that constraints are classified into two types of hard and soft and the weight of soft ones is obtained using the pairwise comparison matrix. In the proposed model, two objective functions are considered to maximize nurses' preferences and minimize the deviations from soft constraints for nursing scheduling problems. The nurses' preferences represent a very important issue in nurses' satisfaction. As a novelty of this paper, three factors used to calculate the nurses' preferences based on the data envelopment analysis (DEA) method are as follows: nurses' preferential ratings, data related to the preferences of past scheduling periods, and the work experience of nurses. Hospital nurses are also divided into two groups: fixed shift work and rotational shift work. Also, a fair allocation is considered for night and weekend shifts for nurses. The proposed model was solved by an improved version of the augmented epsilon constraint method (AUGMECON2) using the data for a case study in the Intensive Care Unit (ICU) in Loghman Hakim Hospital in Tehran, Iran. Comparing the results of the solution of the proposed model with the current method shows that there is a significant improvement in preparing the nursing timetable and responding to nurses' preferences. The computational results of the mathematical model show that the nurses' mandatory overtime is reduced' therefore, the hospital costs are decreased. Also, a sensitivity analysis is presented for the deviations from soft constraints with respect to maximum working hours.

Key Words: Nurse scheduling, nurse preferences, soft constraint, augmented epsilon constraint, overtime.

INTEGRATION OF QUALITY AND MAINTENANCE BY CONSIDERING MULTIPLE ASSIGNABLE FOR HIGH-QUALITY PROCESSES

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Abstracts of Papers in English

A HYBRID RESOURCE LEVELLING AND MATERIAL ORDERING PROBLEM WITH VARIABLE EXECUTION INTENSITIES

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Abstract

The Project Scheduling Problem (PSP) is to determine the sequence and schedule of activities of a project in a way that decision-makers' objectives are optimized without violating precedence constraints. Due to the scarcity of resources, in recent decades, the Resource-Constrained Project Scheduling Problem (RCPSP) has attracted the attention of researchers and practitioners. The main feature of the resource-constrained project scheduling problem is that it takes into account resource constraints, which significantly affect the solutions obtained for project scheduling problems, in addition to other usual constraints, e.g. precedence constraints. The Resource Leveling Problem (RLP) is a special case of the resource-constrained project scheduling problem in which the resource usage variation between consecutive time periods is minimized. Traditionally, the project scheduling problem and the material ordering problem are separately investigated. However, simultaneous planning of both these problems, i.e., resource constrained project scheduling and material procurement, which can reduce total project costs, has been rarely addressed. In this study, the resource leveling problem which aims at controlling the variations of using the resources during the project execution and the material ordering problem are simultaneously addressed. The material ordering is considered to be subject to all-unit discount. In this regard, a mixed-integer linear programing model is