these systems typically fail to deliver lessons when and where they are needed.

In this study, using a literature review, interviews and a case study, a roadmap for implementing the lesson learned system is explained in four stages. First, we illustrate the lesson learned and the learning in the project using a literature review. Second, we detail an understanding of commonly used methods in Iran obtained from two information sources; 1) interviews 2) a case study. Third, the information is analyzed and a conceptual model is developed based on the content analysis of data obtained in the second stage. Finally, we develop a roadmap by identifying key issues in the third stage and by adding activities and checklists to pursue its activities. This project learning roadmap assists business leaders in improving the lesson learned process. This model enables organizations to develop exclusive solutions tailored to the needs of the stakeholders.

Key Words: Project management, knowledge management, lesson learned, roadmaps.

OPTIMIZATION OF A BI-OBJECTIVE (R,Q) INVENTORY POLICY USING OPTIMIZATION VIA A SIMULATION TECHNIQUE CASE STUDY: ARYA CHALK INDUSTRIAL COMPANY

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Abstract

This paper describes the application of simulation in the bi-objective optimization of an inventory control problem, which is based on a (R,Q) policy, in an inventory storage system composed of three stores, for an industrial chalk production company. In this inventory policy, when the inventory level is R or less than R, the order is released in amounts of Q. This policy is placed in an inventory policy group with a fixed order size. In this system, customers enter with a probability distribution function and have a demand with a distinct probability distribution. Customers go to stores for their needs, and the system for accountability to customers replenishes the stores. In this paper, the objective is to determine the amounts of R and Q in order to minimize daily inventory holding costs in each store, and also to minimize customer waiting time in the system. For this purpose, using an optimization approach via simulation, the storage system of a company is simulated using an ED model. The simulation model indicates the structure, manner and operation of the system. In this model, using 4Dscript programming language, the manner of the system is coded. After model validation of the present condition of the system using Mann-Whitneys nonparametric test and through the 2k factorial design, scenarios were designed. By executing them in the simulation model, the amount of customer waiting time in the system and the mean of inventory holding costs in each store for (R,Q) compounds are obtained. Through the amount of objective function for each compound, nonlinear regression models for inventory holding cost and customer waiting time in the system were obtained using Minitab. By solving the regression models using a genetic algorithm, possible answers for problem variables were obtained in a Pareto chart and the results were compared to the present condition of the system. In order to improve system operation among the compounds obtained from regression models, shown in the Pareto chart, the management specifies a mixture for determining the policy programming and inventory control of the company.

Key Words: Inventory policy, optimization, simulation, experiment design, regression, holding cost.

PROJECT LESSONS LEARNED MANAGEMENT IN PROJECT-ORIENTED ORGANIZATIONS

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Abstract

Progressive developments in economics, society and politics have raised knowledge as a key element in development and competitiveness, and knowledge management is considered to be an essential element in this field. By taking the temporary nature of the project into account, dynamics and competitiveness in project-oriented organizations within the business world make the preservation and management of knowledge in project-based organizations more important. The lesson learned system is a knowledge management tool that proposes strategic solutions that avoid wasting time and money and makes perfect use of knowledge management accomplishments. Lessons learned (LL) systems have been deployed in many military, commercial, and government organizations to disseminate validated experiential lessons. They support organizational LL processes, and implement a knowledge management (KM) approach for collecting, storing, disseminating, and reusing experiential working knowledge that, when applied, can significantly benefit targeted organizational processes. An effective lesson learned process can substantially improve decision processes, thus, representing an essential chapter in knowledge sharing and knowledge management. Unfortunately,

considered. Also, as an essential step in reliability evaluation during the design phase, it is necessary to allocate reliability to subsystems, in such a way that full system reliability is satisfied. Performing this process, which is called reliability allocation, creates a more reliable and competitive system, which, at the same time, is compatible with our limitations. The consequences of considering this phase in designing a product are improved design and manufacturing methods, and, as a result, it is possible to gain cheap and reliable products compatible with customer demand. Many parameters that exist in the process of reliability allocation have been generated based on research investigations. These techniques have different attitudes towards performing an allocation process. By analyzing these approaches, the researchers discovered remarkable disorders. These disorders are consequences of weaknesses, some of which all techniques share. One important aspect not considered in these techniques, and considered to be a great weakness, is the importance of subsystems, regarding their place in system configuration and their contribution to full system reliability. In this study, according to the importance and effectiveness of reliability importance measures, we have utilized them as an approach to suggest a new and effective technique. In this process, we use the technique of reliability importance measures to propose a new way to overcome this weakness, and, in two examples, will show the effects of using these measures in the process of reliability allocation. Based on a comparison between the new technique and the two most applicable techniques in literature; ARINC and MAXIMAL ENTROPY, using one hypothetical and one real example, we have shown the preferable results of the new technique.

