time to customer demands and inquiries. ERP is an enabler of business benefits and should not be viewed as a stand-alone initiative with the requirement to pay back its implementation cost. The implementation of such systems is very difficult and many projects do not meet their expectations. There are cases of successful and unsuccessful implementations. The principal reason for failure is often associated with poor management of the implementation process. This paper presents enterprise resource planning (ERP) system, implementation of enterprise information system (especially ASAP methodology), and ERP software package, known as SAP R/3. A brief overview of preventive maintenance system, SAP R/3 Plant Maintenance Module, and automated preventive maintenance system of Iran Khodro company (legacy system) are also presented. This research assesses which system (legacy system or plant maintenance module) facilitates or inhibits the success of preventive maintenance process. We carried out a poll to find out opinions of experts and users; a recent opinion poll has been the main source used for data collection. After the systems assessment by four criteria (User, Process, Master Data, Performance), we found out Plant Maintenance Module has a better operation by Process and Master Data criteria. An action is also recommended, provided that there are more SAP system customizations which can bring about better results.

Key Words: ERP; preventive maintenance system; SAP; PM module.

RELIABILITY AND COST OPTIMIZATION OF A SERIES-PARALLEL SYSTEM WITH K-OUT-OF-N SUB-SYSTEMS WITH CONSIDERING DEPENDENT COMPONENTS FAILURE RATE

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Abstract

Nowadays, with technological advances and the need for high reliable systems, extensive research has been done in the field of reliability optimization. Redundancy allocation problem (RAP) is one of the main issues that has been raised in relation to this subject. Many studies have been carried out in this area and many solutions such as redundancy allocations and component failure rate reduction have been brought up to increase the system reliability. In this paper we considered a series-parallel system with k-out-of-n subsystems and developed a RAP with components failure rate that depend on the number of working components. In this type of failure rate, when a component fails, the remained components work with more pressure and failure rate of these components increases. The system redundancy strategies are considered as cold standby or active for the subsystems. This model has two objective functions (1) maximizing system reliability and (2) minimizing the system cost. The goals of this model are to select the redundancy strategy between active and cold standby and to determine component type and number of allocated redundant components to each subsystem. As RAP belongs to NP-hard problems, so it is very difficult to optimally solve such a problem by using traditional optimization tools. Therefore for solving the model, two effective meta-heuristic algorithms named Non-dominated Sorting Genetic Algorithm (NSGAII) and Non-dominated Ranked Genetic Algorithm (NRGA) are presented. We use design of experiment (DOE) for parameter tuning of this algorithms response surface methodology (RSM) is applied for determining the optimum amount of parameters. Then to illustrate the effectiveness of algorithms, a numerical example is presented and algorithms are compared using five different performance metrics. In order to determine whether there is a significant difference between the performance of algorithms, a single factor ANOVA in significant level ($\alpha = 0.05$) is performed. Finally performance of the algorithms is analyzed and the results are reported.

Key Words: Redundancy allocation problem; k-out-o-n; redundancy strategies; NSGA II.

COMBINATION OF FANP AND FCOPRAS METHODS

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Abstract

Selecting a suitable partner is a vital issue for establishing an efficient and useful supply chain system. The main cause is the significant responsibility of partner performance in supply chain management (SCM) for many aspects such as decreasing costs, improving customer service, maximizing revenue, reducing supply chain risk and optimizing inventory levels, business process and cycle times. Accordingly, these would result in increased competitiveness, customer satisfaction and profitability. On the other hand, partner selection is a complex issue that may involve diverse and different types of criteria, group decision-making and different forms of uncertainty.

Strategic airline alliances are an increasingly common strategy for enhancing airline competitiveness and satisfying customer needs. ,especially in an era characterized by blurring industry boundaries, fast-changing technologies, and global integration. Strategic alliance strategies allow air lines to expand networks, attract more passengers, and take advantage of product complementarities, as well as providing cost-reduction opportunities in passenger service related areas.

