



Essays on Theories and Applications of Decision Analysis in Imprecise Domains

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MITTUNIVERSITETET

2008

AKADEMISK AVHANDLING

För avläggande av filosofie doktorsexamen vid
fakulteten för Naturvetenskap, Teknik och Medier vid
Mittuniversitetet, Campus Sundsvall, som offentligen
kommer att försvaras i sal L111 ,
fredagen den 24:e oktober 2008, kl 13.15.

Opponent är Prof. David Ríos Insua, Universidad Rey Juan Carlos,
Madrid.

Title: Essays on Theories and Applications of Decision Analysis in Imprecise Domains

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ISBN: 978-91-86073-13-8, ISSN: 1652-893X, Doctoral thesis nr: 61

Abstract

This thesis consists of a collection of papers contributing to the field of decision analysis. The main concern is the development of a framework for computer based decision modelling and evaluation, supporting the use of imprecise assessments and input parameters for the decision model. The papers are categorised into four research categories, 1) extensions, 2) evaluation methods, 3) applications, and 4) interfaces.

The focus with respect to the first category has been on extending a computational framework for decision analysis in imprecise domains, to support analysis of decisions with multiple objectives as well as under risk in a common model. This has been achieved by developing procedures for allowing the use and coexistence of well-founded models such as criteria hierarchies and influence diagrams in the framework.

Work falling within the second category is concerned with the investigation of decision evaluation procedures when allowing for probabilities of the second-order to model epistemic uncertainty. The second-order probability distributions on sets of probabilities and utilities is utilised in order to improve the power of expression in both input statements and evaluation results.

The third category studies and describes applications of the proposed decision analysis methods, presented as case studies. These case studies investigate one specific decision problem at a time or classes of similar problems, and propose analytical models to assist in the formal analysis of these problems. Applications of the suggested methodology of this kind can partly be viewed upon as a validation of the suggested methods, and partly as a source of lessons to be learned for future development.

The final category is concerned with the interface between the decision analysis model, supposed to improve the decision maker's capabilities, and the decision maker. It is important to mention that the interfaces are not limited to graphical user interfaces of software tools, but also with the means by which to elicit values and beliefs from stakeholders. The major concern associated with this category in this thesis has been the study of elicitation of risk attitudes.

Keywords: Decision analysis, imprecise information, second-order probability, multi-criteria decision analysis, decision tools.