Key Words: Reliability allocation, reliability importance measures, fundamental problems, subsystem role in system reliability.

APPLICATION OF DESIGN FOR SIX SIGMA TO OPTIMIZE MIXED-CONTENT PARAMETERS IN CELLULAR LIGHTWEIGHT CONCRETE

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Abstract

Although most companies spend less on product design, experience shows that, these companies have to pay higher costs due to production problems or loss of market. Literature studies show that the Design for Six Sigma is a powerful approach for designing products, processes and services. While the tools used in Six Sigma require a process to be in place and functioning, DFSS has the objective of determining the needs of customers and the business, and driving those needs into the product solution so created. DFSS is relevant to the complex system/product synthesis phase, especially in the context of unprecedented system development The aim of this project is to provide a global method for designing robust products based on the Design for Six Sigma methodology. The methodology integrates three concepts: reliability-based optimization, robust design and multi-objective optimization. The methodology proposed for the design of Six Sigma can be explained in four stages: formulation, optimization, simulation and selection. The algorithm is to generate several Pareto-optimal solutions at the optimization stage. The algorithm was applied to the design of lightweight concrete blocks, with consideration of customer need, in three main areas: weight blocks, cost blocks and strength blocks. First, considering expert preferences, the mathematical modeling of the blocks was determined. Second, interactive multi-objective algorithms, taking the decision maker's preferences into account, were developed to generate twelve Pareto-optimal solutions that maintain a probability of constraint satisfaction. Then, 1σ solution optimization (per cubic meter of: 409 kg of cement, 1.4 kg of Polypropylene fibers, 12.14 kg of silica and 8.8l of foam) was adopted for implementation as a compromise between the three criteria (the savings compared to the baseline solution, the coefficient of variance (robustness), and the degrees of desirability). The results show that the variable Polypropylene fibers cause the most variations in cost functions, while Polypropylene fibers, silica, water and foam are the most critical variables for the constraint. Blocks were built and compressive strength was obtained that was consistent with the calculated result.

Key Words: Design for six sigma, robust design, optimization, reliability, lightweight concrete block.

cost effectiveness. The objective functions are of different importance. Humanitarian objectives are naturally more important than the third objective. Therefore, the hierarchical approach proposed in [2] is applied to solve the presented model. This approach achieves the optimal solution if the multi-objective model has a single optimal solution. Otherwise, it attains one of the optimal solutions. Finally, the logistics of commodities and injured persons in region 17 of Tehran are studied using the proposed model.

Key Words: Humanitarian logistics, disaster relief, robust optimization, temporary distribution and medical center, response to earthquake.

CALCULATION OF MAINTENANCE INDEX AND IDENTIFICATION OF CRITICAL SOURCE OF DELAY: CASE STUDY: MAHD KHODRO FESHARAKI

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Abstract

The maintenance process is one of the most necessary processes in every organization, whose main task is to maintain machines in desired conditions or restore machines from non-optimal (non-operational) to optimal (operational) conditions. Machine failure results in the loss of availability time of machines and an increase in organizational costs. It increases the time of production causing irreparable damage to the company. Therefore, improving process performance and, as a result, improving the maintenance process, has been considered by many experts.

In this paper, first we calculate the maintenance index, such as, "Mean Time Between Failure", "Mean Time To repair", and "Mean Time To Failure". Calculating this index is undertaken by using two approaches; "time of declaration" and "time of repair". Then, we calculate "reliability", and "availability in time units" for 3 machines: a 250 ton hydraulic, a 65 ton press and a heckert type. By checking the routine of failure in the past (during the first 8 months of 1388) and forecasting the following 4 months, it is seen that this failure follows an exponential distribution using the chi-square test. In addition, we proposed a new model for reasons behind machine failure, in which the greatest emphasis is on the major delays not due to repair. Also, we used this model to find the rate of delay for more important machines in the system. Finally, a table is created to explain the total rate of units for the delay factor at Mahd Khodro Fesharaki Company. The greatest effect is the lack of commitment of contractors, management weakness of the maintenance unit, and financial issues. It should be noted that the goal of this paper is to identify weakness and delay factors, so a solution is proposed for improving these delay factors and weaknesses.

