Newsletter of the European Working Group
"Multicriteria Aid for Decisions"

Bulletin du Groupe de Travail Européen
"Aide Multicritère à la Décision"

Groupe de Travail Européen "Aide Multicritère à la Décision"
Série 3, nº22 automne 2010.

European Working Group "Multiple Criteria Decision Aiding"
Series 3, nº 22, Fall 2010.

Bernard Roy was born on March 15, 1934 in Moulins-sur-Allier, a medium-sized town in the center of France[1]. He got a degree in Mathematics at the *Université de Paris*. After he obtained his Licence (Rational Mechanics) in September 1954, he joined IEP (*Institut d'Études Politiques)*, a relatively special *Grande École* mainly oriented towards Economics and Political Science, and the *Institut de Statistique de l'Université de Paris* (ISUP), an interfaculty department granting diplomas in Statistics and Probability. At those times Bernard discovered Operations Research and decided to apply Mathematics in the real world. In July 1956, Bernard got a position of researcher at the *Centre National de la Recherche Scientifique* (CNRS). He was also recruited as intern at *Électricité de France* (EDF, the newly nationalized electricity company) where he started to apply linear programming. In that period, Bernard completed his Master's thesis at ISUP, and he wrote his first research paper. Bernard married Françoise in July 1957 (see Figure 1). They will have six children: Sylvie (1958†), Laurence (1961), Isabelle (1964), Solange (1966), Patrice (1968) and Philippe (1970†). After leaving CNRS, Bernard was recruited by a newly created consulting company SEPRO specialized in OR, but very soon, in October 1957, he joined the *Société de Mathématiques Appliquées* (SMA), a joint venture between *Paribas* and an independent consulting company. SMA quickly became SEMA (*Société d'Économie et de Mathématiques Appliquées*) and, after having created several subsidiaries in Europe, SEMA (Metra International). After translating into French the new book of C.W. Churchman, R.L. Ackoff and E.L. Arnoff "Introduction to Operations Research", in 1958, Bernard started to work on applied OR problems. Bernard worked on a variety of problems such as: scheduling, probability and queuing theory, data analysis, transportation studies, cutting stock, location, finance. While working on several scheduling problems, he developed and refined the "activity on node formulation" in project scheduling. In between contracts, Bernard started working on his PhD dissertation devoted to Graph Theory and its applications. He received his PhD in 1961 from the *Université de Paris*, under the supervision of Claude Berge. In 1962, Bernard joined a scientific team called "*Direction Scientifique"*, created by Jacques Lesourne within SEMA with the aim of helping consultants applying new OR techniques. He took the direction of that team in 1964. At the same time, Bernard was appointed as editor-in-chief (position that he maintained until 1977) of a quarterly journal called METRA launched by SEMA to popularize the new management techniques it promoted. The work of Bernard on multiple criteria decision started in the mid-sixties on the basis of real-world problems submitted by SEMA consultants. This led him to the development of the first ELECTRE method (ELECTRE I). In 1969 and 1970, Bernard published the two volumes of his book on Graph Theory. During these consulting years, Bernard taught OR courses at the *Centre Inter-armées de Recherche Opérationnelle* (a permanent education course program in OR for French officers) and headed together with Claude Berge a seminar on Graph Theory and Combinatorial problems. After giving a doctoral course on OR at the newly created *Université Paris Dauphine*, in 1971 he was appointed there Associate Professor in Mathematics, and, one year after, Full Professor. He kept his position at SEMA till 1974, and further he stayed in contact with SEMA till 1979. In 1974 Bernard created a research group called LAMSADE that became affiliated to the CNRS in 1976. This was one of the few research groups in France oriented towards OR. In 1980, he became Scientific Advisor at RATP. His research at LAMSADE was more and more oriented towards Multiple Criteria Decision Aiding (MCDA). Building on this research, he developed an original methodology for decision aiding. More recently, he has been working on robustness analysis. He also took several important responsibilities within *Université Paris Dauphine*, including the direction of a doctoral school. Bernard retired in 2001, but he continues to give some lectures and hold a seminar at LAMSADE as Emeritus Professor.

Bernard has served as Vice President (1974-76) and President (1976-78) of AFCET (the French OR society at that time). He has been President of EURO (1985-86) after having served in the executive committee for several years. He is involved in the editorial committee of many OR journals, including European Journal of Operational Research.

His major activity at the European level concerned creation and leadership of the EURO Working Group (EURO-WG) on Multiple Criteria Decision Aiding (MCDA). This happened at the first EURO conference which was held in Brussels in 1975. Since then the group was meeting invariably twice a year (in Spring and Autumn). The group aims at promoting original research on MCDA at the European level. The meetings of the group are not conferences. They are designed so as to foster discussions and exchanges. The group has around

[1] A part of this bio is based on the text by D. Bouyssou and D. Vanderpooten about *Bernard Roy*, in S. I. Gass & A. A. Assad (Eds.), Profiles in Operations Research: Pioneers and Innovators, Springer, 2010.

350 members, from about 30 countries, and meetings usually gather between 50 and 100 persons. The success of the group is attested by the fact that most texts on MCDM now speak of a "European school of MCDA" (for a more detailed characteristic of the "European" Conception of MCDA – see the excerpt below).

The 50th Anniversary meeting of the group was held in 1999 in the prestigious château de Cerisy-La-Salle and gathered a large number of members (see Figure 2).

At the 72nd Meeting of the EURO-WG on MCDA in Paris (October 7-9, 2010), Bernard Roy stepped down from his position of the Group Coordinator and he kindly accepted to continue supporting the group's activity as the Honorary Chairman. The new Board of Group Coordinators elected at this meeting is composed of Salvatore Greco, Jose Figueira and Roman Słowiński. The 73rd meeting will take place in Corte (Corsica, France) on April 14-16, 2011. More details on this working group can be found at http://www.cs.put.poznan.pl/ewgmcda/

Bernard holds seven honorary doctoral degrees (Vrije Universiteit Brussels, Belgium, 1978, Université de Liège, Belgium, 1978, Université de Fribourg, Switzerland, 1982, Poznań University of Technology, Poland, 1992, Université Laval, Canada, 1998, Technical University of Crete, Greece, 2002, University of Catania, 2009) as well as the "Hermès de la recherche" from the Université Laval, Québec, Canada. He received in 1992 the EURO Gold Medal, the highest distinction granted by EURO. He holds as well the Gold Medal from the MCDM International Society.

Figure 1: Bernard Roy and his wife Françoise in Gdańsk in 1988

Figure 2: 50th meeting of the working in MCDA at Cerisy in 1999 (Bernard is in the second rank in the middle)

Figure 3. Bernard Roy receiving the honorary doctoral degree at the University of Catania in 2009

[**An excerpt about "European" Conception of MCDA extracted from the chapter:** J.Figueira, S.Greco, B.Roy, R.Słowiński: ELECTRE Methods: Main Features and Recent Developments. Chapter 3 [in]: C.Zopounidis, P.M.Pardalos (eds.), *Handbook of Multicriteria Analysis*. Springer, Berlin, 2010, pp. 51-89.]

In the operational research and decision aiding community, to which we belong, the decision-aiding activity (which is meant to be scientific) is founded on three pillars:

1) The *actions* (formal definition of the possible actions or alternatives),

2) The *consequences* (aspects, attributes, characteristics, ... of the actions, that allow to compare one action to another), and

3) The *modeling of one or several preference systems* (it consist of an implicit or explicit process, that for each pair of actions envisioned, assigns one and only one of the three possibilities: indifference, preference, or incomparability).

The last pillar needs further explanation. When given two possible actions, any individual, whoever he/she may be, based on the actions' consequences, and his/her value system, can state: "I prefer the first to the second" or vice-versa, "I am indifferent between the two", or "I am unable to compare these two actions". Modeling a preference system means to specify a process that will provide this type of results based on a pre-established model of the action consequences. These consequences are most often complex and inadequately known. They can be modeled in quantitative or qualitative terms, in a deterministic or stochastic manner, with a part of arbitrariness or ill determination.

According to the "European" conception, the analyst must seek for obtaining a coherent and structured set of results. These results should be sought in order to guide the decision aiding process and facilitate communication about the decisions. To do so, the analyst must use an approach that aims at producing knowledge from working hypotheses, taking into account the objectives and the value systems involved in a particular decision context. This approach should be based on models that are, at least partially, co-constructed through interaction with the decision maker. This co-construction first concerns the way the considered actions are taken into account, as well as the consequences on which these actions will be judged. Secondly, the co-construction process concerns the way that certain characteristics (notably the values attributed to the different parameters) of the preference model were judged the most appropriate given the specificities of the decision context and the working hypotheses retained. In this conception, it is no longer necessary to assume that there exists, in the mind of the decision maker, a stable procedure capable of defining the decision maker's preference system completely, before even beginning the decision aiding process.

To elaborate results likely to make things more clear to the decision maker (e.g., "if..., then..." results), in the "European" conception, the analyst must propose working hypotheses which will allow the co- construction of the preference model to play an appropriate role in the decision aiding process. The co-constructed model must be a tool for looking more thoroughly into the subject, by exploring, interpreting, debating and even arguing. To guide this process of co-construction, the analyst must also interact with the decision maker assuming that he/she understands the questions that are asked. Nevertheless, in the "European" conception, it is not necessary to assume that the given responses are produced through a stable pre-existing process, but only that these responses are made up through interaction with the decision maker's value system, which is rarely free of ambiguity or even contradiction. In particular, the analyst must make sure that the person who responds to the questions is able to place these questions in the context of the current study. The analyst must also admit that these questions can bring the person thus questioned to revise certain pre-existing preferences momentarily and locally. According to the "European" conception, the knowledge produced does not aim to help the decision maker to discover a good approximation of a decision which would objectively be one of the best, taking into account his/her own value system, but rather more humbly to provide the decision maker with a set of results derived from the reasoning modes and working hypotheses. The decision maker will better understand the results produced and will appropriate them (and potentially share with others) if the analyst makes sure that understanding of the underlying reasoning modes and working hypotheses is integrated into the model co-construction process. In this "European" conception, the analyst does not need to accept either of the following two postulates:

- Postulate of the decision maker's optimum. In the decision context studied, there exists at least one optimal decision, or, in other words, there exists one decision for which it is possible (if sufficient time and means are available) to establish objectively that there are no strictly better decisions with respect to the decision maker's preference system.

- Postulate of the decision context reality. The principal aspects of the reality on which the decision aiding is based (particularly the decision maker's preferences) are related to objects of knowledge that can be seen as data (i.e., existing outside of the way they are modeled); these objects can also be seen as sufficiently stable over time and for the questions asked, such that it is possible to refer to the exact state or the exact value (deterministic or stochastic) of given characteristics judged to accurately portray an aspect of that reality.

He/she may find these postulates as totally unrealistic, or may even have good reasons for accepting the existence of incomparabilities in the preference models used.

Roman Slowinski, Salvatore Greco,
José R. Figueira

Opinion Makers Section

Note on "outcomes profiles evolution and no need for synthetical impact indexes" in Public policies Evaluation".

Maurice Baslé,

CREM-CNRS-University of rennes 1.

Maurice.basle@univ-rennes1.fr

Traditionally, in evaluation of public policies, the public value chain of public activities begins from operations (their human and financial cost or inputs), and then postulate outputs or effective realisations, and immediate outcomes and then more hypothetical synthetic or systemic impact. The whole chain is presented with the convention of a logical diagram of impact. (logically, "if causes, then some effects").

The synthetical impact is generally estimated by monitoring the evolution (the delta) of a proxy extracted in the mine of context data. This is for example the employment impact or the carbon print.

When mastering a public program, there is generally an attempt of targeting and getting the best evolution of a synthetical index of impact comparing to the target is the supreme goal.

But, as it is well known, there is a lot of postulates for accepting the synthetical index. We also know that, taking account of imprecision in each outcome measure, and confronted to the irrelevance of a lot of synthesis algorithms, we argue that it is really an innovation in Public policies Evaluation to propose to stop before getting the most synthetical index of impact. Less aggregating and more comparing intermediate results would be a sufficient and excellent approach. So we could be the advocate of a more Multidimensional or multicriteria evaluation. Comparisons of the evolution of outcomes profiles should be adequate for monitoring the program.

In our different case studies, the main purpose is to take the outcomes of programmes for each period, and to compare these profiles year on year without having to calculate a synthetic impact index.

We could examine the universities rankings issues with the same considerations. Is it useful to have a general ranking like the Shanghaï ranking between the totality of universities in the world or should it be better to consider only profiles and deny any interest in the final weighted arithmetic mean between the notations captured in five dimensions.

The new experimentation of a European multidimensional ranking (Cherpa consortium, (Center for Higher Education and Research Performance Assessment)) in an outgoing train and it will be a demonstrator of the potential superiority of a non-outranking tool.

