Decision Support: Study Requirements and Procedure

Jožef Stefan International Postgraduate School, Ljubljana
Programme: Information and Communication Technologies [ICT2 and ICT3]
Course Web Page: http://kt.ijs.si/MarkoBohanec/DS/DS.html

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Purpose and Goals

- General understanding of Decision Support:
  - decision making and decision support: areas and disciplines
  - decision process
  - components of decision making
- Decision Analysis:
  - modeling methods and techniques
  - decision making under risk and uncertainty
  - decision tables, decision trees, influence diagrams
  - multi-attribute models: MAUT, AHP, DEX
- Practical assignment:
  - acquiring practical skills for decision modeling and solving complex decision problems,
  - deeper understanding of decision-support methods
- Advanced Topics (no lectures, individual study & consultations; 10% of written exam):
  - classification of multi-attribute methods
  - additional methods: TOPSIS, PROMETHEE, UTA
  - aggregation and value functions
  - combining data mining and decision support
  - machine learning and revision of decision models

Required Reading

1. Main sources:
   a. for Slovene-speaking students:
      - Bohanec, M.: *Odločanje in modeli*. 1. ponatis, DMFA - založništvo, 2012
        Chapters: required 1-7 & 9-14, recommended 8 & 15-17.
   b. for English-speaking students:
      - Bohanec, M.: Decision Making: A Computer-Science and Information-Technology Viewpoint. *Interdisciplinary Description of Complex Systems* 7(2), 22-37, 2009
      - + other literature covering equivalent topics (see the course web page)
2. Course slides in English:
   http://kt.ijs.si/MarkoBohanec/DS/DS.html

Required Reading

Ljubljana: DMFA – založništvo, 2012
Zbirka: Učbeniki in priročniki

Supplementary Reading

For further information, see:
http://kt.ijs.si/MarkoBohanec/DS/DS.html

Practical Assignment Types

1. **Research**: *Research topic* on decision modelling methods, proposed by the professor.
2. **Applicative**: Take a sufficiently complex real-life *decision problem*, familiar to you. Follow the typical stages of decision analysis and propose a solution. At least *two decision models* should be developed and compared in terms of used methods, model components and evaluation results. *Analysis and interpretation* of results are mandatory.
3. **Project**: Any other topic, related to *decision making* and *decision support*, practical and/or theoretical, suggested by the student. Preferably, the results should contribute to some research or development project.

Research Assignment Topics

1. Generalization of DEX decision tables by various methods: decision trees, rule learning, DOMLEM, linear approximation, multi-linear approximation, ...
2. Extending DEX: Using DRSA & Decision Tables for ND→D utility functions (N = Numeric, D = Discrete)
3. Experimenting with "DEX with Cycles"
4. Apply method MCHP (Multiple Criteria Hierarchy Process) on a car evaluation example and compare it with DEX
5. Compare method TODIM with some other comparable method (MAUT, AHP, TOPSIS, K-T, ... − choose one) on a compatible decision problem from the literature
6. The same as above for method VIKOR

Applicative Practical Assignment

1. Define your own decision problem
   (possibly real, about 15-20 attributes, 5-10 alternatives)
   [should be approved by the professor]
2. Select two decision modeling methods (e.g. decision tree, influence diagram, Kepner-Tregoe, AHP, DEXi, ...)
3. Solve the problem using the methods: develop two models, evaluate and analyse alternatives, compare and assess the results.

Report on Applicative Assignment

In general, the report and presentation should address the following:

- Description of the decision problem, aims and goals of the decision
- Description of the developed models: attributes, utility functions
- Description of alternatives
- Utilisation of the models: evaluation of alternatives, sensitivity and/or what-if analysis
- Summary of the decision-making process, lessons learned
- Also make sure to provide the models in form of files

Requirements and Procedure

- Each student is required to make their Practical Assignment and write a report.
- Each individual assignment topic should be pre-arranged in agreement with the professor.
- The report must be sent by e-mail to marko.bohanec@ijs.si *no later than the last Friday, 12:00 a.m.*, before the presentation/examination event. Sending reports for earlier previews is encouraged.
- A final printed version of the report must be handed to the examiner before presentation.
- Examinations consist of two parts:
  - [*ICT3 only*] A 60-minute written exam with questions addressing topics from the required literature (from both a theoretical and practical viewpoint).
  - A 10-15 minutes oral defense of each student's seminar work (supported by slides).
- For passing the examinations, both parts have to be evaluated positively. Each part contributes 50% to the final evaluation.