Key Words: Reliability, availability, maintenance, mean time between failure, mean time to repair, failure probability.

A NEW TECHNIQUE IN RELIABILITY ALLOCATION USING RELIABILITY IMPORTANCE MEASURES

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Abstract

In the process of designing a product or a physical system, reliability engineering is an important factor to be

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Abstract

In most experiments, the experimenter is interested in identifying effective controllable factors to model their relationship function. The classic approaches of response surface methodology and experimental design need to meet some requirements such as residual normality. However, in many real world applications, the assumptions may be violated. In such cases, data transformation methods can be an alternative. However, the mentioned method may increase total error in multiple response analyses. Genetic programming is a meta-heuristic approach in determination of effective controllable variables, and has been previously applied to many areas. One of the major differences between GP and the GA (Genetic Algorithm) is in the representation of the solution. In addition, GP is used to identify a suitable relationship function between variables, while the GA is used to optimize an objective function and find the near optimal values of decision variables. Therefore, each solution in GP represents one equation of the relationship function between variables. In this paper, genetic programming is applied for determination of the relation function between the response variables and controllable factors for non-deterministic, non-normal distributed responses. In other words, three steps are considered in the proposed method. In the first step, a relation function is estimated for each response according to the GP. Then, all estimated response functions are aggregated to a single response by the desirability function. In the last step, a GA is used for optimization of the extracted integrated function. Moreover, three examples are used to illustrate applications of the proposed method. In the first example, the efficiency of the proposed method in a single response problem is considered. The second example is used to compare the performance of the proposed method with the result of the regression method, while residuals have non-normal distribution. In the last example, the proposed method is applied to a multi-response problem in a real case study from the literature. Finally, the computational results of simulated data and previous studies confirm that the proposed method has a proper performance in determination of a suitable level of controllable factors.

Key Words: Design of experiments, multi response variables, non-deterministic residuals distribution, genetic programming, genetic algorithm.

A MULTI-OBJECTIVE ROBUST OPTIMIZATION MODEL FOR LOGISTICS PLANNING IN AN EARTHQUAKE RESPONSE PHASE, CONSIDERING TEMPORARY DISTRIBUTION CENTERS AND MEDICAL CENTERS

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Abstract

Logistics management is a key issue that should be considered for an appropriate response to earthquakes. The problem of interest is the outgrowth of a recent paper [2], where they focused on the logistics of relief items among distribution centers, and the demand nodes and logistics of injured persons among affected areas and hospitals for a prolonged period of time. The main drawback of their approach is that vehicles require to travel long distances among demand points, distribution centers and hospitals. In fact, they did not consider intermediate/temporary nodes to facilitate the logistics operations. In practice, temporary depots and medical centers are also established to facilitate the logistics of commodities and for serving injured people. This paper presents a multi-objective, multi-period model to manage the logistics of both commodities and injured people in the earthquake response phase. In the presented model, the optimal location of temporary distribution centers and the optimal capacity of medical centers are considered. Relief items can either be directly delivered from distribution centers to affected areas or they can be shipped from distribution centers to temporary depots, and, then, from temporary depots to affected areas.

According to uncertain parameters, such as demand quantity, supply quantity, number of injured persons and capacity of medical centers, a robust optimization method is applied to deal with uncertainties.

The presented model attempts to minimize the number of unserved persons, the number of unsatisfied demands and the number of utilized vehicles. The first two objectives are humanitarian objectives and the third leads to

minimization of buyer costs, volume of defective produce and delayed received goods, are considered. Two Pareto-based multi-objective meta-heuristic algorithms, namely; the non-dominated sorting genetic algorithm (NSGA-II) and the non-dominated ranking genetic algorithm (NRGA), are proposed to solve the supplier selection proposed model. Since the solution quality of all meta-heuristic algorithms severely depends on their parameters, the Taghuchi method has been utilized to tune the parameters of the algorithms. Finally, computational results obtained by implementing the algorithms on several problems of different sizes demonstrate the performance of the proposed methodologies.