See. Baslé, M. (2008). Economie, consueil et gestion publique. Suivi et évaluation de politiques publiques. Editions Economica. Paris

MCDA Research Groups

CDSID – Center for Decision Systems and Information Development - Brazil

Danielle Costa Morais, PhD - Assistant Professor
e-mail: daniellemorais@yahoo.com.br
Caroline Maria Miranda Mota, PhD - Assistant Professor
Luciana Hazin Alencar, PhD - Assistant Professor

The Center for Decision Systems and Information Development (CDSID - http://www.cdsid.org.br) is related to the Federal University of Pernambuco, in Brazil. The Center started its activities as a research group in 1987, yielding the status of consolidated research group in 1996 by CNPq (the Brazilian Research Council). The CDSID's mission is to create and transfer scientific knowledge in Information and Decision Systems, by applying it in organizations.
Research Members of CDSID include 10 researchers (Full and Assistant Professors) and more than 25 collaborators (PhD and MSc students) headed by Prof. Adiel T de Almeida. They work in areas related to Information and Decision Systems, by conducting research projects, training staff and undertaking consultancy activities in the business environment. The Center engages in interactions with several organizations, by means of contracts and agreements that receive institutional support from research associations, foundations and private companies. The

Center is very active in applied research. Most of its members have achieved the recognition for their productivity in research from CNPq.
CDSID encompasses several lines of research which use MCDA in different fields, publishing relevant studies. Amongst the main applications areas of MCDA, we have found the following to be the most fruitful:

- **Performance Evaluation System:** contributes with methods and models to monitor and control socio-technical systems to support decision-making processes so as to maintain performance in accordance with availability requirements (reliability and maintainability), intrinsic quality, cost and other relevant goals.
- **Supply Chain (SC):** develops analysis, methods and models related to SC performance, selection of suppliers, routing problems, performance evaluation, etc. Many sectors have been involved in such studies, e.g. the civil construction industry, food industry, cosmetic industry, health sector, *inter alia*. The studies include subjects related to supplier selection models using multicriteria decision aid and group decision, identifying tools and techniques in order to select suppliers and evaluation in food industry, analysing the performance of the Supply Chain, and analyzing collaborative relationships.
- **Systems to Enhance Competitiveness:** contributes with methods and models associated with the Business Competitiveness Management which incorporates assessing the impacts of models for the competitive process, project management, and knowledge management with a view to prospective analysis and strategic systems, including prioritizing multicriteria decision models.
- **Group Decision and Negotiation:** develops models and methods of Group Decision and Negotiation. Some models use multicriteria methodology, and consider the preferences of each decision maker involved. The models are developed depending on the extent of divergence among the decision-makers involved in the decision process. Other models are developed by voting procedures in order to establish a collective preference from different individual ones. Also develops models that aggregate of expertise. In addition, develops studies on problem structuring methods as applied to several sectors of activity. It develops procedures to ensure fair division in distributive and integrative negotiation processes and studies of coalition analysis. Besides these issues, contributes studies on e-negotiation.
- **Risk Management:** develops models and methods for multidimensional risk management, with the emphasis on industrial and technological risk, but this also involves risks and financial risks in projects. This includes MCDM methods integrated with stochastic models which often use subjective probability evaluation. For the industrial context, the main applications of these models have been on electricity plants, gas pipelines and in the context of energy from hydrogen.
- **Project Management:** develops methods of decision support for project management and risk assessment in project management. In addition, two research fields can be highlight: (1) To investigate the influence of culture, with regard to team behavior, the organizational approach, tools and methodologies, for the success or failure of a project; (2) to contribute with methods and models for planning, controlling and monitoring projects, with a view to supporting organizations in the decision-making process involving multiple objectives (criteria). Projects and research interests cover areas of knowledge such as: Civil Engineering; Information Systems (Software Development); the Petrochemical Industry and the Energy Industry. The main projects developed by the center are: The effect of cultural perspectives on perceptions of success and failure in an IS/IT project, with a project team drawn from seven different countries; COLABORE: Software for collaborative relationship between Activities and Projects, Management model for prioritizing and selecting Research & Development (R&D) Projects, using a multicriteria approach; Process planning and managing projects with multicriteria evaluation; and Support for the basic features of MS Project tool with respect to constructing transmission lines.
- **Water Resources Management:** This is very often an important point of discussion with regard to global concerns. This line of research develops studies and models for Information and Decision systems to aid in a structured way the decision process regarding conflicts arising from multiple uses of water, the availability of water, controlling water losses, strategies for conserving water in urban areas, and other decisions problems related to hydrographic basins. The center develops techniques and processes of group decision and negotiation in order to improve the participation of civil society in decision processes, by generating a participatory multicriteria group decision model to make the process more efficient. The center has developed projects such as: 1) Decision making on a water supply system using multicriteria analysis; 2) Group Decision-Making that informs the Management Strategy for dealing with Leakages in a Water Network; 3) Integrated model of problem structuring and multicriteria group

decision-making for social sustainable development; 4) Rehabilitating a water network: a group decision-making approach; 5) A Multicriteria Group Decision Model to Support Watershed Committees in Brazil, and so forth.

- **Reliability and Maintenance Engineering:** develops models and methods for Managing and Maintaining Engineering Systems. Reliability, Maintenance, Safety and Decision Support Systems together constitute one of the most newest research approaches currently being developed. According to some important authors in this area, analyzing reliability and risk analysis pertains to quantified measures of uncertainty about certain adverse events. However, since quantified measures of uncertainty are only an intermediate step in the process of decision making, authors advocate, in a broader view, that the analysis of reliability and risk is simply a set of tools to support the process of structuring problems of decision making under uncertainty. Thus, this perspective makes the analysis of risk and reliability one of the most prominent research areas amongst the different areas studied by this research group. It is worth noting that it is as a result of CDSID studies that consideration of multiple risk dimensions has become mainstream practice even in groups whose views on analyzing risk and reliability are more conservative. In addition, issues of special interest to modeling maintenance have been developed. Subjects such as modeling for maintenance contracts; using Multicriteria decision models to support maintenance planning; and a multicriteria decision model to determine inspection intervals for monitoring the condition of equipment are among the main contributions of this center. Besides several articles on this area, the group has made some important contributions by supporting companies through undertaking Research and Development of special interest to a company.
- **Multicriteria Methods and Models:** this line of research deals with developing new multicriteria methods and models and decision support**.** Methodological developments have been proposed concerning real life applications and include contributions on compensatory and non-compensatory methods, ordinal methods, as well integration of known methods, such as outranking approach and utility theory.
- **Planning and Management Information Systems:** contributes with methodologies for planning and management information systems incorporating the vision to set up or remodel an information system in an organization, including its strategic assessment and business processes, and methods of multicriteria decision support for prioritizing actions**.** Such research aims to provide adequate organizational solutions, by taking into consideration, *inter alia*, the great impact of Information Systems on the productivity and quality of companies and the importance of Planning and Management Information Systems appropriately. Among the methodologies and tools applied by the group in this context we highlight Multicriteria Decision, DEA, Game Theory, Statistical Inference, Group Decision and Negotiation, Business Process Management (BPM), the Balanced Scorecard (BSC). The main topics of projects funded in the information Management area are: 1) Models for Management Information Systems – Proposals for corporate planning and project management in information systems; 2) A study of the relations between the Information Systems department and other Business Functions; 3) Developing and applying a methodology for planning information systems; 4) Diagnosing the maturity and the conceptual adequacy of information systems planning in Brazilian companies.
- **Portfolio of Projects:** develops methods and models for managing a Project Portfolio, a selection of portfolios, given multiple objectives and the probabilistic dynamic behavior of the environment. Research and Development (R&D) projects have been the main focus of this line.
- **Decision Support Systems:** contributes to designing and developing interactive systems, which include in its architecture: decision model base and data base to support the organizations in decision making involving multiple objectives (criteria) in dynamic environment, including non-structured process.

Some research collaborations of CDSID with European institutions have led to sending PhD students abroad and also receiving researchers from abroad.

The Center regularly participates in the most important conferences on Operations Research and Management Sciences. Given the classical approach of optimization that is common in these conferences, some of the papers presented by the group that deal with multicriteria have provided a very interesting space for discussing potentialities for enriching the optimization approach.

Further, the members of CDSID are invited to attend and organize sessions at the most important conferences all around the world. In addition, the Center has promoted the Seminar of Information and Decision (SIDS- www.gpsid.org.br/sids**).** This event is dedicated to themes related to information and decision systems. Some of the keynote speakers have been: Prof. Ralph Keeney (Fuqua School of Business, Duke University, Durham – USA); Prof. Lyn Thomas (University of Southampton, UK); Prof. José Figueira (CEG-IST, Center for Management Studies of Instituto Superior Técnico -

Portugal) and Prof. Melvin Shakun (Leonard N. Stern School of Business, New York University).

At present, the CDSID is among the highest rated research groups in Brazil, as evaluated by CNPq (the Brazilian Research Funding Bureau). Members of the group have also participated in various front-line academic activities in Brazil, such as, by being a member of Board Direction of SOBRAPO (the Operational Research Society of Brazil), members of committees of CNPq and CAPES (the Brazilian Post-Graduate Evaluation Bureau), ABEPRO (the Brazilian Association for Production and Management Engineering) and so on.

Further information:
Address: CDSID – UFPE. PO Box: 7462; Recife - PE, 50.722-970, Brazil,
Web-page: www.cdsid.org.br

Forum

Quelques réflexions sur la recherche de solutions robustes en programmation linéaire

Virginie Gabrel, Cécile Murat
Université Paris-Dauphine, LAMSADE, CNRS,
UMR7024,F-75016 Paris, France
E-mail: {gabrel,murat}@lamsade.dauphine.fr

Introduction

Lorsqu'un problème de décision est modélisé à l'aide d'un programme linéaire, il peut s'avérer très difficile d'attribuer une valeur unique plausible à chacun des paramètres du modèle. Les raisons peuvent être de natures différentes : technique (erreurs d'arrondis, difficulté à récupérer et à calculer certaines valeurs de paramètre) et/ou contextuelle (présence de phénomènes aléatoires, avenir incertain). Tous les paramètres du modèle ne sont pas entachés d'incertitude et d'indétermination simultanément : ces incertitudes peuvent peser uniquement sur la fonction objectif, sur les coefficients des variables dans les contraintes et/ou sur les seconds membres des contraintes. L'approche consistant à intégrer les éléments d'incertitude et d'indétermination dans le programme mathématique à résoudre peut alors s'avérer nécessaire. En l'absence de loi de probabilités décrivant l'incertitude, l'optimisation robuste a pour objectif de déterminer des solutions qui résistent au mieux aux aléas.
La première étape consiste donc à choisir un ensemble d'incertitude pour chacun des paramètres du programme (polyèdre, intervalle, ensemble discret de valeurs plausibles...) et, à décrire de quelle façon cette indétermination sera partiellement ou complètement levée au cours du processus de décision. La deuxième étape concerne la compréhension et l'analyse du contexte décisionnel afin de donner un sens à la notion de robustesse. Et enfin, il s'agit de résoudre la version robuste du programme mathématique considéré.
Nos recherches récentes sur ces problématiques de robustesse nous amènent à un certain nombre de conclusions que nous souhaitons exposer :

- les problématiques de robustesse et les réponses à y apporter diffèrent en fonction des paramètres incertains : l'incertitude concernant l'évaluation d'une solution (portant sur les coefficients dans la fonction objectif) doit être distinguée de l'incertitude concernant la réalisabilité d'une solution (portant sur les coefficients intervenant dans les contraintes),
- la théorie de la dualité reste pertinente mais doit être revisitée,
- le cas de l'incertitude pesant uniquement sur les seconds membres des contraintes mérite une étude spécifique,
- dans le cas où l'incertitude pèse sur la réalisabilité des solutions, les problèmes ne sont pas de même nature lorsque le système de contraintes présente ou non des égalités,
- la comparaison des approches de robustesse n'a de sens que vis-à-vis d'un contexte décisionnel clairement identifié.

Incertitude sur l'évaluation versus incertitude sur la réalisabilité

Nous considérons le programme linéaire suivant :

$$(P)\begin{cases}\max cx\\ Ax \le b\\ x \ge 0\end{cases}$$

Les coefficients c_j des n variables x_j sont entachés d'incertitude. Un scénario s est un vecteur $c^s=(c_1^s, \dots, c_j^s, \dots, c_n^s)$, composé de valeurs considérées comme réalistes et plausibles. Nous supposons connu un ensemble S de scénarios (dénombrable ou non).
Dans la plupart des approches d'optimisation robustes, l'évaluation d'une solution x retenue est de la forme $f_{wor}(x) = \min_{s\in\Gamma} c^s x$, avec $\Gamma \subseteq S$. Lorsque Γ inclut tous les scénarios de S, la valeur de x n'est autre que la valeur obtenue sur le critère du pire cas. Ce critère est utilisé dans le cadre de la robustesse (cf. (Kouvelis & Yu, 1997)) dans la mesure où la valeur de x sur ce critère est une valeur garantie quel que soit le scénario. Appliquer le critère du

pire cas revient à rechercher la solution maximisant sa pire valeur. Ce critère peut répondre à la préoccupation de robustesse d'un décideur très prudent qui cherche à ne prendre aucun risque. La faiblesse de ce critère est que le choix d'une solution est fondé sur un scénario unique peu probable : le plus défavorable pour cette solution. Aussi, des modèles plus récents s'intéressent à la définition d'un ensemble Γ de scénarios permettant de nuancer le scénario le plus défavorable (par ex. (Bertsimas & Sim, 2004)).

Lorsque l'incertitude porte sur les coefficients intervenant dans les contraintes (A et/ou b), la notion de robustesse prend alors un autre sens. En effet, dans ce cas l'évaluation d'une solution x ne diffère pas selon les scénarios plausibles et, être robuste revient à garantir la réalisibilité de la solution x pour tous les scénarios de Γ (avec $\Gamma \subseteq S$) pouvant se réaliser (cf. (Soyster, 1973), (Bertsimas & Sim, 2004), (Ben-Tal, El Ghaoui, & Nemirovski, 2009)). Un scénario s est défavorable à une solution x lorsque x n'appartient pas à l'ensemble des solutions réalisables défini par : $X^s = \{x \in \mathbb{R}^n : A^s x \leq b^s, x \geq 0\}$. Aussi, pour une solution x donnée, deux cas de figure sont à considérer :

- soit x est réalisable dans tous les scénarios s et dans ce cas, $f_{wor}(x) = cx$,
- soit il existe au moins un scénario s pour lequel x n'est pas réalisable et, dans ce cas, $f_{wor}(x) = -\infty$.

