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Traveling salesperson problem (TSP) instances encountered in real-world logistics operations are often sparse and asymmetric, and of large size. The literature on tabu search heuristics for the traveling salesman problem primarily deals with relatively small symmetric TSPs defined on complete graphs. In this paper, we provide data structures which speed up the performance of tabu search on large sparse asymmetric TSPs. We show that the speed up using our data structures is significant, and allows us to use tabu search on much larger instances than those reported in the literature.

3 - A new greedy approach to the Quadratic Assignment Problem (QAP)

Theodoros Gevezes, Mathematical and Physical Sciences, Aristotle University of Thessaloniki, 51124, Thessaloniki, Greece, theogev@gen.auth.gr

A new greedy approach is presented for the QAP, where instead of building a solution starting from an empty set, a feasible solution is reached gradually by deleting the worst elements. In order to implement this greedy approach, a set of necessary and sufficient conditions for a zero-one matrix to be a solution of the QAP is proved, while the verification of these conditions requires the solution of linear assignment problem with additional constraints. The new greedy approach has been incorporated in a Greedy Randomized Adaptive Search Procedure (GRASP) with favorable computational results.

4 - A new heuristic for the minimization of tool switches problem

Edson Senne, Mathematics, UNESP/FEG, Caixa Postal 205, 12516-410, Guaratingueta, SP, Brazil, elfsenne@feg.unesp.br,
Antonio Chaves, *Horacio Yanasse*

The minimization of tool switches problem (MTSP) seeks a sequence to process a set of jobs so that the number of tool switches required is minimized. This work presents a new heuristic for the MTSP. This heuristic has a constructive phase, which is based on a graph where the vertices correspond the tools and exists an arc $k=(i,j)$ binding vertices i and j if tools i and j are necessary for the execution of task k , and an improved phase based on the Iterated Local Search. Computational results show that the proposed heuristic has better performance than other methods from the literature.

■ WD-05

Wednesday, 14:00 - 15:20

3.2.16

Electronics

Stream: Metaheuristics

Invited session

Chair: *Marc Sevaux*, EU/ME, Université de Bretagne Sud - UEB, Lab-STICC - CNRS UMR 3192, Centre de Recherche - BP 92116, 56321, Lorient, France, marc.sevaux@univ-ubs.fr

Chair: *André Rossi*, Lab-STICC - UMR 3192, Université de Bretagne-Sud, Centre de Recherche, BP 92116, 56321, Lorient, France, andre.rossi@univ-ubs.fr

1 - Implementation of the UMTS Technology in the GSM existing Network: capacity/interference optimization

Abdellah El Fallahi, logistics & computer sciences, ENSA Tetouan, ENSA Tetouan, ENSA, 93000, Tétouan tanger, Tétouan, Morocco, aelfallahi@gmail.com

UMTS is the Third Generation mobile telecoms networks which will bring video, music and internet services to the cell phone and a range of electronic products. This paper deals with the implementation of the UMTS services in the existing GSM900 bandwidth. It focuses on the issue of spectrum and capacity reduction in UMTS900 deployment area and buffer area, which can be seen as an optimization problem, where the decision variable is the number of transmitters that assure an acceptable QoS of the GSM service. An efficient tabu search method is proposed to solve this problem.

2 - Exact and metaheuristic approaches for memory cache management

Maria Soto, Lab-Sticc, Université de Bretagne Sud, Rue Saint Maude, 56100, Lorient, Brittany (Bretagne), France, maria.soto@univ-ubs.fr, *André Rossi*, *Marc Sevaux*

Designing embedded systems is more and more challenging as technology empowers to integrate an increasing number of functionalities in a microchip. Because of this complexity increase, designers rely on CAD software which produce chips that often lack optimization. Consequently, the designed microchips are too power-consuming. Memory cache management has been shown to have a deep impact on performances, thus this work focuses on data allocation to memory banks. This issue is shown to be close to the k -weighted graph coloring problem and is addressed with graph coloring inspired metaheuristics

3 - Point Coverage, Sink Location, and Data Routing Problems in Wireless Sensor Networks: MILP Formulations and Solutions

Kuban Altinel, Dept. of Ind. Eng., Bogazici Univ, Bebek, 34342, Istanbul, Turkey, altinel@boun.edu.tr, *Necati Aras*, *Evren Guney*, *Cem Ersoy*

The point coverage, sink location, and data routing problems are considered within a unified frame and two integrated mixed-integer linear programming formulations are developed. They are difficult to solve and a hybrid procedure is proposed. The best sensor locations are sought by tabu search in the upper level. For the fixed sensor locations, the remaining problem of determining sink locations and data routes are solved approximately in the lower level. According to the experimental results performed on a number of test instances, we can say that the new method is efficient and accurate.