Key Words: Supply chain, supplier selection, multi objective decision making, non-dominated sorting genetic algorithm, non-dominated ranking genetic algorithm.

ASSESSMENT AND IMPROVEMENT OF THE RELIABILITY OF THE PELLETS 23 MM GUN TUBE USING BAYESIAN NETWORKS AND FUZZY FAILURE MODE AND EFFECT ANALYSIS

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Abstract

The process of development and expansion of advanced industries with abundant industrial production in the current era reveals the necessity of the implementation of preventive methods in dealing with possible failures. This necessity becomes more evident in industries whose real value of produce encompasses a large volume of potential assets (e.g. the munitions industry). Reliability is one of the most important qualitative characteristics of components, products, and large, complex systems that play a crucial role in the performance of such equipment.

Modern engineered products, from each component to large systems, must be designed and produced in such a way as to have the necessary reliability. In every industry, especially the aerospace industry, it would be dangerous and harmful from different economic, human, and political aspects when a system fails or becomes dysfunctional. The current trends in various industries indicate that establishing a system capable of quickly referring the failure rate of a product, or estimating its reliability, is a requirement for each industry. The reliability of a system is the probability that the system will perform a given task under certain conditions and at certain time intervals. According to this definition, it is obvious that reliability indicates the continuation of functionality without failure (e.g. in accomplishing a mission). Therefore, reliability is defined as the probability that a system or component remain functional without failure. Reliability is of crucial importance in the arms industry. One of the products of the arms industry is the anti-aircraft missile, which is used against enemy threats. If such a product is functional or becomes functional late, there will be irreparable damage, which itself adds to the importance of the product.

In this study, first FFBD and FBD are used in order to calculate reliability and improve the functionality of munitions and weapon systems. Then, higher levels of FTA are identified using a FBD. After that, RBD is prepared, and reliability is estimated using the Fuzzy-Bayesian technique. Finally, design errors are identified and improved using a Fuzzy FMEA.

Key Words: Reliability, function flow block diagram (FBD), fault tree analysis (FTA), fuzzy bayesian networks, failure mode and effect analysis.

MODELING OF MULTI-RESPONSE PROBLEMS WITH NON-DETERMINISTIC NON-NORMAL DISTRIBUTED RESPONSES USING GENETIC PROGRAMMING

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Abstract

Global competitiveness has recently become a big challenge for many companies around the world, which are forced to seek lower costs and higher quality for what they produce. The prosperity of manufacturing firms depends on selecting and producing products which provide customer satisfaction to meet multiple objectives. If a company is able to produce customer-oriented products at a low price and in minimum time, it can be successful. So, customer need analysis should be paid attention to in product development and the design phase. Also, the technical capabilities of a manufacturing firm and the restrictions of a company should be considered. In this way, they have one big challenge: How can they respond effectively to different and easily changing customer demands? By focusing on customer opinion, Quality Function Deployment (QFD) has been developed. Quality Function Deployment (QFD) is a robust, efficient and powerful tool in the design, development and planning of products. QFD has been used in many industries and companies over the last few decades. The main function of QFD is conversion of the voice of the customer (VOC) to Technical Characteristics (TCs). However, it is not always easy to prioritize and assess TCs during the total mass of information from the different customer attitudes. This paper provides a methodology for the development of an intelligent Quality Function Deployment (IQFD) and points for developing an intelligent system based on a fuzzy inference system, in order to capture information through the House of Quality (HOQ) matrix. The paper describes the need for development of intelligent QFD to make it easier for engineers and managers to choose between TCs and improve the quality of products and systems. This paper is composed of a background of QFD, a review of related research work, and representation of an intelligent system for its analysis. Then, it applies the proposed methodology to a case study of House of Quality for the design of a new undergraduate curriculum in the mechanical engineering department of the university of Wisconsin-Madison.

Key Words: Quality function deployment, house of quality, expert system, fuzzy inference system, technical characteristics.

