COURSE DESCRIPTION

General information		
Lead instructor	Associate Professor Pavle Boškoski Assistant Professor Davor Davidović	
Course name	**CDS-14: Selected chapters on high-performance computing**	
Study programme	**Computer and Data Science, third cycle Doctoral Study Programme**	
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

Course description

1.1. Course goals

The instructional unit contributes to the development of the following general and subject-specific competencies:

General competences:

- Ability to identify a given 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.
- Familiarity with the notion of quality and strive for professional quality through autonomy, (self-) criticism, (self-) reflection and (self-) evaluation.

Subject-specific competences:

- Acquittance of advanced knowledge from the fields of high-performance computing, parallel processing, and HADOOP, SLURM, Docker and containers, OpenMP, OpenCL/Cuda.
- Ability to apply subject-specific theoretical knowledge in practice and use appropriate methodological approaches to solve problems in the proposed areas.

1.2. Course enrolment requirements

The precondition for this course is enrolment in the first or second year of the study programme.

1.3. Intended course learning outcomes

Knowledge and understanding:

Student

- gains advanced knowledge from the fields of high-performance computing, parallel processing, and HADOOP.
- Can configure SLURM, and optimally exploit parallel systems.
- Can prepare containers and deploy them on HPC.
- Understands the appropriateness of theoretical methods to solve practical problems and their limits,
- Is able of analytical thinking, and to analyse and solve complex practical problems.

1.4. *Course content*

At the course selected chapters from the following areas will be presented and analysed:

- SLURM (Simple Linux Utility for Resource Management): architecture, configuring, basic commands
- Docker and containers: setup and usage
- Multiprocessor programming (OpenMP)
- Programming of graphic processing units (OpenCL / Cuda)
- High-performance parallel computing with clusters and cloud networks,
- Hadoop (MapReduce, The Hadoop distributed file system, developing a Hadoop application for analyzing massive data)

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

Title	*Number of copies*	*Number of students*
Deakin, T., & Mattson, G. (2023). Programming Your GPU with OpenMP: Performance Portability for GPUs. MIT Press.		

NVIDIA (2022). CUDA C++ Programming Guide. Design Guide. https://docs.nvidia.com/cuda/pdf/CUDA_C_Programming_Guide.pdf		
Slurm (2021). Slurm tutorials. https://slurm.schedmd.com/tutorials.html		
Wilt, N. (2018). The CUDA Handbook: A Comprehensive Guide to GPU Programming. Addison-Wesley.		
White, T. (2015). Hadoop: The Definitive Guide, Fourth Edition, O'Reilly Media, Inc.		
1.10. Supplementary readings		
1.11. Methods of quality monitoring that ensure the acquisition of knowledge, skills and competences.		