4 - Multi-objective optimization of Memory Built-In-Self-Test sharing

Yann Kieffer, laboratoire G-SCOP, 38031 Cedex 1, Grenoble, France, yann.kieffer@g-scop.inpg.fr, *Zaourar Lilia*, *Nadia Brauner*

Because of the growing integration of systems-on-chips, testing semiconductor on-chip memories is becoming more and more challenging. To improve testability and reduce costs, the additional testing circuitry has to be shared among memories. This sharing impacts the surface cost of these special elements, and also both the test time and test power necessary to test the individual chips after production. We present a model and solution for this sharing problem, where both sequential and parallel sharing are allowed, as specified by compatibility rules given as parameters of the optimization.

■ WD-06

Wednesday, 14:00 - 15:20

8.2.30

DEA Application VII - Retailing and health

Stream: DEA and Performance Measurement

Invited session

Chair: *Stella Sofianopoulou*, Industrial Management & Technology, University of Piraeus, 80 Karaoli & Dimitriou street, 18534, Piraeus, Greece, sofianop@unipi.gr

1 - Assessment for Teaching and Medical Integrated Activities inside Brazilian University Hospitals

Angela Silva, Economia, Unoiversidade Estadualdo Rio de Janeiro, Rua Belisario Tavora 80 ap 506, 22245-070, Rio de Janeiro, Rio de Janeiro, angela@pep.ufrj.br, *Marcos Estellita Lins*, *Maria Stella Castro Lobo*, *Roberto Fiszman*

This paper measures the performance of Brazilian Federal University Hospitals and the integration between medical and teaching activities. We propose a Network DEA model that considers the medical care and the teaching dimensions simultaneously, with equivalent weights. We consider an output-oriented VRS model. The chosen external input variables were: physicians, teachers (for both dimensions), beds and operational expenses (for the medical care dimension); the output variables were: medical grad students (teaching dimension) and adjusted admissions (medical care dimension)

2 - The assessment of retailing efficiency using Network Data Envelopment Analysis

Clara Vaz, Escola Superior de Tecnologia e de Gestão, Instituto Politécnico de Bragança, Campus de Santa Apolónia, Apartado 134, 5301 - 857, Bragança, Portugal, clvaz@ipb.pt, *Ana Camanho*, *Rui Guimarães*

This paper describes a method for the assessment of retail store performance based on DEA. The assessment considers the stores aggregate several subunits, corresponding to sections with management autonomy. This motivated an analysis at the section level and the store level. The performance assessment of the sections involves a comparison among similar sections located in different stores, and evaluates efficiency spread. This is followed by an analysis at the store level to define targets for the sections by using a Network model that takes into account the sections share limited resources.

3 - Analyses of investment efficiency using network DEA

Hirofumi Amatatsu, Information Science of Graduate School of Engineering, Seikei University, 3-3-1 Kichijoji-Kitamachi, 180-8633, Musasino-shi, Tokyo, Japan, amatatsu@mint.ocn.ne.jp, *Tohru Ueda*

Enterprises have been investing to keep their positions in markets or to make new positions. Central and local governments have also been doing similar activities. In this paper we propose DEA algorithms to evaluate efficiency of these investments using financial reports and input-output tables for multiple periods. The algorithms include 1) Dynamic DEA algorithms for simple organizations 2) Dynamic DEA algorithms for matrix type network organizations and 3) Malmquist productivity indexes.

4 - Retail chain performance evaluation using Data Envelopment Analysis

Vassilis Dedoussis, Industrial Management & Technology, University of Piraeus, 80 Karaoli & Dimitriou str., 185 34, Piraeus, Greece, vdedo@unipi.gr, *Stella Sofianopoulou*

The efficiency of a retail chain is a major issue in the retailer's competitiveness, since its profitability depends on the profitability of its parts. Data Envelopment Analysis is employed for resolving this problem in a fast food retail chain and assessing managerially useful measures of store-level retail productivity. The mathematical model created is multidimensional and accepts multiple inputs and outputs, both quantitative and qualitative for every outlet, which are then used as tools for measuring the technical efficiency of the stores. Computational results from a real-world test case are presented.