Comme on cherche à maximiser $f_{wor}(x)$, la solution optimale se trouve nécessairement parmi celles qui sont réalisables sur tous les scénarios de Γ. Si l'intersection des ensembles X^s est vide, toutes les solutions ont pour évaluation $-\infty$ et le critère du pire cas ne permet plus de les discriminer. Une autre approche que celle du pire cas doit alors être appliquée.

Le critère du regret maximum, également très utilisé en analyse de robustesse, cf. (Kouvelis & Yu, 1997), est malheureusement équivalent au critère du pire cas dans le cas d'incertitude sur la réalisibilité. Rappelons que l'évaluation d'une solution x sur le critère du regret maximum est : $f_{reg}(x) = \max_{s\in\Gamma}(c\bar{x}^s - cx)$ avec $\bar{x}^s$ étant la solution optimale dans X^s, l'ensemble des solutions réalisables pour le scénario s. Comme précédemment, s'il existe un scénario s pour lequel $x \notin X^s$, alors $f_{reg}(x) = +\infty$. Si x est réalisable dans tous les scénarios, alors le regret maximum admet une valeur finie définie par $\max_{s\in\Gamma}(c\bar{x}^s) - cx$ car la valeur cx ne dépend pas de s. Il s'agit donc de minimiser cette valeur sur l'intersection des ensembles X^s et nous obtenons comme solution optimale x^*_{reg} telle que : $f_{reg}(x^*_{reg}) = \min_{x\in(\cap X^s)}(\max_{s\in\Gamma}(c\bar{x}^s) - cx)$. Comme la quantité $\max_{s\in\Gamma}(c\bar{x}^s)$ est indépendante de x, il s'en suit que $f_{reg}(x^*_{reg}) = \max_{s\in\Gamma}(c\bar{x}^s) + \min_{x\in(\cap X^s)}(-cx)$. En conséquence, la solution optimale selon le critère du regret maximum correspond à la solution optimale selon le critère du pire cas.

L'incertitude sur la réalisabilité induit donc des problématiques de robustesse de nature différente de celles induites par l'incertitude sur l'évaluation des solutions. En analyse de robustesse, la fonction objectif ne peut donc pas être interprétée comme une contrainte supplémentaire.

Théorie de la dualité en optimisation robuste

Dans le cas particulier où l'incertitude porte uniquement sur les seconds membres des contraintes, il est naturel de considérer le dual de (P) afin de transférer l'incertitude sur les coefficients dans la fonction objectif des variables duales (notées λ) et, d'y appliquer le critère du pire cas. Nous obtenons alors :

$$(D_{wor}) \begin{cases} \min \max_{s\in\Gamma} \lambda b^s \\ \lambda A \geq c \\ \lambda \geq 0 \end{cases}$$

Néanmoins, le dual de (D_{wor}) ne permet pas de retrouver la valeur optimale de (P) selon le critère du pire cas. En effet, lorsque Γ contient un ensemble dénombrable de scénarios, (D_{wor}) peut s'écrire comme suit :

$$(D_{wor}) \begin{cases} \min z \\ z \geq \lambda b^s, \forall s \in \Gamma \\ \lambda A \geq c \\ \lambda \geq 0 \end{cases}$$

Son dual est alors :

$$(H) \begin{cases} \max cx \\ \sum_{s\in\Gamma} u_s = 1 \\ Ax = \sum_{s\in\Gamma} b^s u_s \end{cases}$$

Ce programme linéaire permet de déterminer la solution optimale réalisable sur une combinaison convexe particulière de l'ensemble des scénarios : ceci ne garantit en aucun cas d'être réalisable sur tous les scénarios. Au mieux, la solution optimale de (H) correspondra-t-elle à une solution réalisable sur un des scénarios de Γ. Il apparaît donc que (H) ne fournit pas une solution qui correspondrait à celle du pire cas pour le problème (P) dans lequel l'incertitude porte sur les seconds membres des contraintes.

Il est montré, dans (Gabrel & Murat, 2010), qu'optimiser selon le critère du pire cas un programme linéaire dans lequel les incertitudes portent sur les seconds membres ne revient pas à optimiser selon le même critère son programme dual dans lequel l'incertitude porte sur les coefficients de la fonction objectif. Plus exactement, nous montrons qu'il s'agit de dualiser le critère : du pire cas vers le meilleur cas. Il faut donc appliquer le critère "dual", à savoir celui dit du meilleur cas, sur le problème dual dans lequel l'incertitude porte sur les coefficients de la fonction objectif.

En conclusion, si nous souhaitons transférer la prise en compte de l'incertitude des seconds membres vers la fonction objectif (ou inversement), nous nous devons d'appliquer le critère "dual" sur le programme linéaire dual.

Le cas spécifique de l’incertitude sur les seconds membres

Dans un grand nombre d’applications, l’incertitude porte uniquement sur le vecteur des seconds membres (typiquement lorsque ce vecteur représente l’évolution de la demande d’un produit sur différentes périodes). Il est alors possible de tirer profit des relations de dualité exposées précédemment.
En outre, comme l’incertitude pèse alors sur une colonne de la matrice des contraintes, et non plus sur une ligne, certaines approches, celle de Bertsimas et Sim par exemple, ne sont plus pertinentes. En effet, dans l’approche proposée par Bertsimas et Sim, à chaque contrainte est associé un budget d’incertitude qui, lorsque seule la valeur du second membre est incertaine, va varier entre 0 et 1 pour chaque contrainte, ce qui revient à choisir une valeur pour le second membre.

Des égalités dans les contraintes

En optimisation robuste, l’approche classique qui consiste à transformer une contrainte d’égalité en deux contraintes d’inégalité de sens opposé n’a pas de sens. D’une part, on aboutit à un programme linéaire ne vérifiant plus l’hypothèse d’indépendance entre les coefficients incertains puisque les mêmes coefficients incertains se retrouvent dans deux contraintes différentes. D’autre part, dans l’une des deux contraintes, si la pire valeur pour un coefficient incertain est la plus petite, alors il s’agira de la plus grande valeur dans la contrainte opposée. Avec des égalités dans les contraintes, il n’existe plus de solution qui soit réalisable sur tous les scénarios de Γ.
Deux cas de figure sont alors envisagés :

- soit l’incertitude est levée avant la prise de décision et les contraintes peuvent être satisfaites à l’égalité,
- soit il faut choisir x en présence d’incertitude ce qui nécessite d’accepter et d’envisager la violation des contraintes d’égalité.

Dans le premier cas, il ne s’agit plus de déterminer une solution robuste. Néanmoins, en phase de planification ou d’optimisation multi-étape, cf (Gabrel, Murat, & Remli, 2010), on s’attachera à calculer des bornes sur les valeurs optimales du problème correspondant aux meilleur et pire optimum possibles.
Dans le second cas, d’autres modèles de robustesse doivent alors être appliqués nécessitant de bien appréhender le contexte décisionnel. A titre d’illustration, considérons un contexte où le fait de choisir une solution qui s’avèrera finalement non réalisable, engendre un surcoût émanant des corrections à appliquer à cette solution (pour la rendre admissible). Une solution robuste est alors une solution minimisant le maximum des surcoûts. Il s’agit en fait d’une solution dont la distance à la réalisabilité n’est jamais trop importante quel que soit le scénario qui se réalisera.
Analyse de robustesse liée au contexte décisionnel

L’approche choisie dans le cadre de l’optimisation robuste est intimement liée au décideur et au contexte décisionnel. La version robuste d’un problème varie donc en fonction :

- des ensembles d’incertitude retenus sur chacun des paramètres comme sur l’ensemble Γ des scénarios,
- de la façon dont les valeurs des paramètres seront révélées (en une seule fois ou en plusieurs étapes successives) et du statut des variables (dans le cadre de l’optimisation robuste multi-étape, cf (Ben-Tal, El Ghaoui, & Nemirovski, 2009)),
- et du critère choisi pour évaluer la robustesse (à coté des critères classiques du pire cas et du regret, il en existe de plus récents comme, par exemple, celui de la bw-robustesse introduit dans (Roy, 2010)).

Les études comparatives que l’on peut alors mener doivent nécessairement porter sur des versions en adéquation avec le contexte décisionnel. A notre sens il n’est pas pertinent, comme on peut le voir dans certaines études, de comparer une approche du type pire cas et une approche bi-étape : il est évident que la seconde fournira de meilleures solutions (au regard de la fonction objectif initiale) puisque le modèle contient plus d’informations (une partie de l’incertitude est levée au cours du processus de décision).

Les problématiques de robustesse en programmation linéaire constituent donc un champ d’investigations très dynamique, d’autant qu’il nous amène à revisiter un certain nombre de résultats bien établis en univers déterministe.

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Consultancy Companies

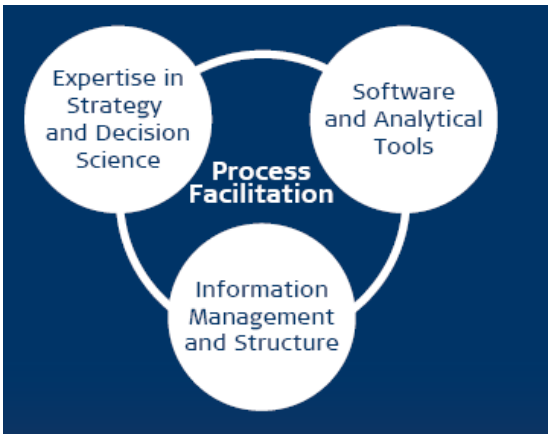
Cogentus is a Management Consulting company specialized on data analytics. Its main objective is to help organizations solve tough decisions i.e. involving multiple stakeholders, uncertainty or high level of complexity. Cogentus Data Analytics Tools are designed to be powerfully persuasive and work on a practical level, helping organizations to gather, manage, aggregate, visualize and analyze data in a way that creates real added value. Cogentus operates at all level of the organizations including corporate, business management, program management and projects.
Global organisations across a range of industry sectors use Cogentus solutions to maximize project performance, optimize resource allocation, evaluate possible partnership ventures, assess communication strategies, monitor activities effectiveness, facilitate organizational change, unlock creativity and stimulate innovation, and improve their decision making processes in general.

WHAT'S DIFFERENT

Stakeholder Perspectives – Cogentus data analytics is unique in that it can take into account many stakeholder viewpoints in a same model. It is clear that different stakeholders value things differently and trying to create a single data source that suits all doesn't always work. In fact, it papers over a multitude of cracks. It is far better to accept those differences and see what effect it has and then **manage those differences.**
Strategic Alignment – Cogentus data analytics are carried out such that it aligns with the organisation's mission and vision. This means that managers can always be sure of a good strategic fit whatever.
Value For Money – Cogentus data analytics are all about demonstrating value for money arguments even where value is hard to measure. In addition data collection, storage and retrieval process are systematised to always guarantee efficiency gains.

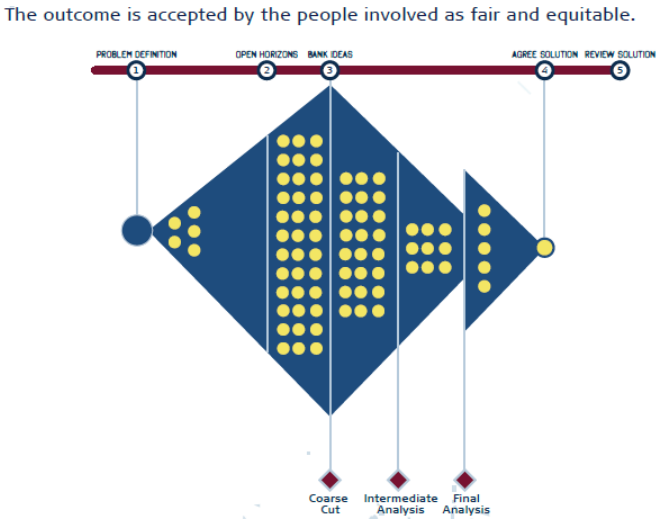
COGENTUS FRAMEWORK

Cogentus offers a mix of academic expertise in decision science and Multi Criteria Decision Analysis (MCDA) techniques, robust reusable processes and its own analytical tools. These combine together, using facilitated process where necessary, to provide an extremely robust data analytics framework.



Cogentus approach is based on:

- Workshops - getting people together which allows different disciplines within the organization and external stakeholders create a common language to increase understanding.
- A systematic process that keeps people on track and focused on action.
- Software enabling robust analysis of complex issues with high impact output that clearly conveys the impact of decisions.



COGENTUS SOFTWARE

Cogentus decision support tool set includes its own software packages. Continuously enriched from practical experiences their flexible tools are perfectly adapted to clients’ needs. Cogentus decision support tools offer a powerful analytical help to structure difficult problems, build common understanding, unlock creativity and feel confident with difficult decisions. Their user-friendly software packages offer infinite scenario simulation capabilities to help managers evaluating available options and identifying the best solutions for their organisations.

Cogentus decision support software includes Promax Survey, Promax Std and Promax Pro which are leading edge data gathering and analytical tools. They enables companies of all sizes to improve their decision making results in a cost effective manner, providing less risk and a quick return on investment for customers .

Promax Survey

Good decisions need to be supported with data, but there are more and less expensive ways to collect it. As part of its offer, Cogentus helps clients structuring their data collection and their information management process in the most efficient way, using a state-of-the-art online survey tool: Promax Survey. It is a web-based survey tool designed to capture and gather key information about existing technologies, project impact, organisation progress or a target population views, for example. In general it can be used at the data gathering stage for any decision, prior to subsequent analysis. Moreover its extended functionalities allow using this tool even to collect and aggregate major market research data online. As opposed to the old fashioned survey designs with the hard copy questionnaires, Promax Survey is a modern, cost effective and user friendly online software that will make the researcher's life a lot easier.

