COURSE DESCRIPTION

General information		
Lead instructor	Associate Professor Borut Lužar Professor Riste Škrekovski Assistant Professor Davor Davidović Assistant Professor Drago Cmuk	
Course name	**CDS-09: Selected chapters in graph theory**	
Study programme	**Computer and Data Science, third cycle Doctoral Study Programme**	
Course status	Elective	
Year	First or Second	
Number of credits and mode of delivery	ECTS student workload coefficient	10
	Number of hours (L+P+S)	30/30/240

Course description
1.1. Course goals
Learning unit contributes to the development of the following general competencies: - ability to identify a research problem, analyze it, and offer possible solutions. - ability to create new knowledge, which represents a contribution to science - mastery of standard research methods, procedures and processes in diverse scientific fields and subject-specific competencies: - ability to design and implement original solutions of given scientific problems - ability to conduct independent scientific work in the area of intellectual property - capability to apply patent informatics methodologist to a given research problem
1.2. Course enrolment requirements
For enrollment, a good knowledge of basics in graph theory and probability theory is required.
1.3. Intended course learning outcomes
Knowledge and understanding: The student: - gets acquainted with the concept of random graphs and the possibilities of their application in complex networks problems. - understands processes in complex networks through the prism of theoretical notions in graph theory.

Transferable skills:

- Acquired knowledge will be transferable to other areas, e.g., to analysis of complex networks.

1.4. Course content

Overview of fundamental notions of graph theory

Extremal problems

- Hamilton paths and cycles
- Graph structure
- Szemeredi's Regularity Lemma and its applications

Graph coloring

- Coloring graphs on surfaces
- Perfect graphs
- List and DP-colorings

Random graphs

- The use of the expectation
- Properties of almost all graphs
- The use of the variance

Random walks on graphs

- Electrical networks
- Hitting times and commute times
- Conductance

1.5. Modes of delivery (mark the appropriate boxes with an X)	☒ *lectures* ☐ *seminars and workshops* ☒ *practicals* ☐ *remote learning* ☐ *field work*	☒ *independent work* ☐ *multimedia and network* ☐ *laboratory* ☐ *supervision* ☐ *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):

- Written exam, 80%

- Homework, 20%

1.9. Required readings and number of copies relative to the number of students currently taking the course

Title	*Number of copies*	*Number of students*
Lužar, B. Zapiski predavanj in vaj.		
Bollobás, B. (1998). Modern Graph Theory. Springer, New York.		
Bundy, A., & Murty U. S. R. (2010). Graph Theory. Springer, London.		
Matoušek, J., & Vondrák, J. (2008). The Probabilistic Method – lecture notes. Samozaložba. http://turing.une.edu.au/~tkalinow/probabilistic_method.pdf		

1.10. Supplementary readings

1.11. Methods of quality monitoring that ensure the acquisition of knowledge, skills and competences.