

Decision Theory Course

<i>Name of the subject:</i> Decision Theory -BSc	<i>SUBJECT code:</i>	Weekly hours: 6 3 lectures+3 practices	Credit: 8 ECTS
<i>Subject leader:</i> Djordje Nikolić	<i>Academic Degree:</i> Assistant Professor	Prerequisites: Mathematics and Statistics	

Purpose: The course will provide an introduction to models of rational decision making. One of the primary purposes of the course is to provide a set of powerful decision making methods that will help the students to gain critical awareness and ability in choosing and using these methods in order to solve various decision making problems. Also, this course will enable the students to approach decisions in academic and professional context in a systematic approach, as well as they will obtain competences in explaining the results of decision making analysis in order to give applicable information for management decisions. However, the course does not aim to train decision making for specific domains, but rather offers a general perspective.

Course description: Applications of the theories to various contexts will be discussed and trained. In this course, the different aspects of decision making will be covered, from the formation of decision making process, discussing concepts such as rationality, preferences, goals, uncertainty, Probabilistic analysis, expected value, Bayesian probability, utility and how to handle multi-criteria decision-making. The focus of this course is on the state of art methods, tools and techniques that students can use to solve decision making problems under uncertainty, under risk, as well as to address different multi-criteria methods in fuzzy environment. Furthermore, students will learn some methods for group decision making.

Schedule

Weeks	Topics
1.	Introduction to Decision Theory: Historical overview; Decision Making process; Conditions for rational choice; Decision elements; Types of Decision-Making environments.
2.	Making decision under uncertainty: Payoff table; Maximax criterion (optimistic method); Wald's Maximin criterion (pessimistic method); Hurwicz's criterion; Savage's minimax regret criterion; Laplace's insufficient reason criterion.
3.	Making decision under risk: Decision tree; Maximizing expect monetary value method; Minimizing expected regrets method; a priori analysis; The value of perfect information...
4.	continued: Bayesian probabilistic theory; calculating revised probabilities; Multistage decision problem; The value of imperfect information...
5.	Utility theory: Measuring utility and constructing a utility curve; Utility in Decision-Making analysis.
6.	Test
7.	Decision Making under certainty: Multi-criteria decision making model; Multi-Attribute Utility Theory; Simple Additive Weighting Model.
8.	continued: Analytic Hierarchy Process method; Analytic Network Process method...

9.	continued: ELECTRE and PROMETHEE outranking methods
10.	continued: TOPSIS and VIKOR methods
11.	continued: Fuzzy logic theory; Decision making in fuzzy environment
12.	Group decision making: Normative theories of group decision making; Kenneth Arrow social choice theory; Amartya Sen social choice theory.
13.	continued: Voting methods: The Plurality Method; The Method of Plurality with Elimination; The Borda Count Method; The Method of Pairwise Comparisons (Condorcet Winner); The Approval Voting.
14.	Test

Final grade:

The grading structure is as follows:

Activity	Points
Final examination	50
Case study preparation and class presentations	10
Tests	30
Participation in class	10

Grading scale:

Points	Grade
0-50	5 (fail)
51-60	6 (satisfactory)
61-70	7 (good)
71-80	8 (very good)
81-90	9 (excellent)
91-100	10 (excellent- outstanding)

Compulsory literature:

1. Wisniewski, M. (2009). Quantitative methods for decision makers (fifth edition), Prentice Hall,
2. Baker, D., Bridges, D., Hunter, R., Johnson, G., Krupa, J., Murphy, J. and Sorenson, K. (2002) Guidebook to Decision- Making Methods, WSRC-IM-2002-00002, Department of Energy, USA. http://www.dss.dpem.tuc.gr/pdf/Decision%20Making%20Guidebook_2002.pdf
3. Figueira, J., Greco, S., Ehrgott M. (Eds.) (2004). Multiple Criteria Decision Analysis: State of the Art Surveys, Springer, New York.
4. Tzeng, G.H., Huang, J.J. (2011). Multiple Attribute Decision Making Methods and applications. CRC Press, Taylor & Francis Group.

Supplemental literature:

1. Hanssons, S.O. (2005). Decision Theory- A Brief Introduction. Department of Philosophy and the History of Technology, Royal Institute of Technology (KHT), Stockholm.
2. Parmigiani, G., Inoue, L.Y.T. (2009). Decision Theory, Principles and Approaches. John Wiley & Sons, Ltd, United Kingdom.
3. Brans, J.P., Vincke, Ph. (1985). "A preference ranking organization method", Management Science, 31, 647-656.
4. Behzadian, M., Kazemzadeh, R.B., Albadvi, A., Aghdasi, M., (2010). PROMETHEE: A comprehensive literature review on methodologies and applications. European Journal of Operational Research 200, 198–215.
5. Roy B. (1968). "Classement et choix en présence de points de vue multiple (la méthode electre) ” , RAIRO, 2, 57-75.
6. Saaty, T.L. (1980). The Analytic Hierarchy Process, McGraw Hill.
7. Arrow, K. (1951). Social Choice and Individual Values. John Wiley and Sons, New York, USA.
8. Sen, A.K. (1970). Collective Choice and Social Welfare. Holden-Day, San Francisco.
9. Behzadian, M., Otaghsara, K., Yazdani, M., Ignatius, J. (2012). A state-of-art survey of TOPSIS applications. Expert Systems with Applications, 39: 13051-13069.
10. Opricovic, S., Tzeng, G.H. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. European Journal of Operational Research 156 (2): 445–55.
11. Opricovic, S., Tzeng, G.H. (2007). Extended VIKOR method in comparison with outranking methods. European Journal of Operational Research 178 (2): 514–29.