In this paper, a hybrid multi criteria decision making model is proposed to cope with partner selection problems. This model is based on combination of Fuzzy Analytical Network Process (FANP) and Fuzzy Complex Proportional Assessment (FCOPRAS).The analytical network process (ANP) is exploited in order to handle tangible and intangible criteria and to overcome the problem of interrelation among criteria or alternatives .In addition, fuzzy theory is utilized to model decision makers' judgments with trapezoidal fuzzy numbers. To rank the alternatives, the COPRAS method has been utilized which provides valuable and useful information including the extent of objectives and demands achieved by decision makers and the amount of efficiency for one alternative towards another. Finally "the Airline of the Islamic Republic of Iran" as a real case is applied to demonstrate the procedure of the proposed model and select the appropriate partner. Results show the great ability of the proposed approach in solving unstructured and complex partner selection problems under incomplete and vague information environment.

Key Words: Strategic airline alliances, airline industry, fuzzy complex proportional assessment, fuzzy analytical network process, MCDM.

THE ROLE OF ERP IN THE ENTERPRISE PROCESS IMPROVEMENT AND ERP IMPLEMENTATION ENHANCEMENTS IN THE PREVENTIVE MAINTENANCE SECTION A CASE STUDY IN IRAN KHODRO COMPANY

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Abstract

Nowadays, enterprises strive to keep transforming their business processes in accordance with fast-changing customer demands so as to survive the intense global competition. Economic globalisation and internationalisation of operations are essential factors in integration of suppliers, partners, and customers within and across national borders. The objective is to achieve integrated supply chains. In this effort, implementation of information technologies and systems, such as enterprise resource planning (ERP), facilitates the desired level of integration. Enterprise Resource Planning (ERP) systems provide integration and optimization of various business processes, which can lead to improved planning, decision quality, and a smoother coordination between business units resulting in higher efficiency and a quicker response

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Abstract

In this paper, a stochastic bi-objective inventory control model is developed, in which its objectives are to minimize the total inventory and transportation costs and minimize the expected number of items stocked out annually. The demand within the lead time is a random variable with a normal distribution. In this paper, multi-mode transportation is used. Since the fixed transportation costs are high, coordination of orders and full truckload shipments can benefit from economies of scale. Bin packing problems have been used for allocation product to trucks, which belong to a class of well-studied and highly popular combinatorial optimization problems. In general, bin packing problems are motivated by a large number of real-world applications. The problem is to find a best assignment of objects to bins such that weight of the objects in each bin does not exceed its capacity and the number of bins used is minimized. 'Variable-sized bin packing problem' and 'bin packing problem with over-sized items' are generalizations of the bin packing problem. The first problem is to pack a given set of items into a minimum-cost set of bins of variable sizes and costs. In the second problem, some item sizes are larger than the largest size of bins. Because the presented model is a bi-objective nonlinear programming type and NP-hard one to solve it in reasonable time, a well-known multi-objective evolutionary algorithm, namely a non-dominated sorting genetic algorithm (NSGA-II), is proposed. To verify the obtained solution and evaluate the performance of the proposed algorithm in small-size problems, we use the ε-constraint as an exact method that has been developed for general multi-objective problems. It solved ε-constraint problems obtained by transforming one of the objectives into a constraint. In large-sized problems, 10 problems are solved with the proposed NSGA-II. Then, the Pareto-optimal solutions are evaluated. Finally, the consultation is provided.

Key Words: Bi-objective inventory control, Bin packing, stochastic demand, multi-mode transportation, NSGA-II.

NEW APPROACH IN FUZZY GAME THEORY FOR EVALUATING OPTIMAL DECISION IN MULTI-CRITERIA DECISION MAKING PROBLEM

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Abstract

In this study, a multi-criteria decision making problem where there is perfect competition among decision makers (i.e., their criteria are completely in conflict) is examined and solved. This problem also considers the uncertainty in performance criteria. Game theory is used which considers two scenarios. The first scenario considers random uncertainty whereas the second consider fuzzy uncertainty. In this study, decision making problem is converted to matrix games. The first scenario considers Monte Carlo simulation in the space of a large number of matrix games with uncertain payoffs. The second scenario uses fuzzy ranking and GMCR II to obtain the equilibrium of matrix games. Finally, for a real example with non-cooperative stability definitions, optimal decision is achieved with respect to both scenarios. The results obtained from solving games by both methods show power equilibrium of tunnel option. However, in Monte-Carlo method game theory, it is shown that the option of dual conveyance system has greater power stability than the option of continuing extract. Moreover, the two options do not differ in terms of stability in our approach. Both methods conclude that the finishing extraction can never reach equilibrium.
Finally, due to the stability power in option of building tunnel option, final decision will result to in building tunnel.