PRESENTATION OF A NOVEL, MULTI OBJECTIVE MODEL FOR THE SUPPLIER SELECTION PROBLEM IN A SUPPLY CHAIN, AND ITS SOLUTION USING PARETO-BASED META-HEURISTIC ALGORITHMS

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Abstract

Supplier selection is one of the most critical activities of purchasing management in a supply chain, because of the key role of supplier performance in cost, quality, delivery and service towards achieving its objectives. Selecting the right supplier significantly reduces purchasing costs and improves corporate competitiveness, which is why many experts believe that supplier selection is the most important activity of a purchasing department. Supplier selection is a multiple-criteria decision-making (MCDM) problem that is affected by several conflicting factors. Consequently, a purchasing manager must analyze the trade-off between the several criteria. MCDM techniques support the decision makers (DMS) in evaluating a set of alternatives. In a real situation, for supplier selection problems, the weights of criteria are different and depend on purchasing strategies in a supply chain. It is a common practice for suppliers to offer quantity discounts to encourage the buyer towards larger orders. In this case, the buyer must decide what order quantities to assign to each supplier. This is a complicated multiobjective decision-making problem affected by several conflicting factors. This paper develops a mixed integer nonlinear programming model to coordinate the system of a single buyer and multiple vendors under an incremental quantity discount policy for the vendors. In this paper, in addition to considering incremental discount strategies, the cost of shortages is also considered. In this model, three goals, including

and the use of global suppliers have all motivated the study of risk management in the supply chain. Supply chain risks can arise from multiple sources, including political events, demand fluctuation, technological changes, financial instability and natural disasters, etc. To be able to handle these risks, Supply Chain Risk Management (SCRM) is needed, and specific responses and strategies for the management of risk are required. Supply Chain Risk Management plays a major role in successfully managing business processes in a proactive manner.

The general trend towards focusing more on core competencies has forced companies to use outsourcing strategies and has led to the appearance of the supply chain. Also, due to the rapid advancement of technology, the basic supply chain is rapidly evolving into what is known as a "Supply Network". The Supply Network is also faced with these risks, so it requires specific and adequate responses such as techniques, attitude and strategies for their management. In this article, we focus on supply network risk management and propose a fuzzy mixed-integer linear programming model for designing a supply network, including selection of suppliers, manufacturers and distribution centers among potential choices and the determination of material flow between them. This is done by considering risks in different layers of the network, such as the operational risk of suppliers, the operational and financial risks of manufacturers and the disruption risk of distribution centers. Value at risk (VaR), generalized extreme value theory (EVT) and cash flow at risk (CFaR) methods are used to present a model for quantification of these risks, and the fuzzy set theory is used to represent the uncertainty of parameters. Finally, a numerical example is presented to show the application of this model and some computational results are reported.

Key Words: Supply network risk management, value at risk, generalized extreme value theory, cash flow at risk, fuzzy theory.

EVALUATING THE EXTENT ANALYSIS METHOD AND PROPOSING A NEW METHOD TO DERIVE A CRISP PRIORITY VECTOR FROM FUZZY COMPARISON MATRICES

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Abstract

Different methods are provided to deal with imprecise judgments of decision makers for the analytical hierarchy process. Most previous methods, which allow consideration of imprecise judgments as fuzzy numbers, provide the local and global weights of elements as fuzzy numbers too. Local and global fuzzy numbers need additional aggregation, computation and ranking procedures. The global weights may overlap each other and make the ranking of alternatives difficult. As a result, since there are different methods of fuzzy computation and fuzzy ranking, in some problems, we cannot have a unique ranking of fuzzy numbers. In order to overcome this deficiency, one method for solving fuzzy analytical hierarchy process problems and obtaining the crisp priority vector is called extent analysis. As mentioned, the main challenges of solving such problems are the fuzzy computations and ranking of fuzzy numbers, because different computation and ranking of fuzzy numbers may result in the different ranking of alternatives. Since the extent analysis method derives the crisp priority vector from fuzzy comparison matrices, it eliminates the need for additional computation and ranking of fuzzy numbers. This method is used in much research, but, in this paper, it is indicated that the priority vector of this method is not appropriate. To overcome this defect, in this paper, a new meta-heuristic based algorithm is proposed to derive the crisp priority vector from fuzzy comparison matrices. Furthermore, in order to illustrate the proposed method of this paper, it is compared with four methods available in the literature. The computational results indicate that the proposed method is appropriate for deriving the crisp priority vector from fuzzy comparison matrices.