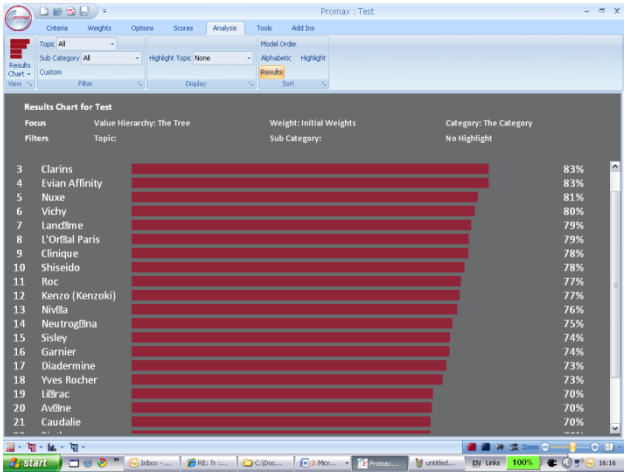
As part of this offering Cogentus also helps clients tailoring questionnaires according to every particular information need and subsequently hosting the resulting survey data on Cogentus server if necessary. Access to hosted databases is simplified using Promax Survey’s filtering system which allows automatic tailored reports according to specific enquiries at any point in time. Finally, stored data can be easily exported to commonly used analysis software (e.g. excel, spss, etc) as well as to Promax Std and Promax Pro software which links Cogentus’ data gathering and information management service to its analysis offering.

Promax Std

This multi criteria analysis software updates Cogentus previous version Promax Ranking software with a new and improved look as well as extra functionality. Additional mind mapping functionalities considerably enhance problem structuring possibilities during the initial phases of the modelling process. The flexibility of the software also makes it an ideal tool when running creativity workshops with clients to stimulate brainstorming options for example. Promax Std can be used for decisions where there are multiple options which need to be ranked in order of preferences. It is powerful enough to be used for multi-million dollar decisions but simple enough for more straight forward ones as well. Promax Std is used by Cogentus clients to solve difficult problems in all sorts of domains, such as:

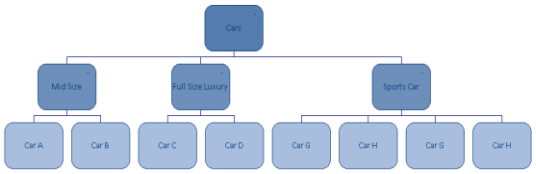
- Technology Selection
- Bids & Proposals
- Vendor Evaluation
- Partnering Evaluation
- Investment Appraisal
- Market research data visualization
- Strategy formulation

Improved Interface: Far easier to use, since the interface is now much more like Office 2007, with Ribbon toolbar

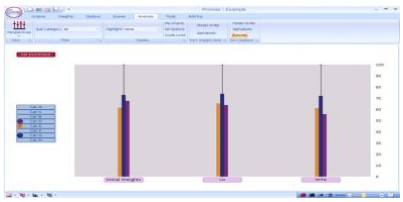


***Multiple Trees*:** Allows you to model different stakeholder ways of representing the same problem (different ways of measuring value or even different criteria)

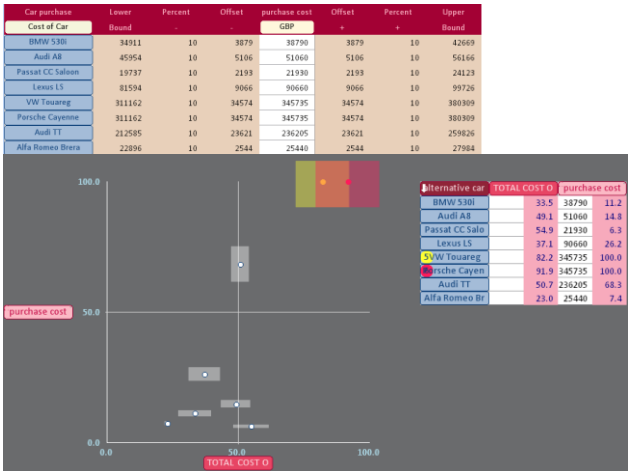
***Multiple groups and Categories*:** Organise information and visualise results from any category of your choice



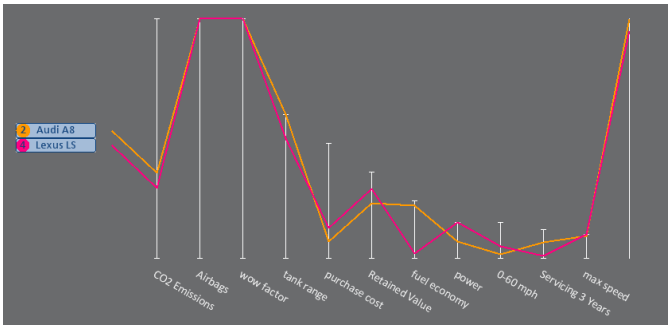
***Weight Sets*:** Use multiple weight sets to reflect different relative values of numerous stakeholders and look at the decisions from alternative perspectives



***Uncertainty*:** A unique three point estimation function, allows the user to assess whether options are, in fact, sufficiently different from each other



***Improved Outputs*:** Exciting new ways of displaying the results, in order to ensure absolute clarity.

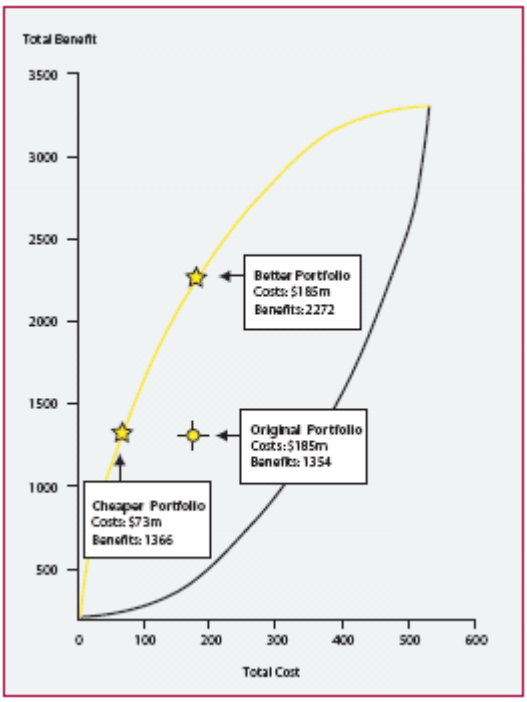


Promax Pro

This Optimisation software uses a portfolio approach to choose the best combination of projects for a given budget. It is a sophisticated tool that will cope with “must do” projects, dependencies, exclusions, among other interactions to reflect more realistic situations. Highly visible outputs and many enhanced features make this a product unrivalled in this specialized field. Some applications are:

- Program management budgeting
- Benefits management
- Resource allocation and prioritisation
- Value management

- Asset management
- Negotiation
- Joint Venture creation



Benefits

- *Flexible*: Highly adaptive, inputs and outputs are compatible with visual, textual and numerical thinking, integrates multiple model versions and appraises and evaluates options in any problem area
- *Conflicting Objectives*: It can capture conflicting objectives, and aid to achieve consensus, since it addresses the viewpoints of all stakeholders
- *Enlightening Outputs*: Results can be visualized from different angles (results charts and tables, sensitivity analysis, strengths and weaknesses, matrices, perspectives)
- *Responsiveness:* Can be instantly updated and re-run as new information is received
- *Consistency:* Reduces dependency on key individuals, avoid hunches and ego, and encode embedded knowledge.
- *User Friendly*: The clear screens make the modelling process simple, allowing the user to concentrate on the problem and not the software

To purchase log onto Cogentus website
www.cogentus.co.uk/products

Software

jRank–Ranking using Dominance-based Rough Set Approach

http://www.cs.put.poznan.pl/mszelag/Software/jRank/jRank.html

Marcin Szeląg, Roman Słowiński, Jerzy Błaszczyński
marcin.szelag@cs.put.poznan.pl

General description

jRank is a decision support tool for solving multi-criteria choice and ranking problems. It is a highly configurable command line Java application, based on java Rough Set (jRS) library developed in the Laboratory of Intelligent Decision Support Systems (IDSS) at Poznań University of Technology. This library implements methods of data analysis provided by the Dominance-based Rough Set Approach (DRSA) [12,13,15] and Variable Consistency Dominance-based Rough Set Approaches (VC-DRSA) [1, 2, 3, 4]. DRSA is designed for problems with background knowledge about ordinal evaluations of objects from a universe, and about monotonic relationships between these evaluations, e.g.,"the larger the mass and the smaller the distance, the larger the gravity" or "the greater the debt of a firm, the greater its risk of failure". DRSA also accepts non-ordinal evaluations.

For considered *learning set* of objects A and *test set* of objects T (which can be the same as A), both loaded from text files in ISF format [7], the following steps are performed:

1) creation of a *pairwise comparison table* (PCT), on the basis of *preference information* given by the *decision maker* (DM) as *reference ranking* (weak order) on $A^R \subseteq A$ or *pairwise comparisons* of some objects from $A^R \subseteq A$,
2) calculation of *lower* and *upper approximations* of outranking relation S and *non-outranking* relation S^c, for PCT created in step 1; approximations are calculated according to DRSA or VC-DRSA,
3) induction of certain (or possible) *decision rules* from lower (or upper) approximations defined in step2; in order to induce *minimal set of rules*, VC-DomLEM sequential covering algorithm [5, 6] is used; thanks to the adaptation of the idea described in [10], it is also possible to use an *exhaustive set of rules*, without explicit induction of rules (i.e., to use a virtual exhaustive set of rules),
4) application of decision rules to all pairs of objects from $T \times T$ which yields a *preference structure* (graph) in set T,
5) *exploitation* of the preference graph by one of six available *ranking procedures* [9,11,14,16] in order to

obtain a final ranking (weak order) in T; this ranking is a solution to the ranking problem; in case of a choice problem, the solution is the set of objects which share the first place in the final ranking.

jRank can be downloaded from the IDSS website. A user's manual describing in detail application of DRSA to multi-criteria choice and ranking problems, describing application of jRank, and presenting an illustrative example, is available on-line at jRank homepage.

Illustrative Example

Without going into technical details on how to run jRank, which can be found in the user's manual [7], let us analyze the results obtained for Thierry's choice problem [8], which is a car selection problem, where preference information is given by the DM as a reference ranking on 5 out of 14 cars: $11 \succ 3 \succ 13 \succ 9 \succ 14$.

Experiment configuration file experiment.properties [7] used to configure jRank has the following content:

```
learningDataFile = ThierrysChoice.isf
referenceRanking = 11, 3, 13, 9, 14
objectConsistencyMeasure = rough-membership
objectConsistencyMeasureThreshold = 1.0
```

As a result of jRank run, we obtained the following new text files:
`ThierrysChoice_partialPCT.isf` – contains PCT created for a given reference ranking,
`ThierrysChoice_partialPCT.apx` – contains approximations of relations S and S^c in PCT,
`ThierrysChoice_partialPCT.rules` – contains decision rules generated by VC-DomLEM algorithm,
`ThierrysChoice.graph` – contains preference graph in a format accepted by `Gvedit` and `dotty` from `Graphviz`,
`ThierrysChoice.ranking` – contains final ranking (weak order) of considered cars.

In order to create PCT, jRank assumes that car x outranks car y (i.e., $x\ S\ y$) if x is ranked not worse than y. Otherwise, it assumes that x does not outrank y (i.e., $x\ S^c$ y). Moreover, the pairs of cars from PCT are described by differences of evaluations on considered five criteria: price, accel, pick_up, brakes, and road_h, denoted as $q_1,\ldots, q_5$. Criteria q_1, q_2, q_3 are to be minimized, and q_4, q_5 to be maximized. Table 1 shows just two exemplary rows of created PCT.

Table 1: Part of PCT for Thierry's choice problem

(x,y)	Δ_{q_1}	Δ_{q_2}	Δ_{q_3}	Δ_{q_4}	Δ_{q_5}	Relation
(11,3)	564	-0.7	-0.1	-0.33	0.25	S
(13,11)	-318	1.9	2.1	-0.6	-1.5	S^c

In the generated *.apx file we can see that there are no inconsistent pairwise comparisons (which happens if a pair of objects belonging to relation S^c *dominates* a pair of objects belonging to relation S).

VC-DomLEM algorithm induced the following five certain rules:
1 if price(x) – price(y) ≤ -1534 then $x\ S\ y$
2 if price(x) – price(y) ≤ 0 and road_h(x) – road_h(y) ≥ 0 then $x\ S\ y$,
3 if price(x) – price(y) ≤ 564 and road_h(x) – road_h(y) ≥ 0.25 then $x\ S\ y$,
4 if price(x) – price(y) ≥ 1534 then $x\ S^c\ y$,
5 if price(x) – price(y) ≥ 564 and road_h(x) – road_h(y) ≤ 0.25 then $x\ S^c\ y$.

Preference graph resulting from application of the five induced rules to all pairs of cars is presented in Fig 1. Green arcs denote outranking relation S; red arcs denote non-outranking relation S^c. Note that this graph exhibits an internal information which need not to be interpreted by the DM.

