LOGIC 2

ACADEMIC YEAR 2024-2025

Degree	Bachelor of Science in Computer Science			
Qualification	Computer Science			
Professor	PhD Kristina Sargsyan			
Distribution of hours	CM 17 h.	TD 15 h.		ECTS 3

EXPECTED LEARNING OUTCOMES OF THE COURSE		
A- Knowledge		A 1 Understand and apply the foundations of non-monotonic modal logic and fuzzy logic
B-Skills	B1 - Skills to apply professional knowledge	B 1.1 Demonstrate the ability to apply non-monotonic modal logic to real-world problems involving dynamic and incomplete information. B 1.2 Utilize fuzzy logic principles to model and solve problems with imprecise and uncertain data. B 1.3 Design and implement logical frameworks using non-monotonic modal logic for decision-making processes in complex systems. B 1.4 Develop and optimize fuzzy logic systems to evaluate and make decisions under uncertainty. B 1.5 Critically analyze and compare different logical approaches to address the limitations of classical logic in handling uncertainty and change. B 1.6 Evaluate the effectiveness of fuzzy logic models in various real-world scenarios and refine them based on performance metrics. B 1.7 Implement non-monotonic modal logic in the development of intelligent systems capable of adapting to new information and changing environments. B 1.8 Use fuzzy logic to create robust decision-support systems in professional fields such as engineering, artificial intelligence, and data science.
	B2 - General (transversal) skills	B 2.1 Demonstrate the ability to analyze complex problems and formulate logical solutions using non-monotonic modal logic and fuzzy logic principles. B 2.2 Adapt logical frameworks and methodologies to different problem domains and evolving real-world scenarios. B 2.3 Take initiative in self-directed learning, seeking opportunities to deepen understanding and skills in logical reasoning beyond the scope of the course. B 2.4 Manage time effectively to meet deadlines for assignments and exams while balancing other academic and personal commitments.

KNOWLEDGE / SKILLS ASSESSMENT & EVALUATION		
Ongoing evaluation tasks (max 1/3 of grade for the total course)	Midterm exam (max 1/3 of grade for the total course)	Final exam
Assessment : Oral ☐ Written ☐	Assessment : Oral ☐ Written ☐	Assessment : Oral ☐ Written ☒
Duration : XXX h. Criteria :	Group base: Yes ☐ No ☐	Group base: Yes ☐ No ☒
Course project : Yes ☐ No ☐ Presentation : Yes ☐ No ☐	Duration : - h.	Duration : 1.5 h.
Tasks type & Weight : XXXXXX	Exam type : XXXXXX	Exam type : Summative Semestral Exam (written) / Assignment /Practical Assignment

TEACHING METHODS & TOOLS

Students will be guided to develop problem-solving skills through interactive activities that are closely tailored to the lesson at hand. Students will be guided to discover activities that promote self-learning and help students develop critical thinking skills and retain knowledge that leads to self-actualization.

- Lecture
- Explanation
- Slideshow
- Presentation
- Demonstration
- Video-presentation
- Practical Work
- Modeling
- Exercises
- Self-study
- Instruction with demonstration
- Extra-mural/individual work
- Study of textbooks, sources
- Individual work
- Problem solving learning

KNOWLEDGE & SKILLS PREREQUISITS

Sets and their operations, functions, relations, recurrence

COURSE DESCRIPTION /SYLLABUS / RESOURCES

TOPIC	HOURS	CORE RESOURCES [1]	ADDITIONAL RESOURCES
Introduction to Non-Monotonic Modal Logic	3 CM	Harry J. Gensler. Introduction to Logic	
Non-Monotonic Reasoning in Dynamic and Incomplete Information Systems	6 CM+6TD	"Artificial Intelligence: A Modern Approach" (Chapters on Reasoning and Uncertainty)	
Introduction to Fuzzy Logic: Concepts and Principles	1.5 CM	Lecture Notes on Fuzzy Logic Systems	"Fuzzy Logic and Soft Computing" by V. K. V. Kumar
Applications of Non-Monotonic Modal Logic in Real-World Problems	3 CM+3TD	Lecture Notes on Real-World Applications	"Non-Monotonic Reasoning: Logical Foundations of Commonsense" by Gerhard Brewka
Fuzzy Logic and its Application in Modeling Imprecise Data	1.5 CM	Lecture Notes on Real-World Applications	"Fuzzy Set Theory and Its Applications" by H.-J. Zimmermann
Critical Analysis of Non-Monotonic Modal Logic and Fuzzy Logic Systems	1.5CM	- Comparative Study Papers on Non-Monotonic and Fuzzy Logic Systems	
Real-World Applications: Intelligent Systems Adaptation and Decision-Support	3 CM+3TD	"AI: Adaptation with Non-Monotonic Logic"	- Industry Use Cases: "Fuzzy Logic in AI and Engineering Systems"

[1] *For each topic max 20 -25 page of reading*

STRUCTURE OF THE COURSE & ADDITIONAL INFORMATION REGARDING THE COURSE PREPARATION

CORE REFERENCES

1. Artificial Intelligence: A Modern Approach, 4th Global Edition by Stuart Russell, Peter Norvig English | 2022 | ISBN: 1292153964 | 1152
2. Patrick J. Hurley, Lori Watson. A Concise Introduction to Logic, 13th Edition - Cengage Learning, 2018
3. Mordechai Ben-Ari. Mathematical Logic for Computer Science, Springer Science & Business Media, 2012
4. Harry J. Gensler. Introduction to Logic, third edition - New York and London: Routledge, 2017

ADDITIONAL REFERENCES

1. Lepage. Elements de Logique Contemporaine-Presses de l'Univ. de Montreal, 2001.
2. Delmas-Rigoutsos, Lalement. La Logique ou l'Art de raisonner-Le Pommier, 2001.
3. Kossak R. Mathematical logic on Numbers, Sets, Structures, and Symmetry – Springer, 2018
4. Gochet P., Gribomont P., Thayse A. Logique. Volume 3, Méthodes pour l'intelligence artificielle - Paris : Hermès Science publications, ©2000
5. Jones T. AI Application Programming, 3th Edition - Charles River Media, 2017
6. Harry J. Gensler. Historical Dictionary of Logic -Lanham, Md., Scarecrow Press [Rowman & Littlefield], 2006

WEB RESOURCES

1. https://www.harryhiker.com
2. www.cengage.com
3. http://www.satlive.org/solvers/
4. http://intrologic.stanford.edu/logica/homepage/index.php
5. https://leanprover.github.io/logic_and_proof/
6. https://www.phil.cmu.edu/projects/apros/