Key Words: Game theory;, matrix games;, multi-criteria decision making;, monte carlo simulation, ; fuzzy ranking.

SELECTING PARTNER IN THE AIRLINE INDUSTRY USING

Abstract

Selling products and understanding customers are two influential factors in today's competitive world. To keep up with the pace, different branches in industry such as food industry have decided to attract and increase their customers, products and services and consumer goods such as edible oil are no exception. Increasing brand awareness and retaining customers are two of objectives in this process. Sciences such as data mining are very helpful in understanding customer behavior. Nowadays, data mining and customer relationship management, as two complementary sciences, help to improve getting to know customers, managing customer relationship properly and increasing revenue. In this paper, a research has been carried out on the data of an edible oil producing company using the above concepts. Using K means algorithm and RFM analysis, different customer clusters have been studied and after calculating the optimum number of clusters, customer behavior has been examined using Customer Lifetime Value analysis and an effort has been made to provide solutions for improving customer relationship and reaching company goals. Finally, due to the similarity between recency concept and market share and also market growth to purchase cash flow or monetary, the two concepts have been combined with growth share matrix and the company in question has been analyzed from market share and growth view points and a solution to increase the two factors, which are fundamental concepts in business continuity, has been proposed.

Key Words: food industry, business, data mining, customer relationship management, strategic Management.

PRIORITIZATION & SELECTION OF PROJECTS BASED ON LINGUISTIC FINANCIAL CRITERIA BY FUZZY MOORA & DEVELOPED WEIGHTED ENTROPY

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Abstract

Todays, selecting effective and efficient project is of vital importance in any organization. In this respect, the project plays a critical role in organization's future more than any other factor and involves any parts of company, such as marketing, finance-, etc. The selection of projects and work programs are key functions of both public and private sector organizations. In addition, the accurate predictions of future cash flows are faced with difficulties. Various objectives are usually taken into account when projects are analyzed, including economic desirability, technical issues, and environmental, and social factors. As the decision maker tries to maximize or minimize outcomes associated with each objective depending on its nature, a Multi-Criteria Decision Making (MCDM) problem arises. Also, choosing a simple, comprehensive technique, which is simultaneously able to compare the ranking of alternatives and then be compared with the virtual alternative, make this complexity too compounded. In fact, adopting a simple technique which ranks the alternatives and compares them to a virtual alternative might be hard especially in fuzzy environment.

Then, in this research, the fuzziness of the investment is presented. Fuzzy rate of return analysis, fuzzy B/C ratio, fuzzy payback period techniques and fuzzy project risk-performed in this article- are fuzzy investment analysis techniques.

Two scales including eleven points and five ones of linguistic descriptions use to convert fuzzy numbers into crisp ones and then by applying them, 10 assumed projects rank.

Thus, Fuzzy Moora used in this research has several advantages. First and foremost, this method can rate 10 projects with interval characteristic and linguistic scale. Needless to say, it can also determine the relative distance from the ideal (the positive point) and anti-ideal alternative (the negative point).

Key Words: Project selection; fuzzy moora; qualitative & linguistic measures; virtual alternative.

STOCHASTIC BI-OBJECTIVE INVENTORY CONTROL WITH MULTI-MODE TRANSPORTATION AND THE USE OF A BIN PACKING PROBLEM

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tle centers and disposal centers). First, a deterministic mixed-integer linear programming (MILP) model is developed for the integrated logistics network to avoid sub-optimality caused by the separated design of the forward and revers networks. Then, the two-stage stochastic model of the presented MILP model is developed by using a scenario-based approach. After that we analyze the effect of changes in demand of customers in both deterministic and stochastic models and compare them in each scenarios. Both models have been solved by GAMS software considering each scenarios. Furthermore, he numerical results show that the stochastic model can handle the uncertainty data as well and both models can be feasible for all scenarios. Finally, the conclusion is provided. We can consider multiple periods, pricing, routing and other meta-heuristic algorithms in the represented model for future studies.