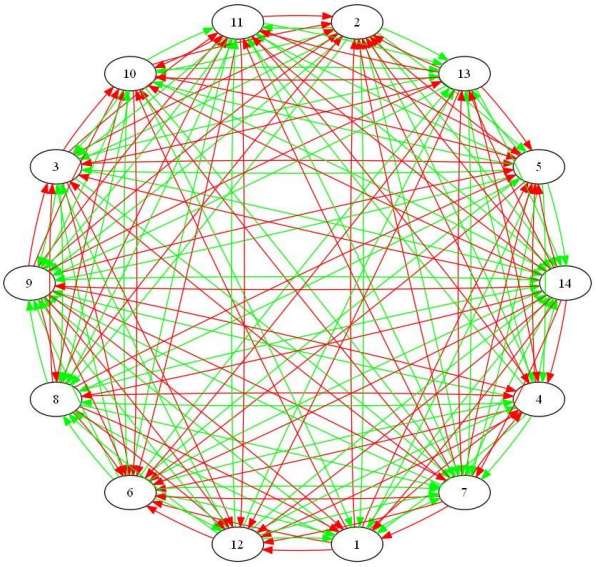


Figure 1: Preference graph for the Thierry's choice problem

Final ranking of considered objects (weak order) is obtained by applying to the preference graph one of six *ranking procedures*. In our example, we applied a default procedure, i.e., the Net Flow Score (NFS) (for the definition see, e.g., [15]). The resulting ranking is presented in Table 2.

The ranking consists of thirteen ranks, ordered according to the net flow score. There is one tie between car no. 5 and 12.

One can easily observe that the final ranking includes the reference ranking given by the DM on five cars.

Table 2: Final ranking of cars for Thierry's choice problem

rank	cars	net flow score
1:	6	24.0
2:	2	22.0
3:	5, 12	16.0
4:	10	10.0
5:	4	6.0
6:	11	0.0
7:	3	-2.0
8:	1	-4.0
9:	13	-10.0
10:	8	-13.0
11:	7	-17.0
12:	9	-22.0
13:	14	-26.0

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jMAF : Dominance-based Rough Set Data Analysis Framework

Jerzy Błaszczyński, Roman Słowiński
Poznań University of Technology, Poland

In this short paper, we present a dominance-based rough set data analysis framework called jMAF. This framework includes multiple criteria and multiple attributes sorting method that uses monotonic decision rules as a preference model and other decision aiding tools provided by the Dominance-based Rough Set Approach (DRSA) [4-7, 9-11] and Variable Consistency Dominance-based Rough Set Approach (VC-DRSA) [2].

Method

The multiple criteria and multiple attributes sorting method implemented in jMAF is composed of three elements that represent the Dominance-based Rough Set Approach (DRSA) to the sorting problem. The first element is calculation of approximations of unions of decision classes from a decision table [4-7, 9-11]. The decision table is a representation of preferential information provided by the decision maker (DM). It consists of objects described by regular attributes and criteria [4-7, 9-11]. Each object in the decision table is assigned to one preference ordered decision class Cl_t. The approximations of unions of decision classes $Cl_t^{\geq}$ and $Cl_t^{\leq}$ (i.e., sets of objects belonging to at least class Cl_t, and sets of objects belonging to at most class Cl_t, respectively) [4-7, 9-11] allow to identify those objects that are consistent with respect to the dominance principle (i.e., objects belonging to a lower approximation), and those objects that are inconsistent (i.e., objects belonging to an upper approximation) [4-7, 9-11].
The second element is induction of decision rules on the basis of the approximations [3, 7]. A decision rule is a logical statement of the form "*if ...*, *then ...*" that serves as a generalized description of objects. For a given union of classes, $Cl_t^{\geq}$ or $Cl_t^{\leq}$, the decision rules induced under the hypothesis that objects belonging to the lower approximation of the union are positive examples, and all the others are negative, suggest a *certain* assignment to "class Cl_t or better", or to "class Cl_t or worse", respectively. On the other hand, the decision rules induced under the hypothesis that objects belonging to upper approximation of the union are positive examples, and all the others are negative, suggest a *possible* assignment to "class Cl_t or better", or to "class Cl_t or worse", respectively. An extension of DRSA allows also considering rules with a required consistency level [2, 3]. Identification of supporting objects and bases of rules is important for interpretation of the rules in multiple criteria decision analysis. In jMAF, a set of minimal decision rules that cover all objects belonging to lower approximations of decision classes with required consistency level is induced by VC-DomLEM algorithm [3].
The third element of the rough set approach to sorting is classification (i.e., assignment) of (new) objects by the induced decision rules. The standard classification procedure for DRSA is described in [6]. In this procedure, an object covered by a set of rules is assigned to a class (or a set of contiguous classes) resulting from intersection of unions of decision classes suggested by the rules. A new classification procedure is presented in [1]. It is based on a notion of score coefficient associated with a set of rules matching the object and suggesting classes to which this object may be assigned. The score coefficient reflects relevance between the matching rules and the class to which the object may be assigned by the rules. A vector of values of score coefficients calculated for an object with respect to each class can be interpreted as a distribution of relevance between rules that match the classified object and the classes. Both these classification procedures are implemented in jMAF.
An additional but important element of rough set analysis of data that is provided by the jMAF framework is reduction of attributes [8].

jMAF software

The jMAF software is written using Eclipse Rich Client Platform. It is based on java Rough Set (jRS) library [12]. jRS library implement methods of analysis provided by the Dominance-based Rough Set Approach and Variable Consistency Dominance-based Rough Set Approach. The library can be used as a component of other programs or as a separate component to run computations in batch mode. Latest version of the jMAF software (and also jRS library) can be downloaded from [12].
The functionality of the jMAF software is summarized in Figure 1.

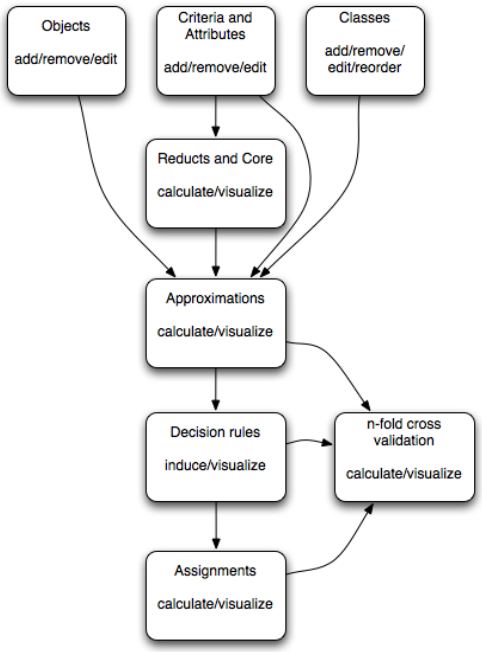
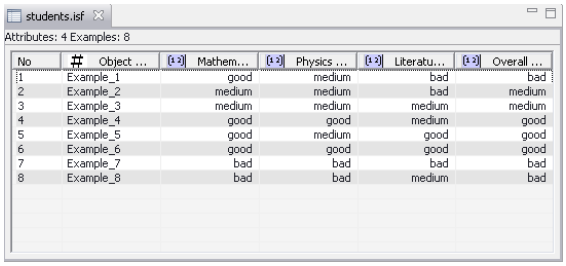


Figure 1: Functionality of jMAF software

Illustrative example

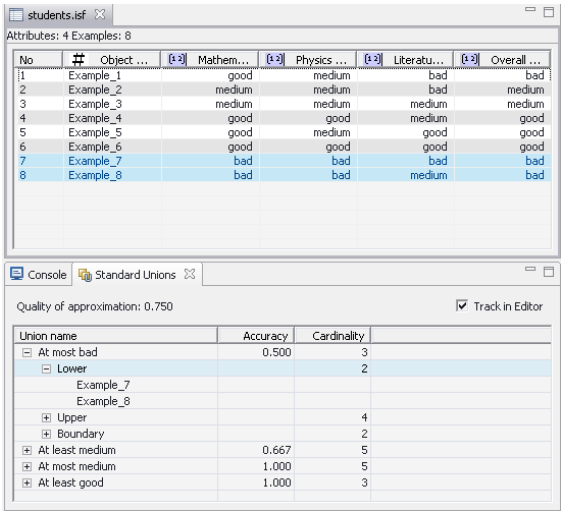
Let us consider the following sorting problem. A jury must give an overall evaluation to students of a college on the basis of their achievements in Mathematics, Physics and Literature. These three subjects are clearly criteria (condition attributes) and the comprehensive evaluation is a decision attribute. For simplicity, the value sets of the attributes and of the decision attribute are the same, and they are composed of three values: bad, medium and good. The preference order of these values is obvious. In order to build a preference model of the jury, DRSA is used to analyze a set of exemplary evaluations of students provided by the jury. These examples of ordinal classification constitute an input preference information presented in Figure 2.

Figure 2: Preference information in decision table



No	Object ...	Mathem...	Physics ...	Literatu...	Overall ...
1	Example_1	good	medium	bad	bad
2	Example_2	medium	medium	bad	medium
3	Example_3	medium	medium	medium	medium
4	Example_4	good	good	medium	good
5	Example_5	good	medium	good	good
6	Example_6	good	good	good	good
7	Example_7	bad	bad	bad	bad
8	Example_8	bad	bad	medium	bad

The next step in rough set analysis is calculation of approximations (see Figure 3).



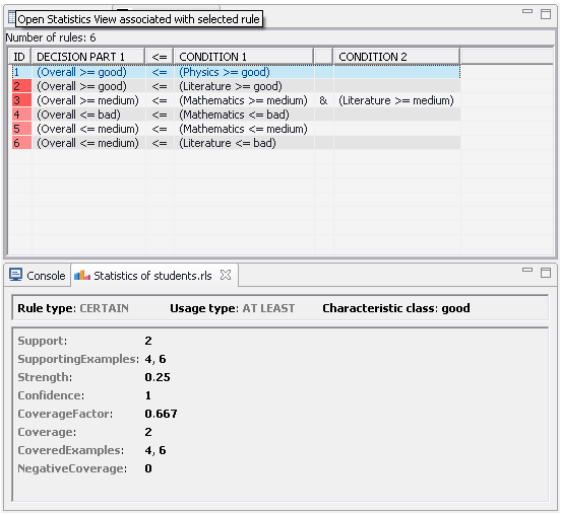
No	Object ...	Mathem...	Physics ...	Literatu...	Overall ...
1	Example_1	good	medium	bad	bad
2	Example_2	medium	medium	bad	medium
3	Example_3	medium	medium	medium	medium
4	Example_4	good	good	medium	good
5	Example_5	good	medium	good	good
6	Example_6	good	good	good	good
7	Example_7	bad	bad	bad	bad
8	Example_8	bad	bad	medium	bad

Union name	Accuracy	Cardinality
At most bad	0.500	3
Lower		2
Example_7		
Example_8		
Upper		4
Boundary		2
At least medium	0.667	5
At most medium	1.000	5
At least good	1.000	3

Figure 3: Approximations

Given the above rough approximations, one can induce a set of monotonic decision rules representing the preferences of the jury. To this end, we use one of the available methods – minimal covering algorithm (VC-DomLEM).The idea is that evaluation profiles of students belonging to the lower approximations can serve as a base for some certain rules (see Figure 4). The obtained set of certain rules may be analyzed with concern to meaningfulness of the patterns discovered in the decision table. Statistics of induced rules (see Figure 4) give insight into the relevance of the rules.

Figure 4: Set of induced decision rules and statistics of the first rule



ID	DECISION PART 1	<=	CONDITION 1		CONDITION 2
1	(Overall >= good)	<=	(Physics >= good)		
2	(Overall >= good)	<=	(Literature >= good)		
3	(Overall >= medium)	<=	(Mathematics >= medium)	&	(Literature >= medium)
4	(Overall <= bad)	<=	(Mathematics <= bad)		
5	(Overall <= medium)	<=	(Mathematics <= medium)		
6	(Overall <= medium)	<=	(Literature <= bad)		

Usually, the DM wants to know what is the value of induced rules, i.e., how good they are classify objects. Thus, we proceed with reclassification of students from the input decision table (learning sample) using rules induced from this table (Figure 5).

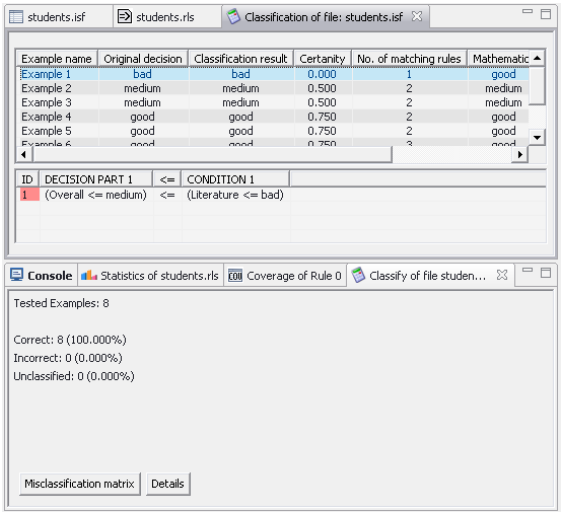


Figure 5: Results of reassignment

Finally, the rules can also be applied to classify some new objects (testing sample).

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UTADIS^{GMS}: multiple criteria sorting using a set of additive value functions

Miłosz Kadziński
Poznań University of Technology, Poland

In this short paper, we present software implementation of a new multiple criteria sorting method, called UTADIS^{GMS} [7], on the Decision Desktop platform.

UTADIS^{GMS} method

The UTADIS^{GMS} method presented in [7] can be seen as a generalization of UTADIS [3], and adaptation of the UTA^{GMS} method [6] to multiple criteria sorting problems. It is based on the principle of robust ordinal regression [8]. The preference information supplied by the Decision Maker (DM) is composed of possibly imprecise exemplary assignments to classes for a subset of reference alternatives, which are relatively well-known to the DM. These assignment examples are subsequently used to infer the set of all general compatible additive value functions composed of monotonic non-linear marginal value functions. Due to consideration of all criteria values as coordinates of characteristic points, we have a guarantee that increasing the number of characterestic points would not bring some “new” compatible value functions, and that none of the classes would be ignored because of considering only a limited set of piecewise linear value functions. The general scheme of the method is presented in Figure 1.