■ WD-07

Wednesday, 14:00 - 15:20

8.2.47

Project Scheduling

Stream: Project Management and Scheduling [c]

Contributed session

Chair: *Premysl Sucha*, Department of Control Engineering, Czech Technical University, Faculty of Electrical Engineering, Karlovo namesti 13, Prague 2, 121 35, Prague, Czech Republic, suchap@fel.cvut.cz

1 - Time-cost tradeoffs under time and cost chance constraints

Zohar Laslo, Industrial Engineering and Management, SCE-Shamoon College of Engineering, Bialik/Bazel Strs, 84100, Beer Sheva, Israel, zohar@sce.ac.il, *Gregory Gurevich*

Seeking for the improvement of the project planning, we analyzed two current procedures and a new developed procedure for crashing the project completion by additional budget. We consider a project with various types of activities where the randomness of their duration derives from external uncertainty, internal uncertainty or both of them and where correlation between their actual cost and random duration is known. The objective is to 'optimize' the allocation of budget among project activities, seeking to minimize the budget, subject to any chance constrained contractual due date.

2 - Social Network Analysis of project partnership

Blazanka Divjak, Faculty of organization and informatics, University of Zagreb, Pavlinska 2, 42 000, Varazdin, blazanka.divjak@foi.hr, *Nina Begicevic*, *Petra Peharda*

In this paper we present a research on the social network of project partnership in the EUREKA network. The main method used is the Social Network Analysis. Two hypotheses were set: H1 Countries from the same region cooperate more among themselves than with the countries from any other region. H2 Central countries in the social network of partnership in EUREKA projects are developed countries. We tested the hypotheses on countries from Northern, Central, Mediterranean, Western and South-Eastern and Eastern Europe. The results indicate that countries from the same region cooperate more with the countries outside the region and that the central countries in the social network are developed countries.

3 - Flexible Human Resource Management through Decision Support Systems - A Case-Study in a Contact Center Outsourcer

João Justino, HR Department, Teleperformance Portugal, R Alexandre Braga 25-B, 1150-003, Lisboa, Portugal, jj1165@acuity.pt, *Joao Telhada*

Managing the relationship with employees, while keeping high levels of quality in customer satisfaction, has been a continuous challenge for business managers. Usually this relationship is strict, thus introducing flexibility is a breakthrough innovation that can only be achieved in a business intelligence framework. A case study is presented describing the design, adoption and implementation of an intelligence system in a contact center outsourcer for managing the usage of operators in a flexible way. Some indicators are given that illustrate the importance of such systems.

4 - Take-give Resources in Project Scheduling with Time Windows

Premysl Sucha, Department of Control Engineering, Czech Technical University, Faculty of Electrical Engineering, Karlovo namesti 13, Prague 2, 121 35, Prague, Czech Republic, suchap@fel.cvut.cz, *Zdenek Hanzalek*

The problem that we address in this work is motivated by a real scheduling problem from a lacquer production which is seen as the project scheduling problem with general temporal and resource constraints. In addition, there are special resources called take-give resources that are needed from the beginning of an activity to the completion of another activity. In addition, we consider sequence dependent changeover time on take-give resources. We suggest two heuristic solutions to solve the problem. Performance of both heuristics is evaluated on a set of lacquer production benchmarks.

■ WD-08

Wednesday, 14:00 - 15:20

6.1.36

Various Advances on Management and Scheduling II

Stream: Project Management and Scheduling

Invited session

Chair: *Erwin Pesch*, FB 5 - Institute of Information Systems, University of Siegen, Hoelderlinstr. 3, 57068, Siegen, Germany, pesch@fb5.uni-siegen.de

Chair: *Gerhard-Wilhelm Weber*, Institute of Applied Mathematics, Middle East Technical University, ODTÜ, 06531, Ankara, Turkey, gweber@metu.edu.tr

Chair: *Edmund Burke*, School of Computer Science & IT, University of Nottingham, Jubilee Campus, Wollaton Road, NG8 1BB, Nottingham, United Kingdom, ekb@cs.nott.ac.uk

1 - Evaluation and comparison of project management software

Vassilis Kostoglou, Department of Informatics, Alexander TEI of Thessaloniki, P.O. Box 141, 57400, Thessaloniki, Greece, vkostogl@it.teithe.gr

Most projects are characterized by complexity due to their size, the requirement for scheduling of tasks and tracking of progress, and the dire need for using their resources efficiently. A large number of relevant software is available to project managers. This work examines thoroughly and evaluates 12 selected project management programmes on six introduced main criteria, each consisting of several components. All programmes are tested and ranked for every criterion and aggregately according to their scores on a five grade scale. Software performances are commented and conclusions are drawn.

2 - On Resource Complementarity in Activity Networks — Preliminary Results

Helder Silva, IFAM - Instituto Federal de Educação, Ciência e Tecnologia do Amazonas, Rua Governador Danilo Areosa S/N,