Key Words: Integrated forward/reverse logistics, closed-loop supply chain, risk, environmental concerns, two-stage stochastic programming.

PROPOSING AND OPTIMIZING A MULTI-OBJECTIVE MATHEMATICAL MODEL FOR CROSS DOCKING PROBLEM USING META-HEURISTIC ALGORITHMS

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Abstract
The supply chain management is regarded as an important infrastructure in managing material flow. Cross docking is considered to be as an efficient method in supply chain management to control the inventory flow, which is essential in supply chain management. The other objectives of the cross dock are inventory reduction, increased levels of customer responsiveness and better control of the distribution operation. Since this system plays a key role in the supply chain, setting up multi objective approaches may help to solve real world issues and problems of such systems, in which many of the objectives are different and even conflicting.
This paper proposes a new multi-objective mathematical model which, unlike the previous works, considers transportation from suppliers to customers, from suppliers to other suppliers, from suppliers to cross sock, from cross dock to customers and from a customer node to other customer nodes. In this paper, three different types of objective functions are considered: to minimize the total time in supply chain, to minimize transportation cost, and to minimize the number of transportation times in the network. As mentioned earlier, these three objectives are in conflict with each other; and by considering three objective functions simultaneously the control of the supply chain is more appropriate. Since these three models belong to the NP-hard class, their solving time severely increases with increasing the problem dimensions. In this paper, to solve these three models, meta-heuristic algorithms have been used. The algorithms used in solving the model are Multiple Objective Particle Swarm Optimization and Non-Dominated Sorting Genetic Algorithm. The model is solved using both algorithms and computational experiments are reported.

Key Words: Cross dock; supply chain management; meta-heuristic; scheduling; transportation planning.

PROVIDE A MODEL FOR ANALYZING CUSTOMER BEHAVIOR USING DATA MINING (THE ANALYSIS OF EDIBLE OIL INDUSTRY)

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A CLUSTERING ALGORITHM FOR DETECTION OF MULTIPLE CHANGE-POINTS IN MONITORING SIMPLE LINEAR PROFILES

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Abstract

Detection of change time of the process parameters is a crucial problem in statistical process control (SPC), because more detailed information on the time and the pattern of a change can provide process managers with more effective clues for root-cause analysis and corresponding corrective actions. Parameter changes may take different forms including monotonic, trend, step shift, and so on. The issue frequently considered in the relevant studies involves only a single shift, whereas an out-of-control condition may be caused by multiple changes occurring in different points. On the other hand, recently, the issue of profile monitoring in which the quality of a process or product is represented by a functional relationship between a dependent and a number of explanatory variables has attracted a great deal of attention as witnessed by the growing number of publications in this area. Our investigation showed that the studies dealing with change point estimation in profile monitoring had neglected the case of multiple change points. This gap is noticed as the primary subject of this research and a clustering-based algorithm is proposed for estimating the number, as well as the location of the change points, while monitoring a simple linear profile. This clustering-based method, which is implemented in an iterative manner, is an extension of a similar method in monitoring univariate individual quality measures using Shewhart control charts. A decision rule determined via simulation using a pre-specified significance level enables the algorithm to detect multiple change points of the parameters in addition to identifying out-of-control conditions. The proposed method is applied in the phase I of process monitoring, where a historical dataset is available and the ultimate goal is to find reliable estimates of the process parameters, including the intercept and the slope of a linear profile model. Extensive simulation scenarios were devised to declare the performance of the aforementioned method.

Key Words: Statistical process control, multiple change point, profile monitoring, clustering-based detection rule.