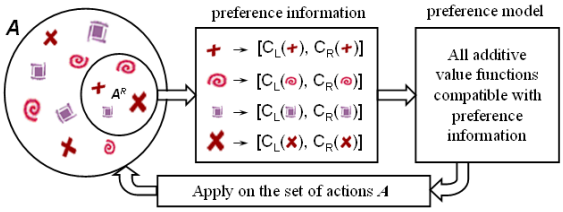

Figure 1: General scheme of UTADIS^{GMS} method

For each alternative, UTADIS^{GMS} computes two kinds of assignments to classes: necessary and possible. The necessary assignment specifies the range of classes to which the alternative can be assigned considering all compatible value functions simultaneaously. Thus, it can be considered as robust with respect to preferences of the DM. The possible assignment specifies, in turn, the range of classes to which tha alternative can be assigned considering any compatible value functions individually. The computation of the necessary and possible ranges of classes for each alternative requires verification of the truth of possible and necessary weak preference relations that compare the specific alternative with all reference alternatives. This is done through the resolution of linear programs.

UTADIS^{GMS} software

The UTADIS^{GMS} software is written as a plugin to the second version of Decision Desktop (d2) platform (1.1) [1]. The plugin is an OSGI bundle, i.e dynamically loadable collection of classes, resources, and configuration. Data access within the platform is achieved through Hibernate. To analyze potential inconsistency and verify the truth of necessary and possible preference relations we use GLPK linear solver, and to visualize relations and assignments of alternatives in form of tables we take advantage of standard Java classes. Latest version of the platform can be downoaded from the collaborative software development management system Sourceforge [2]. The functionality of UTADIS^{GMS} software is summarized in Figure 2. Its future version will be augmented by the UTADIS^{GMS}-GROUP method for group decisions [5], and by selection of a representative value function for robust multiple criteria sorting [4].

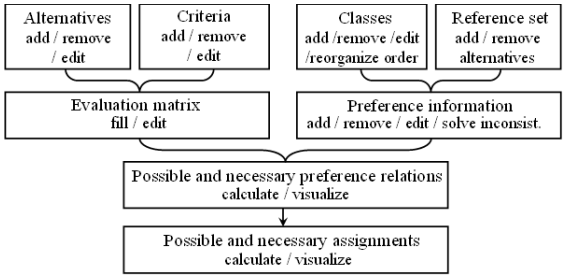

Figure 2: Functionality of UTADIS^{GMS} software

Illustrative example

Let us consider a didactic example, which shows how the presented method and software can be applied in practical decision support. The problem consists in sorting seven sales managers evaluated on three criteria of the gain type into four preference ordered classes associated with incentive packages. The bar chart that is used within d2 to represent evaluation matrix for this particular problem is given in Figure 3.

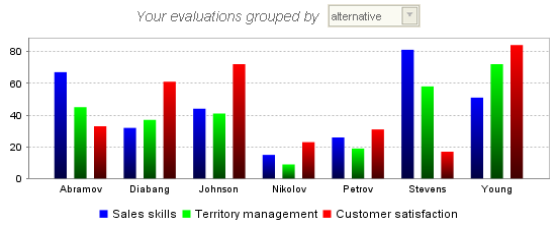

Figure 3: Bar chart representing evaluation matrix

Apart from defining the sets of alternatives and criteria, and filling the evaluation matrix, the coordinator of the project is required to specify preference ordered classes with the proviso the lower the order number of the class, the better it is (see Figure 4).

Classes

Order no.	Name	Short name	Description
1	HIGH		the best class
2	UPPER-MIDDLE		
3	LOWER-MIDDLE		
4	LOW		the worst class

Figure 4: Preference ordered classes

In order to sort all alternatives into the predefined classes, the DM has to provide preference information in form of holistic judgments. Let us suppose that (s)he has chosen two reference alternatives, for which (s)he is able to provide assignment to classes. For Petrov the desired class is precise, whereas for Johnson it consists of two consecutive classes (see Figure 5).

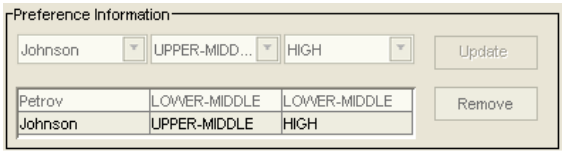

Figure 5: Assignment examples

Considering the provided preference information, one computes the necessary and possible weak preference relations for pairs of alternatives, such that one of them belongs to the reference set. Generally, the matrix of possible relation is rather dense as it is unusual that one alternative does not outrank the other alternative for any compatible value function. On the contrary, the matrix of necessary relation is usually rather sparse (see Figure 6).

Necessary Preference Relation

	Abramov	Diabang	Johnson	Nikolov	Petrov	Stevens	Young
Abramov	True	Undef	False	Undef	True	Undef	Undef
Diabang	Undef	True	False	Undef	True	Undef	Undef
Johnson	False	True	True	True	True	False	False
Nikolov	Undef	Undef	False	True	False	Undef	Undef
Petrov	False	False	False	True	True	False	False
Stevens	Undef	Undef	False	Undef	False	True	Undef
Young	Undef	Undef	True	Undef	True	Undef	True

Figure 6: Necessary weak preference relations

Within an example-based sorting procedure, the method computes for each alternative two kinds of assignments: necessary and possible. The possible results show that the inferred model is able to assign all reference alternatives to their desired classes (see Figure 7). As far as non-reference alternatives are concerned, they could be possibly assigned to rather wide ranges of classes. However, only in one case this range does not exclude any class. Note that this kind of information would be lost if traditional UTADIS was used to conduct this analysis, because then only a single value function would be considered instead of the set of compatible value functions.

Possible Assignment

	Min Category	Max Category
Abramov	LOWER-MIDDLE	HIGH
Diabang	LOWER-MIDDLE	HIGH
Johnson	UPPER-MIDDLE	HIGH
Nikolov	LOW	LOWER-MIDDLE
Petrov	LOWER-MIDDLE	LOWER-MIDDLE
Stevens	LOW	HIGH
Young	UPPER-MIDDLE	HIGH

Figure 7: Possible assignments

The UTADIS^{GMS} method is intended to be used interactively, that is, the DM can provide progressively new assignment examples or change already provided ones. The process should be continued until it is decisive enough for the DM to attribute final grades to all sales managers.

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The PPSE sotfware: Project Portfolio Selection Environment.

Ana F. Carazo [(1)]; Trinidad Gómez [(2)]; Julián Molina[(2)]; Rafael Caballero[(2)]; Flor M. Guerrero [(1)]
[(1)] Pablo de Olavide University (Seville)
[(2)] University of Malaga

1. INTRODUCTION

Project portfolio selection is an important problem that arises repeatedly over an organization's lifetime, because the need of continuously investing in projects. However, organizations are often confronted with having more projects to choose than the resources to carry them out and thus one of the main management tasks is to select from an array of projects the efficient project portfolio that better adapts to the organization´s objectives (Ghasemzadeh et al., 1999).
Traditionally, decision-makers (DMs) in organizations have carried out this selection process based on their intuition or experience or using simple mathematical models (Cooper et al., 2001; Moore and Baker, 1969). Nowadays, the size and complexity of many organizations make this process more complicated especially when many important aspects are taken into account simultaneously (the features of each candidate project, the available resources, the project interdependences, the objectives and priorities of the DM or DMs of the organization, etc). As a consequence solving this problem (project portfolio selection) has received significant attention from both researchers and practicing managers (Archer and Ghasemzadeh, 1999; Martinsuo and Lehtonen, 2007; Say et al., 2003; etc.).
In our case, to solve this problem we present a solver addressed to help the DM or DMs select and schedule simultaneously a project portfolio in an easy and efficient manner. This solver, Project Portfolio Selection Environment (PPSE), uses a flexible Mathematical Model, a Metaheuristic algorithm to solve it and an user-friendly software with a Windows interface which allow the DM or DMs to consider their preferences throw an interactive decision process.
Relating the model, it is a Nonlinear Binary Multi-Objective Mathematical Model (Carazo et al., 2010) that take into account all of the most important factor mentioned in the literature: multiple objectives, available resources, project interdependencies, preferences of the DM/s and other technical and strategic constraints (mandatory projects, project versions, etc.).
Relating the Metaheuristic Algorithm, PPSE uses a Multiobjective Metaheuristic algorithm as the search engine, called Scatter Search method for Project Portfolio Selection (SS-PPS). This algorithm allows obtaining an approximation of the efficient set of a Multi-objective optimization problem based on Scatter Search. It is an adaptation of the evolutionary method SSPMO (Molina et al., 2007) and consists in two phases. An initial phase: generation of an initial set of Efficient Points using MOAMP (Caballero et al., 2007) and a second phase: (the Scatter Search phase) that consists on the combination and improvement of solutions via Scatter Search.
This Metaheuristic, SS-PPS, originally was designed to provide an approximation to the set of efficient portfolios (the Pareto Set), without any suggestion regarding which of them better represents a final choice. This is, without including preferences of the DM. To solve this problem, the solver was modified to allow incorporating the organizations preferences throw an interactive process to determine the solution that best fits the DM or DMs preferences.
This way, an Interactive tool was included in PPSE, based on the interactive scheme called **g**-dominance proposed by Molina et al. (2009), but more modified to extend this scheme to the case of a group of DMs. The aim of the method is to reduce the size of the approximation of the efficient frontier using information supplied by the DM/s in the form of a reference point g, which corresponds to a desired level for each of the criteria by each DM.
For the case in which there are several[2] DMs the solver maximizes the consensus among the members of the group combining the preferences of all the DMs to obtain a solution acceptable to the group. To do this, we have modified the g-dominance scheme to find a reference point **g** representing a compromise for each DM involved. In this procedure, we followed the classic scheme of using the referent points based on scalarized achievement functions (Miettinen, 1999). According to this scheme, given a reference point and a distance L, we compute an efficient solution fitting the preferences of each DM, which is the efficient point (most preferred solution [PS]) that minimizes the distance L to each reference point. Then, the software calculates the super-ideal reference point **g** of the (most) preferred set of solutions obtained. Once this point **g** is calculated, the PPSE solves the problem again but using this compromise reference point, generating a new representative set of g-efficient solutions to be shown to the DMs. Now, the DMs can (if they wish) set a new set of reference points again and repeat the process until the consensus of all DMs is obtained for a single common solution.

2. DESCRIPTION AND PROPERTIES OF PPSE

The PPSE environment consists of two modules: a user interface to let the DM to easily input (Create) and/or modify problem data step-by-step (Edit); and a resolution module (Solve). The latter module determines (or approximates) the set of efficient portfolios and, if desired,

[2] See Molina et al. 2009 for the interaction with g-dominance for one decision maker.

supports DMs in exploring the solution space to find the most preferred solution.
Figure 1 summarizes the structure of PPSE and Figure 2 shows the first screen (–Main Screen of PPSE–) you can see when you open the solver.

Figure 1. Structure of PPSE

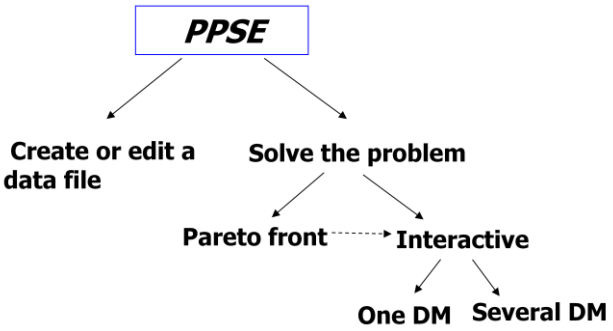
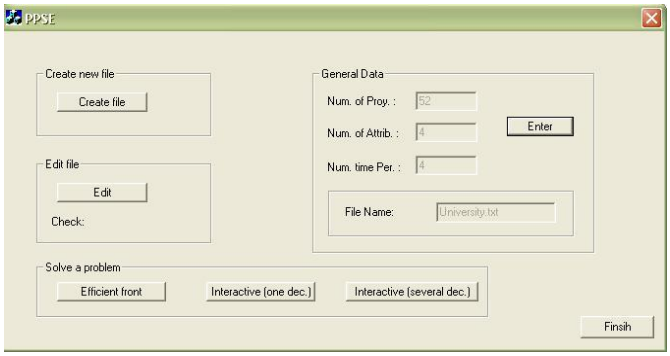


Figure 2. Main screen of PPSE

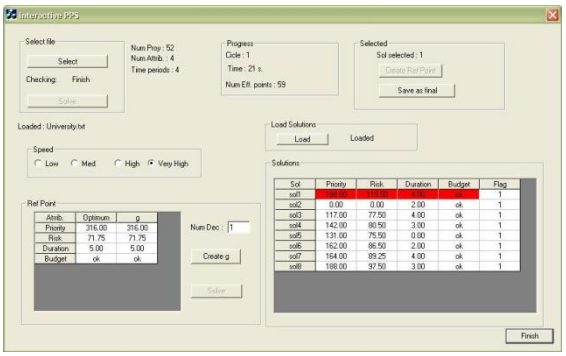


- Create or Edit an input file. PPSE is provided with several friendly tools to create and edit the input files for the software.

- Solve a selected file. PPSE offers three possible options: Efficient frontier, Interactive (one DM), and Interactive (several DM).

  Efficient frontier. In this option the software solves the selected file and determines (an approximation of) the set of efficient project portfolios to be loaded by the interactive module.
  Interactive (one dec.). The DM incorporates new information either by changing the reference point (column g) or by selecting a representative solution from those shown under the heading Solutions (See Figure 3). The process repeats until the DM is satisfied with the solution presented.

