

## COURSE DESCRIPTION

<b>General information</b>		
Lead instructor	Professor Biljana Mileva Boshkoska Assistant Professor Davor Davidović	
Course name	<b>CDS-13: Decision theory and machine learning</b>	
Study programme	<b>Computer and Data Science, third cycle Doctoral Study Programme</b>	
Course status	Optional	
Year	First or Second	
Number of credits and mode of delivery	ECTS student workload coefficient	10
	Number of hours (L+P+S)	30/-/270

<b>Course description</b>
<i>1.1. Course goals</i>
<p>The module contributes to the following general and subject-specific competences:</p> <p>General competences:</p> <ul style="list-style-type: none"> <li>- Ability to identify a given research problem, analyse it and offer possible solutions.</li> <li>- Ability to create new knowledge, which represents a contribution to science.</li> <li>- Mastery of standard research methods, procedures and processes in diverse scientific fields.</li> </ul> <p>Subject-specific competences:</p> <ul style="list-style-type: none"> <li>- in-depth understanding of decision theory and methods for decision support and simulation of decision models</li> <li>- Ability to design solution and implement it for the original scientific decision problems.</li> </ul>
<i>1.2. Course enrolment requirements</i>
A prerequisite for participation is enrollment into the 1st or 2nd year of the study programme.
<i>1.3. Intended course learning outcomes</i>
<p>The student:</p> <ul style="list-style-type: none"> <li>- knows decision theories and a set of methods to support a decision making</li> <li>- knows how to simulate decision models</li> <li>- is able to solve concrete research problems with the help of decision theory.</li> </ul>
<i>1.4. Course content</i>

<ul style="list-style-type: none"> <li>- Decision problem formulation and structuring (decision process, decision aiding, modeling decision aiding process, problem structuring methods, representation of the problem structuring, formulating a decision problem)</li> <li>- Preferences and numbers (evaluation and meaningfulness, numbers and preference relations, pointwise evaluations of an ordinal scale, on an interval scale, on a ratio scale)</li> <li>- Aggregation (aggregation functions, Borda method, conjoint measurement, parameters)</li> <li>- Aggregation procedures (aggregation functions, aggregation on preference relations, aggregation fuzzy relations, aggregation of a performance table, aggregation of a linguistic performance table)</li> <li>- Multi-dimensional preference models (additive model, models based on marginal traces)</li> </ul>							
1.5. Modes of delivery (mark the appropriate boxes with an X)		<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> practicals <input type="checkbox"/> remote learning <input type="checkbox"/> field work			<input checked="" type="checkbox"/> independent work <input type="checkbox"/> multimedia and network <input type="checkbox"/> laboratory <input type="checkbox"/> supervision <input type="checkbox"/> other _____		
1.6. Student obligations							
1.7. Monitoring student work (mark the appropriate boxes with an X)							
Class attendance		Participation in class		Seminar paper		Experimental work	
Written exam		Oral exam		Essay		Research	
Project		Continuous assessment of knowledge		Student report		Practical work	
Portfolio		Schoolwork		Homework			
1.8. Assessment and evaluation of student work during classes and the final exam							
Type (examination, oral, coursework, project): - Project work, 100%							
1.9. Required readings and number of copies relative to the number of students currently taking the course							
<i>Title</i>				<i>Number of copies</i>		<i>Number of students</i>	
Kochenderfer, M. J., Wheeler, T. A., & Wray, K. H. (2022). Algorithms for Decision Making. The MIT Press.							
Papathanasiou, J., Zarate, P., & Freire de Sousa, J. (Eds.). (2021). EURO Working Group on DSS : a tour of the DSS developments over the last 30 years. Springer.							
Papathanasiou, J., & Ploskas, N. (2018). Multiple Criteria Decision Aid Methods, Examples and Python Implementations. Springer.							
Abbas, A. E., & Howard, R. A. (2016). Foundations of Decision Analysis (Global Edition). Pearson.							
Saaty, T. L. (2010). Mathematical Principles of Decision Making (Principia Mathematica Decernendi): The Complete Theory of							

Analytical Hierarchy Process. RWS Publications. ISBN-13: 978-1888603101.		
Bouyssou, D., Marchant, T., Pirlot, M., Tsoukias, A., & Vincke, P. (2006). Evaluation and Decision Models with Multiple Criteria: Stepping Stones for the Analyst. Springer.		
<i>1.10. Supplementary readings</i>		
<i>1.11. Methods of quality monitoring that ensure the acquisition of knowledge, skills and competences.</i>		