TWO-STAGE STOCHASTIC PROGRAMMING MODEL FOR LOCATION OF COLLECTION CENTERS IN GREEN LOGISTICS NETWORKS

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Abstract

In the recent decades, environmental concerns have been attracted more attentions of researchers because of hazardous effects that create by logistics networks on the human's environment. Nowadays, customers are interested in products that are amicable with environment and can be recovered. Therefore, manufacturers are forced by customers not only to supply environmentally amicable products but also to be responsible for the returned products. On the other hand, natural and political conditions (e.g., natural disaster, disease, sanctions and wars) cause risk and indemnify the structure of logistic networks. The risks can be could be divided in two groups. Internal risks (e.g., delay, interrupt and failure) can be controlled by the prediction of managers; however, external risk (e.g., flood, earthquake and thunder) cannot be controlled by managers. Hence, in this paper, we develop a two-stage stochastic model for an integrated forward/reverse logistics network with eight echelons considering risk and environmental conditions. Three echelons in forward logistics (i.e., suppliers, plants and distribution centers) and four echelons in revers logistics (i.e., collection centers, repairing centers, disman-

Abstract

Control charts are used to monitor the variation of productions and processes. They can detect an out-of-control signal when an assignable cause is occurred. Recently, many researchers have investigated different types of profiles. Simple linear profile is one of the most important types of profiles, which has many applications in industry, especially in calibration. The simple linear profile is characterized by a relationship between a response variable and one explanatory variable. Monitoring simple linear profiles in both phases I and II is well studied in the literature. In phase I, the parameters are unknown and are estimated by historical dataset while the process parameters are known in phase II and the main aim is detecting assignable causes as quickly as possible. One of the most popular methods in phase II monitoring of the simple linear profile is $EWMA\_3$ scheme. In the $EWMA\_3$ scheme, three EWMA control charts are used to monitor the regression parameters of the simple linear profile, including intercept, slope and standard deviation- separately. In this paper, we specifically concentrate on phase II monitoring of the simple linear profiles through $EWMA\_3$ scheme. Since the third statistic in the $EWMA\_3$ scheme does not follow any specific distribution, we first propose an EWMA control chart for monitoring the standard deviation instead of the third control chart used in the $EWMA\_3$ scheme. Then, a variable sampling interval (VSI) method is proposed to improve the performance of the modified $EWMA\_3$ control chart. In the VSI procedure, the sampling interval for the next sample depends on the current sample situation on the control chart and it varies over time. The performance of the proposed VSI $EWMA\_3$ control chart is evaluated in terms of the adjusted average time to signal (AATS) obtained by a Markov chain approach. A numerical example is provided to demonstrate the effectiveness of the proposed adaptive control chart. The results show that the VSI $EWMA\_3$ control chart is more effective than the FSI $EWMA\_3$ control chart.

Key Words: Statistical process control, ($EWMA\_3$) control chart; markov chain; variable sampling interval (VSI); adjusted average time to signal (AATS).

TWO METAHEURISTIC APPROACHES FOR DISCRETE TIME-COST-QUALITY TRADEOFF PROBLEM WITH GENERALIZED PRECEDENCE CONSTRAINTS

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Abstract

A project should be delivered according to the contract at a specified time and date. On this basis, execution and completion times of activities are predicted and predetermined. But in some cases, it is necessary to complete the project even earlier than the specified date. It is obvious that in reaching shorter accomplished time, the time of some activities should be reduced. This reduction of time, known as crash activity time, is accompanied by the increasing use of resources and the spending of more costs. On the other hand, performing the activities in a longer duration decreases the costs of activity, but it may lead to the increase of the project duration, which may incur certain penalties. In relation to these advances and penalties, making a comprehensive and correct decision is a rigid challenge for managers. In practice, one of the most fundamental measures for project success is its quality, which can be influenced by time acceleration with additional costs. The goal of time-cost-quality trade-off is to select subset of activities for accelerating and to select the proper execution modes to minimize the total project time and cost, and maximize its overall quality.

In this research, a new model is proposed for time-cost-quality trade-off problem in which, unlike the previous researches that have only one precedence relation, other kinds of precedence relations have been taken into consideration. However, these constraints complicate the problem, but carry us to the real world. On the other hand, attempt is made to optimize the time, cost, and quality objectives simultaneousl.