Key Words: Analytic hierarchy process, priority vector, multiple criteria decision making, meta-heuristic algorithms.

AN INTELLIGENT FUZZY LOGIC-BASED SYSTEM TO SUPPORT HOQ ANALYSIS

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A simulated annealing (SA) algorithm was developed and tuned for solving the proposed models in large-scaled instances. The developed algorithm was implemented using randomly generated problems with different sizes. Comparisons between results of the solution algorithm and an exact solution approach show the efficiency of the proposed solution algorithm.

Key Words: Hierarchical maximal covering, referral, cooperative covering, allocation, simulated annealing.

A FUZZY MULTI-OBJECTIVE LOGISTICS MODEL FOR RELIEF DISTRIBUTION AND VICTIM EVACUATION DURING DISASTER OCCURRENCE

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Abstract
Natural disasters are highly likely to lead to severe problems, including extensive human misery and physical loss or damage. In order to primarily reduce loss of human life, it is vital to respond quickly to natural disasters. One stage of disaster relief operations is in dealing with disaster response, an aspect of which is logistics. Both the distribution of disaster relief to the affected areas and the evacuation process of injured victims to temporary medical facilities are major activities in disaster relief logistics in the disaster response phase. The predictive analysis of natural disasters and their consequences is challenging because of uncertainties and incomplete data. The significance of accounting for uncertainty in the context of disaster relief logistics stimulates an interest in developing appropriate decision making tools to cope with uncertain and imprecise parameters in relief logistics design.
This paper proposes a multi-objective, multi-mode, fuzzy mathematical programming model under the inherent uncertainty of input data in such a problem. The proposed model integrates strategic planning, such as the location of relief distribution centers, with tactical support decisions, i.e., the quantity of flow between facilities to avoid separate decision-making processes between strategic and tactical levels. Furthermore, the model considers the determination of the location of temporary medical facilities after natural disaster occurrences. In our approach, not only demands, but also supplies and the cost of transportation, are considered as the fuzzy parameters. According to recent studies, the performance of relief operations is measured based on total cost and demand satisfaction levels. Therefore, our multi-objective model contains: (i) minimization of the sum of the setup cost, transportation costs, vehicle assignment costs and shortage costs; (ii) maximization of serving injured people. To solve the proposed fuzzy multi-objective optimization model, an interactive fuzzy solution approach, based on the epsilon-constraint method, is proposed, because of its capability of measuring and adjusting the satisfaction levels of each objective function explicitly. A case study is used to demonstrate the significance and applicability of the developed fuzzy optimization model, as well as the usefulness of the proposed solution approach.

Key Words: Disaster relief logistics, relief distribution, victim evacuation, fuzzy multi-objective optimization, uncertainty.

SUPPLY NETWORK PLANNING CONSIDERING RISK

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Abstract
The risk thematic is not a new concept but a recent and growing subject in supply chain management. Global competition, the increasing complexity of the supply chain, the continuous search for competitive advantage

Abstracts of Papers in English

COOPERATIVE HIERARCHICAL MAXIMAL COVERING LOCATION-ALLOCATION PROBLEM

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Abstract

In classic covering location models, each demand point can be covered by only one facility. In cooperative covering problems, each demand point can be covered by one or more facilities. As an application of cooperative models, each facility sends signals out so that signal intensity decreases by an increase in distance. In the hierarchical maximal covering location problem (HMCLP), a fixed number of facilities with different servicing levels is located in order to maximize covered demands. In this paper, the cooperative covering concept is developed by the HMCLP with referral (HMCLP(R)) in a discrete space. It is assumed that there are two level facilities and the model is nested, so, high-level facilities provide both types of service. Each demand point is covered if its high-level demands are provided by high-level facilities directly or with referral from low-level facilities. The proposed model is presented in two forms: CHMCLP(R) for physical signals and CHMCLAP(R) for non-physical signals, while the second one considers the allocation structure as well.

The proposed models are analyzed using numerical examples. The analysis shows that the covering radii have important roles to play in the performance of the developed models. For instance, with very small referral covering radius, each low level facility is located around and near a high-level facility. So, low level facilities are covered in a non-cooperative manner by the high-level facilities, and, moreover, they cover less demand points. Therefore, covering radii should be determined carefully by considering the problem, facility specifications and other determinant factors.