  Figure 3. Screen of interaction with one DM.



- Interactive (several dec.) The main characteristic of this option is the possibility of involving several DMs instead of a single one. Here the software requires (in a new screen) the initial reference points g^i and the distance measure (L1, L2, Linf) and based on the previous information, computes the most preferred solution for each DM and the super-ideal point **g** that contains the best value, for each attribute, of the solutions generated. This super-ideal point will be used as a common reference point to carry out the interactive procedure, similar to the case of a single DM.

Conclusions:

The PPSE software is a tool to address, in an easy and simple way, by means of user-friendly software the entire problem of project portfolio selection and scheduling, that is, the creation and edition of the data files, the resolution of the problem and support for the DM(s) in exploring the solution space in order to obtain the most preferred solution. Also, it has the flexibility to cover and solve a wide range of practical situations, in both state and private contexts in a short period of time, so it reduces the resources and time necessary to obtain an efficient solution.

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Persons and Facts

Milosz Kadzinski (Milosz.Kadzinski@cs.put.poznan.pl) is the current Web Site Editor of our EWG.

The web page is at the URL:
http://www.cs.put.poznan.pl/ewgmcda/

About the 71th Meeting

71th MEETING OF THE EURO WORKING GROUP
MULTIPLE CRITERIA DECISION AIDING
Torino, Italy, March, 2010.

The 71st meeting of the European Working Group "Multiple Criteria Decision Aiding (MCDA)" was held in Turin, Italy, the 25-27 of March 2010, at the Regional Museum of Natural Sciences (a historical building - XVII century - in the centre of Turin). Maria Franca Norese was the organiser, with the help of Ersilia Liguigli and Chiara Novello. The organisation was supported by the Regione Piemonte and the Politecnico di Torino. EURO supported the participation of some PhD students and young researchers.

Scientific Programme

The main theme of the meeting was "Decision aid applications in private and public organizations: today and in the future" and several studies, involving real-world applications of MCDA over a wide spectrum of fields, have been submitted, together with methodological studies that might facilitate future applications.
Overall, 35 abstracts had been submitted, out of which 14 were presented in five sessions, 11 were included for discussion and the remaining 10 were proposed in a pre-meeting (the 24th of March), where the organization of an Italian section of the EURO WG MCDA had been discussed.
The 71st Meeting was attended by 60 participants, from 14 different countries. A "poster" session was dedicated to young MCDA researchers and introduced the meeting with eight active participants (Elisabetta Capobianco, Claudia Ceppi, Lioba Markl-Hummel, Chiara Novello, Luisa Paolotti, Mario Regneri, Diana Rolando, Aida Valls Mateu).
A debate was proposed in the 4th session on "How to assign numerical values to different parameters that aim at differentiating the role that the criteria have to play in a comprehensive preference model?" Bernard Roy, Marc Pirlot, Roman Slowinski and Thierry Marchant introduced their points of view, in order to stimulate the debate that resulted interesting and characterized by a really large and active participation.
Both full papers and abstracts were printed in the proceedings. Submitted papers will undergo a two-fold blind review to be selected for publication in a special issue of the International Journal of Multicriteria Decision Making **(**IJMCDM**),** a new journal published by Inderscience.

Social Programme

Anna Ostanello organised the traditional excursion on Saturday. The social programme included a visit to the Roero hills, between Turin and the Langhe hills, where the participants had the opportunity of visiting two fine wine producers and of admiring the beautiful countryside and its traditional cuisine, while the banquet on Thursday evening gave the opportunity of knowing a fresh reading of the Piedmont cuisine.

PROGRAMME

Jeudi 25 mars Thursday, March 25

11.00 - 13.00 **Matinée des jeunes chercheurs: posters**
Young MCDA Meeting: posters
11.00 - 13.00 **Inscriptions/Registration**

13.15 - 14.00 **Déjeuner/Lunch**

14.00 - 14.30 **Session d'ouverture/Opening session**

Session 1

Président/Chairman : Jacques Pictet

14.30-15.30 **F. Macary, J. Almeida-Dias, J.R. Figueira, B. Roy**: Une application de traitement multicritère en gestion agroenvironnementale pour un Syndicat d'Aménagement et de Gestion des Eaux
15.30-16.00 **P.-H. Bombenger, J.-Ph. Waaub**: The Integrated Rural Planning System, an evaluative and participative method of decision-making support to build a sustainable urban development in the Ballons des Vosges Natural Regional Park

Papiers soumis à discussion/Papers submitted for discussion

- **W.K.M. Brauers, E. Zavadskas**: From the previously Centrally Planned Economy of China to Project Management by MULTIMOORA
- **G. Fernandez Barberis, M.C. Escribano Ròdenas**: A real life multicriteria decision making problem: Choosing the site for a University Kindergarten in Madrid

16.00-16.30 **Pause café/Coffee break**

Session 2

Président/Chairman : Jean-Philippe Waaub

16.30-17.00 **F. Taillandier, I. Abi-Zaid**: Vers une évaluation multicritère d'un parc immobilier en vue de construire un plan d'actions environnementales
17.0.17.30 **M.R. Trovato**: A decision model to support the architectural-urban regeneration actions for the old town of Mazara del Vallo
17.30-18.00 **S. Giove, P. Rosato**: The valuation of the attitude of historical building to sustainable economic reuse: a "non additive measure" approach
18.0.18.30 **A.-M. Poli, P. Oberti, J.-M. Culioli, M.-C. Santoni**: Outranking and temporal evaluation of public management effectiveness: an application to the natural reserve of Bonifacio strait

Papiers soumis à discussion/Papes submitted for discussion

- **L. Krus**: On decision support in the case of multicriteria cooperative games
- **N. Cremonesi, S. Griffa, M. F. Norese, C. Novello:** Cognitive mapping and multicriteria models to identify and structure user needs and requirements for an innovative system

- 20.30 **Dîner /Dinner**

Vendredi 26 mars Friday, March 26

Session 3

Président/Chairman: José Rui Figueira

9.0.9.30 **C. Verly, Y. De Smet**: Some considerations about rank reversal occurrences in the PROMETHEE II method
09.30-10.00 **S. Greco, M. Kadziński, R. Slowinski**: The most representative
parameter set for robust outranking approach
10.00-10.30 **S. Greco, V. Mousseau, R. Slowinski**: UTAGMS–INT: Robust Ordinal Regression of Value Functions Handling Interacting Criteria

Papiers soumis à discussion/Papers submitted for discussion

- **A. Leikab, O. Vaarmann**: On decomposition-coordination methods for multi-objective optimization
- **E. Fernandez, E. Lopez, F. Lopez**: Increasing Selective Pressure toward the best compromise in evolutionary multiobjective optimization: the NOSGA-II method

10.30-11.00 **Pause café/Coffee break**

Session 4

Débat/ Debate

Président/Chairman : Maria Franca Norese

11.00-13.30 Débat autour de la question: "**Comment attribuer une valeur aux différents paramètres qui ont pour objet de différencier le rôle que doivent jouer les critères dans un modèle de préférences globales?**"
Après un rappel par la présidente de la raison d'être et de l'objet du débat (voir annexe jointe au programme), **Bernard Roy, Thierry Marchant, Roman Slowinski et Marc Pirlot** présenteront leurs points de vue en 10 minutes chacun afin de lancer le débat.

Debate on: "**How to assign numerical values to different parameters that aim at differentiating the role that the criteria have to play in a comprehensive preference model?**"
After a reminder of raison d'être and aims of the debate (see the document that is forwarded with the programme), **Bernard Roy, Thierry Marchant, Roman Slowinski and Marc Pirlot** will introduce their points of view (10 minutes each) in order to stimulate the debate.

13.30-14.30 **Déjeuner/Lunch**

Session 5

Président/Chairman: Salvatore Greco

14.30 - 15.00 **Roy**: Vie du groupe et prochaines reunions/Working group matters and next meetings

15.00 – 16.00 **Lienert, N. Schuwirth, P. Reichert**: MCDA Elicitation Challenges in a Complex Real-World Decision to Reduce Pharmaceuticals in Wastewater from Communal Hospitals

Papiers soumis à discussion/Papers submitted for discussion

- **S. Vlah, J. R. Figueira**: An Interactive Approach for Multiple Criteria Scheduling in a Croatian Hospital
- **L. Marín, D. Isern, A. Moreno, A. Valls**: Web-based recommender using linguistic preferences

16.00-16.30 **Pause café/Coffee break**

Session 6

Président/Chairman: Marc Pirlot

16.30-17.00 **A. Ishizaka, Ph. Nemery**: A multi-step model for player grouping when sharing facilities

17.00-17.30 **S. Wegener and D. Kirschke**: Priority setting for the agri-environmental programme of Saxony-Anhalt – application of an interactive programming approach

17.30-18.00 **E. Liguigli**: Integrated use of Linear Programming and Multicriteria methods: an application to design a land monitoring system in the SMAT project

Papiers soumis à discussion/Papers submitted for discussion

- **T. Subrt, H. Brozova**: Knowledge Mapping in Group Decision-Making with the support of AHP and ANP
- **D. Loukas, S. Anastasiadou**: Evaluation of post-graduate studies: A multivariate –approach to a stochastic group decision-making problem
- **H. Yamnahakki , M Meslouhi**: Couplage de l'Analyse Multicritère d'Aide à la Décision et l'Analyse Coût-Bénéfice

18.00 Clotûre/ closing

Forthcoming Meetings

(This section is prepared by Carlos Henggeler Antunes)

Forthcoming EWG Meettings/

Prochaines réunions du Groupe

Note:

- It should be remarked again that this is a bilingual group; all the papers should be presented in both official languages of the group (i.e. French with English slides, and *vice-versa*).
- Ceci en un groupe bilingue ; tous les papiers doivent être présentés dans les deux langues officielles du groupe (i.e. en français avec les transparents en anglais et *vice-versa*).

The 74th of the European Working Group "Multiple Criteria Decision Aiding" will be held in Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud – Yverdon-les-Bains – Suisse. October, 6-8 2011. Topic: Systèmes d'information géographique, territoire et environnement. Organizer: Dominique Bollinger.

The 73th of the European Working Group "Multiple Criteria Decision Aiding" will be held in Corsega, France. April 14-16 or March 24-26, 2011. Organizer: Pascal Oberti.

Other Meetings

RailRome 2011 - 4th International Seminar on Railway Operations Modelling and Analysis; February 16-18, 2011; Rome, Italy; http://www.iaror-conferences.org/

Challenges in Statistics and Operations Research; March 8-10, 2011; Kuwait; http://conf.stat.kuniv.edu/

EMO 2011 - Sixth International Conference on Evolutionary Multi-Objective Optimization; April 5-8, 201; Ouro Preto, Brazil; http://www.mat.ufmg.br/emo2011/index.htm

INFORMS Conference on Business Analytics and Operations Research; April 10-12, 2011; Chicago, USA; http://meetings.informs.org/Practice2011

IEEE Symposium Series on Computational Intelligence - SSCI 2011; April 11-15, 2011; Paris, France; http://www.ieee-ssci.org/ (including 2011 IEEE Symposium on Computational Intelligence in Multicriteria Decision-Making; http://www.ieee-ssci.org/2011/ieee-mcdm-2011)

MCDA'73; April 14-16, 2011; Corte, Corsica, France; Contact: University of Corsica, contact: P. Oberti, D. Grandjean, A. Casabianca, A-M. Poli

CSO 2011 - The Fourth International Conference on Computational Sciences and Optimization; April 15-19, 2011; Kunming and Lijiang, Yunnan Province; China; http://www.gip.hk/cso2011/

IO2011 - Conference of the Portuguese Operational Research Society; April 18-20; Coimbra, Portugal; http://www2.inescc.pt/io2011/

EVOSTAR 2011, including 14th European Conference on Genetic Programming, 11th European Conference on Evolutionary Computation in Combinatorial Optimisation, 9th European Conference on Evolutionary Computation, Machine Learning and Data Mining in Bioinformatics, European Conference on the Applications of Evolutionary Computation; April 27-29, 2011; Torino, Italy; http://www.evostar.org

ALIO-EURO 2011 - Workshop on Applied Combinatorial Optimization; May 4-6, 2011; Porto, Portugal; http://www.dcc.fc.up.pt/ALIO-EURO-2011

ISCRAM 2011 - The 8th International Conference on Information Systems for Crisis Response and Management; May 8-11, 2011; Lisbon, Portugal; http://iscram2011.lnec.pt/

ECCO XXIV - The 24th Conference of the European Chapter on Combinatorial Optimization; May 30 - June 1, 2011; Amsterdam, Netherlands; http://www.eccoxxiv.com

5th Global Conference on Power Control and Optimization (PCO'2011). June 1-3, 2011 LE Meridien Dubai, Dubai, UAE; http://www.pcoglobal.com/pco2010DUBAI

The 21st International Conference on Multiple Criteria Decision Making; June 13-17, 2011; University of Jyvaskyla, Finland; http://www.jyu.fi/mcdm2011

INFORMS Healthcare 2011; June 20-22, 2011; Montreal, Canada; http://meetings.informs.org/healthcare2011

3rd IMA International Conference on Mathematics in Sport; June 22-24, 2011; Manchester, UK; http://www.ima.org.uk/Conferences/3rd_maths_sport/

ICMC - International Choice Modelling Conference; July 4-6, 2011; Leeds, UK; http://www.icmconference.org.uk/index.php/icmc/index

2011 IFORS Conference on World OR: Global Economy and Sustainable Environment; July 10-15, 2011; Melbourne, Australia; http://www.ifors2011.org/

ICIAM 2011 - Seventh International Congress on Industrial and Applied Mathematics 2011; July 18-22, 2011; Vancouver, Canada; http://www.iciam2011.com