Due to the complexity of the discrete time-cost-quality trade-off problem, using heuristic and metaheuristic algorithms for solving large-sized problems is undeniable. In this research, the NSGA-II and FastPGA algorithms are used for this purpose and their performances have been evaluated and compared using several criteria that focus on intensity and diversity of solutions.

Key Words: Project management; time-cost-quality trade-off; generalized precedence relations; multi-mode problems; NSGA-II and fastPGA metaheuristic algorithms.

work with interval durations. Then, we proceed to the latest starting times and put forward two Integer Non-Linear Programming models (one for the lower bound and the other for the upper bound) to delineate the incipient scheme behind the propounded approach. These models integrate the longest path model of CPM with its dual to calculate the upper and lower bounds of the latest occurrence times of the project events. Afterwards, we linearize these two models to acquire undemanding binary LP models solvable by means of common mathematical programming software. Finally, an $\alpha - cuts$ based routine to generalize the model to encompass fuzzy numbers, as well as interval durations, is investigated.

Key Words: Project scheduling; interval numbers; fuzzy project networks; latest times.

A NEW APPROACH OF USING DATA MINING TOOLS FOR REDUCING COSTS OF QUALITY IN MEASURING CHEMICAL PARAMETERS

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Abstract
In today's competitive markets, the quality control issues have been attracted by the manufacturers more than before. In this regard, one of the most important issues that can be notable in this domain is the quality costs. Producers and manufacturers always face a two way choice of high quality of products and high related costs and should analyze these two choices to select the optimum alternative. Preparing products with high quality leads to high amounts of costs and manufacturers are always engaged in solving his problem to balance between these two issues: high quality and high amounts of related costs. In this paper we introduce data mining techniques as effective tools that can be used effectively to overcome the above problem and propose a new approach of using these techniques that can be used for the above objectives. Accordingly, we implement the data mining tools in an electrode position paint line to show the effectiveness of such tools to reduce the costs. Actually, the main objective is to extract the knowledge that can be used in reducing the number of product sampling. The data analysis is performed on the chemical parameters of this electrode position paint line which are used to control the process of painting. To obtain the above objectives, the association rule mining technique is used. The results show that we can reduce the number of parameters which are necessary to measure regarding the rules obtained by association rule mining. It is notable that the number of sampling times is reduced in such a way that the quality of the products preserves and the risk of products failures is not also increased. In other words, the costs of sampling are reduced while preserving the quality. The proposed method can be used in similar cases for reducing the costs. It is also useful for dimension reduction purpose.

Key Words: Quality control; electrodeposition paint line; data mining; association rules.

DEVELOPING VSI (EWMA_3) CONTROL CHART FOR MONITORING SIMPLE LINEAR PROFILES

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Abstracts of Papers in English

LINEAR PROGRAMMING MODELS FOR LATEST OCCURRENCE TIMES IN PROJECT NETWORKS WITH IMPRECISE DURATIONS

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Abstract

A better perspective of characteristics of a project can be acquired by determining the time intervals within which project activities could be accomplished. Many methods capable of determining such time characteristics (e.g., CPM, PERT, etc.) are proposed. These methods mainly draw on exact activity durations or rely on historical data, whilst in real projects, the estimates are quite rough, imprecise, and somehow vague in nature, they are usually estimated by experts. Hence, application of fuzzy numbers for modeling activity durations rather than crisp or stochastic variables have pervaded the literature in recent years. In a network with fuzzy durations, the possible early starting times of activities and events are computable through alteration of crisp arithmetic with fuzzy arithmetic. However, this technique fails to find the latest correct starting times; hence, a number of methods have been presented to cope with this problem. Whereas these methods can tackle the problem of computing the latest starting times of activities in a network with imprecise durations, all of them are indeed abstruse, and demand apprehending and implementing complex computer algorithms beyond the ken of many practitioners of the project management methodology. In this paper, we propose a mathematical programming approach to solve the aforementioned problem in a vivid and handy manner, which is readily graspable to applicants with a basic knowledge of Operations Research. To begin with, we present two straightforward Linear Programming models to compute the early starting times of events in a net-