Optimization 2011; July 24-27, 2011; Lisbon (Caparica), Portugal; http://www.fct.unl.pt/optimization2011

MIC 2011 - 9th Metaheuristics International Conference; July 25-28; Udine, Italy; http://mic2011.diegm.uniud.it

ICAOR'11 - 3rd International Conference on Applied Operational Research; August 24-26, 2011; Bahcesehir University, Istanbul, Turkey; http://www.tadbirstm.org.ir/

OR 2011 - International Conference on Operations Research; August 30 - September 2, 2011; ETH Zurich, Switzerland; http://www.or2011.ch/index

ESA 2011 - 19th European Symposium on Algorithms; September 5-7, 2011; Saarbruecken, Germany; http://esa-symposium.org/

AIRO 2011 - 42nd Annual Conference of the Italian Operational Research Society; September 6-9, 2011; Brescia, Italy; http://airo2011.eco.unibs.it

MCDA'74; October 6-8 or 13-15, 2011; Yverdon, Switzerland; Organizer: HEIG-VD, contact: D. Bollinger, J. Pictet

INFORMS Annual Meeting 2011; November 13-16, 2011; Charlotte, North Carolina, USA; http://meetings.informs.org/charlotte2011

EURO 2012 - EURO XXV International Conference; July 8-11, 2012; Vilnius, Lithuania; http://www.euro-2012.lt

INFORMS Annual Meeting 2012; October 14-17, 2012; Phoenix, Arizona, USA; http://meetings.informs.org

INFORMS Annual Meeting 2013; October 6-9, 2013; Minneapolis. Minnesota, USA; http://meetings.informs.org

Announcements and Call for Papers

Web site for Annpoucements and Call for Papers:
www.cs.put.poznan.pl/ewgmcda

Books

Trends in Multiple Criteria Decision Analysis (International Series in Operations Research & Management Science)

Edited By
Matthias Ehrgott (Editor), José Rui Figueira (Editor), Salvatore Greco (Editor)
Springer 2010

ISBN: 978-1-4419-5903-4

http://www.springer.com/business+%26+management/operations+research/book/978-1-4419-5903-4

Abstract

Multiple Criteria Decision Analysis (MCDA) is the study of methods and procedures by which concerns about multiple conflicting criteria can be formally incorporated into the management planning process.
A key area of research in OR/MS, MCDA is now being applied in many new areas, including GIS systems, AI, and group decision making.
This volume is in effect the third in a series of Springer books about MCDA (all in the ISOR series), and it brings all the latest advancements into focus.
Looking at developments in the applications, methodologies and foundations of MCDA, it presents research from leaders in the field on such topics as Problem Structuring Methodologies, Measurement Theory and MCDA, Recent Developments in Evolutionary Multiobjective Optimization, Habitual Domains and Dynamic MCDA in Changeable Spaces, Stochastic Multicriteria Acceptability Analysis, Robust Ordinal Regression, and many more challenging issues.

*** *** ***

Rational Decision Making

By
Franz Eisenführ, Martin Weber, Thomas Langer

Springer 2010

ISBN: 978-3-642-02850-2

http://www.springer.com/business+%26+management/operations+research/book/978-3-642-02850-2

This textbook conveys methods that can improve decision making processes in various fields such as economics, politics, and medicine as well as in personal life. Areas of focus are decision making under conflicting objectives, decision making under risk and uncertainty, decision making with incomplete information about individual preferences or probabilities, and the consideration of time preferences. Special emphasis is placed on the procedures` and concepts`applicability. Explicit sample applications show the methods` benefit for a wide area of decision making problems. Exercises from daily life make it easy for the reader to understand the key insights from decision analysis.

*** *** ***

Multicriteria Decision Aid Classification Methods (Applied Optimization)

by:
Michael Doumpos and Constantin Zopounidis
Kluwer Academic Publishers

ISBN: 1-4020-0805-8

http://www.springer.com/business+%26+management/operations+research/book/978-1-4020-0805-4

The book discusses a new approach to the classification problem following the decision support orientation of multicriteria decision aid. The book reviews the existing research on the development of classification methods, investigating the corresponding model development procedures, and providing a thorough analysis of their performance both in experimental situations and real-world problems from the field of finance.
Audience: Researchers and professionals working in management science, decision analysis, operations research, financial/banking analysis, economics, statistics, computer science, as well as graduate students in management science and operations research.

*** *** ***

Articles Harvest

(This section is prepared by Juscelino ALMEIDA DIAS, judias@ist.utl.pt)

Silvia Angilella, Alfio Giarlotta, Fabio Lamantia, (2010). A linear implementation to PACMAN, European Journal of Operational Research,Elsevier, vol. 205(2), 401-411.

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Other Works

(Communicated by the authors)

PhD dissertations

ALVAREZ GARCIA, Begoña
University of La Coruña (Spain)

Manuscript title
In Spanish. Evaluación y Selección de una cartera de proyectos interdependientes en un contexto borroso. Aplicación al caso de la minería del carbón

In English. Interdependent projets portfolio evaluation and selection in a fuzzy context. Application to the coal mining sector

Defense date
22th october 2010

Jury members

Francisco José MARTINEZ LOPEZ, Professor and Rector from the University of Huelva (Spain)
José Rui FIGUEIRA, Professor from the Ecole Nationale Supérieure des Mines de Nancy (France)
Mariano JIMENEZ LOPEZ, Professor from the University of País Vasco (Spain)
José Alberto SOARES DA FONSECA, Professor from the University of Coimbra (Portugal)
Lucía BOEDO VILABELLA, Professor from the University of La Coruña (Spain)

Abstract
In this research we study the project portfolio evaluation and selection problem from a wide point of view, taking into account interactions existing between projects and fuzzy information.
In the theoretical part concerning the portfolio evaluation we present several methods and techniques that can be used and we show with detail a fuzzy Delphi method. In the part concerning the portfolio selection problem we present several approaches and we propose four different models developed with a multiobjective interactive perspective based on the reference point approach. In these models we incorporate in a sequential form the punctual and fuzzy information related to interactions and other aspects of the selection process.
In the practical part we present the current situation of the coal mining in Spain and in Galicia. Likewise we evaluate and select the projects from the Autonomic Region of Galicia that compete for the Public Subsidies for the Projects that promote the Employment and the Alternative Development in the Coal Mining Areas.

*** *** ***

OUERDANE Wassila, University of Paris Dauphine

Manuscript Title: Multiple Criteria Decision Aiding: a Dialectical Perspective

Defense date: 01/12/2011

Advisor : Alexis Tsoukiàs, Directeur de recherche (CNRS), Université Paris-Dauphine

Reviewers (Rapporteurs) :
- Simon Parsons, Professeur, Department of Computer and Information Science Brooklyn College New York
- Patrice Perny, Professeur, Université Pierre et Marie Curie

Examinateurs:
- Leila Amgoud, Chargé de Recherche (CNRS), Université Paul Sabatier
- Sylvie Coste-Marquis, Maître de conférences, Université d'Artois
- Christophe Labreuche, Ingénieur Chercheur, Thales (invité)
- Thierry Marchant Professeur, Ghent University Belgium (Président)
- Nicolas Maudet , Maître de conférences, Université Paris-Dauphine (Co-advisor)

Abstract: We propose in this thesis to use some tools and concepts from argumentation theory in a decision aiding process, i.e. an interaction between, at least, an expert and a decision maker, where the main objective of this process is to reach a consensus between the two participants. Our ambitions through this work is twofold: (i) enhance decision support capabilities of the analyst representing explicitly and accountably the reasons for which he recommend (or not) a solution (if any); and (ii) enhance decision support capabilities of an (semi) automatic device to handle (at least partially) the dialogue with the user. We first propose to specify in an argumentative terms the steps involved in a multiple criteria evaluation process, a phase of the decision aiding process. To do that, we construct a hierarchical structure where we identify three levels of argument schemes that are embedded. The objective is to make explicit assumptions that are hidden in such a process, hence allowing meaningful and natural explanations. Secondly, we propose to show that by relying on notions of argumentation such as acceptability function and critical questions, we facilitate the revision/update occurring during such a process. The kind of system that we sketch here would allow, among others,: (i) to present a recommendation that can be explicitly justified; (ii) to revise any piece of reasoning involved in this process, and inform of the consequences of such modifications by presenting (for instance graphically) the exchanged arguments.

Keywords: Decision aiding process, Multiple criteria evaluation, Argumentation theory.

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ALMEIDA-DIAS Juscelino

Manuscript Title: Multiple Criteria Decision Aiding for Sorting Problems: Concepts, Methodologies, and Applications.

Defense date: 10/01/2011

Advisors: José R. FIGUEIRA and Bernard ROY

Jury members : Chairman of the IST Scientific Board;
Bernard ROY / Emeritus Professor at Université Paris IX Dauphine, France;
Vincent MOUSSEAU / Professor at École Centrale de Paris, France;
Patrice PERNY / Professor at Université Pierre et Marie Curie, France;
Manuel MATOS / Professor at Universidade do Porto, Portugal;
Paulo CORREIA / Professor at Universidade Técnica de Lisboa, Portugal;
José R. FIGUEIRA / Professor at Universidade Técnica de Lisboa, Portugal.

Abstract:
Our thesis deals with sorting problems following a constructive approach. The aim is to assign objects of a decision, evaluated on multiple criteria, to a set of categories. Each category is pre-defined to receive these objects, which will be or might be processed in the same way. Our research provides a taxonomy framework, in which ten different types of sorting problems are defined with a practical usefulness. Two sorting methods are proposed within this taxonomy, called ELECTRE TRI-C and ELECTRE TRI-NC. These methods deal with decision aiding contexts, where the set of categories is completely ordered. Each category is characterized by a single typical reference action and several ones, respectively. The assignment procedure is based on a descending rule and an ascending rule, which must be used conjointly. Our research also provides a segmenting description algorithm for analyzing the relationship between the assigning conditions of decision aiding sorting models (e.g. ELECTRE TRI-C) and the preferences of decision makers, including an analysis of incoherencies and incompatibilities, without making use of an optimization model. The main research results are validated by two real-world applications (assisted reproduction and agro-environmental risk), which are modeled with medical and environmental experts, respectively.

Key-words: Multiple criteria decision aiding, Constructive approach, Sorting problems, Characteristic reference actions, ELECTRE TRI-C, Segmenting description algorithm.

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Seminars

SÉMINAIRE «MODÉLISATION DES PRÉFÉRENCES
ET AIDE MULTICRITÈRE À LA DÉCISION»

Responsables : Bernard ROY,

Daniel VANDERPOOTEN

(le mardi, à 14.00)

Le 8 décembre 2010

SÉMINAIRE «MODÉLISATION DES PRÉFÉRENCES
ET AIDE MULTICRITÈRE À LA DÉCISION»

Responsables : Bernard ROY,

Daniel VANDERPOOTEN

(le mardi à 14:00)

Prochaines réunions

Le 20 janvier 2011

SÉMINAIRE «MODÉLISATION DES PRÉFÉRENCES
ET AIDE MULTICRITÈRE À LA DÉCISION»

Responsables : Bernard ROY,

Daniel VANDERPOOTEN

(le mardi à 14:00)

Prochaines réunions

25 janvier 2011	Conférence d'**Alexis Tsoukiàs** (LAMSADE) : *Qu'est-ce qu' un problème de décision ?* (salle B217).
15 février 2011	Conférence de **Marc Pirlot** (Université de Mons, Belgique) : *Apprentissage des paramètres d'une méthode de tri multicritère : une étude expérimentale et les questions qu'elle suscite*. (salle à préciser).
15 mars 2011	Conférence de **Gildas Jeantet** (LIP6, Université Paris 6) : *Algorithmes d'optimisation de critères non-EU pour la décision séquentielle dans l'incertain.* (salle à préciser).
05 avril 2011	Conférence de **Craig Boutilier** (Université de Toronto) : *Computational Social Choice: A Decision-theoretic Perspective.* (salle à préciser), résumé (voir pièce jointe).
03 mai 2011	Conférence de **Denis Bouyssou** (Lamsade) et **Thierry Marchant** (Ghent University) : *Une théorie manichéenne de l'utilité espérée subjective.* (salle à préciser), résumé (voir pièce jointe).

Announcement:

The "Useful links" section of the group's homepage

(www.cs.put.poznan.pl/ewgmcda)

is being enlarged. Contributions of URL links to societies, research groups and other links of interest are welcome.

A membership directory of the European Working Group on "Multiple Criteria Decision Aiding" is available at the same site. If you would like to be listed in this directory please send us your data (see examples already in the directory).

Contact: José Rui Figueira (figueira@ist.utl.pt)

Web site for the EURO Working Group "Multicriteria Aid for Decisions"

A World Wide Web site for the EURO Working Group on "Multicriteria Aid for Decisions" is already available at the URL:

http://www.cs.put.poznan.pl/ewgmcda/

Web site Editor: Milosz Kadzinski
(Milosz.Kadzinski@cs.put.poznan.pl)

This WWW site is aimed not just at making available the most relevant information contained in the Newsletter sections, but it also intends to become an online discussion forum, where other information and opinion articles could appear in order to create a more lively atmosphere within the group.

Groupe de Travail Européen "Aide Multicritère à la Décision" /
European Working Group "Multiple Criteria Decision Aiding"

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This newsletter is published twice a year by the "EWG on MCDA", in November/December and April/May , with financial support of the Association of European Operational Research

Contributions should be sent to:
José Rui Figueira (Jose.Figueira@mines.inpl-nancy.fr)

José Rui Figueira
INPL, Ecoles des Mines de Nancy, LORIA Laboratory
Parc de Saurupt, CS 14 234, 54 000 Nancy Cedex, France
E-mail: Jose.Figueira@mines.inpl-nancy.fr