UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Visoko zmogljivo računalništvo
Course title:	High Performance Computing

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Računalništvo in spletne tehnologije, visokošolski strokovni študijski program prve stopnje	-	Prvi	Drugi
Computer Science and Web Technologies, first cycle Professional Study Programme	-	First	Second

Vrsta predmeta / Coursetype Izbirni / Elective

Univerzitetna koda predmeta / Universitycoursecode: 2-RST-MAG-IP-VZR-2024-02-05

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	-	30	-	-	90	5

Nosilec predmeta / Lecturer: Izr. prof. dr. Biljana Mileva Boshkoska

Jeziki / **Languages:**	**Predavanja /** **Lectures:**	Slovenski / Slovenian, Angleški / English
	Vaje / Tutorial:	Slovenski / Slovenian, Angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisits:

Pogoj za vključitev v delo je vpis v 1. letnik študija.

Pogoj za pristop k izpitu so opravljene vse obveznosti na vajah ter priprava in zagovor projektne naloge.

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

To attend the exam students will have to prepare and present a project assignment.

Vsebina:

Content (Syllabus outline):

Pri predmetu bodo predstavljena in obdelana izbrana poglavja z naslednjih področij: • visoko zmogljivo paralelno procesiranje na gručah, omrežjih in v oblakih, • računanje na heterogenih sistemih (grafične procesne enote, koprocesorji), • Hadoop (Uvod, MapReduce, distribuirani datotečni sistem Hadoop, razvijanje hadoop aplikacije za analizo vele podatkov)	At the course selected chapters from the following areas will be presented and analysed: • high performance parallel computing with clusters and cloud networks, • computing with heterogeneous systems (e.g. graphical processing units – GPUs, coprocessors) • Hadoop (Introduction, MapReduce, The Hadoop distributed file system, developing a hadoop application for analysing massive data)

Temeljni literatura in viri / Readings:

- Robey, R. and Zamora, Y. (2021): Parallel and high Performance Computing, Manning.
- Kirk D. B. and Hwu W. W. (2012). Programming Massively Parallel Processors, Morgan Kaufman.
- Alex Holmes (2014). Hadoop in Practice, Manning.
- Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman (2014), Mining of Massive Datasets, Cambridge University Press.
- Tom White (2015). Hadoop: The Definitive Guide, Fourth Edition, O＇Reilly Media, Inc.

Cilji in kompetence: / **Objectives and competences:**

Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc: Študenti bodo pri predmetu osvojili: • sposobnost algoritmičnega razmišljanja; • sposobnost obvladovanja in pretvorbe realnega problema v obliki lažje predstavljivega modela; • napredna znanja s področja visoko zmogljivih računalnikov, paralelnega procesiranja ter HADOOP; • teoretična znanja bodo znali uporabiti v praksi ter z ustreznimi metodološkimi pristopi reševati probleme na predlaganih področjih.	*The instructional unit contributes to the development of the following general and subject-specific competences:* Students will gain: • ability of algorithmic thinking. • ability to manage and transform a real-life problem into the form of an easier to perceive model; • advanced knowledge from the fields of High performance computing, parallel processing and HADOOP; • Students will be able to apply theoretical knowledge in practice and use appropriate methodological approaches to solve problems in the proposed areas.

Predvideni študijski rezultati: / **Intended learning outcomes:**

Znanje in razumevanje: • Osvojitev naprednih znanj s področij visoko zmogljivega računalništva, paralelnega procesiranja ter HADOOP.	*Knowledge and understanding:* • Advanced knowledge from the fields of high-performance computing, parallel processing and HADOOP.

• Konfiguracija HADOOP, izraba paralelnih sistemov. • Razumevanje primernosti teoretičnih metod za reševanje praktičnih problemov ter njihovih omejitev, sposobnost analitičnega razmišljanja, sposobnost analize in reševanja kompleksnih praktičnih problemov. • Kombiniranje znanj pridobljenih pri predmetih s področja strojne opreme, programske opreme, algoritme ter programiranja.	• Configuration of HADOOP, optimal exploitation of parallel systems. • Understanding of the appropriateness of theoretical methods to solve practical problems and their limits, the ability of analytical thinking, ability to analyse and solve complex practical problems. • Combining the knowledge gained from courses in the areas of hardware, software, algorithms, programming.

Metode poučevanja in učenja:

Learning and teaching methods:

• predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov); • vaje (reševanje različnih problemov, implementacija algoritmov).	• lectures with active students participation (explanations, discussion, questions, examples, problem solving); • excercises (solving various problems, implementation of algorithms).

Načini ocenjevanja: Delež (v %) / Weight (in %)   **Assessment:**

	Delež (v %) / Weight (in %)	
• pisni izpit • projektna naloga	50 % 50 %	• written exam • project work

Reference nosilca / Lecturer's references:

- TADIĆ, Bosiljka, AND JELKOVIĆ, Miroslav, MILEVA-BOSHKOSKA, Biljana, LEVNAJIĆ, Zoran. Algebraic topology of multi-brain connectivity networks reveals dissimilarity in functional patterns during spoken communications. *PloS one*, 2016, vol. 11, no. 11, str. e0166787-1-e0166787-25.
- ŠUBELJ, Lovro, BAJEC, Marko, MILEVA BOSHKOSKA, Biljana, KASTRIN, Andrej, LEVNAJIĆ, Zoran. Quantifying the consistency of scientific databases. *PloS one*, 2015, vol. 10, no. 5, str. 116.
- BOŠKOSKI, Pavle, DEBENJAK, Andrej, MILEVA-BOSHKOSKA, Biljana. Rayleigh copula for describing impedance data - with application to condition monitoring of proton exchange membrane fuel cells. *European journal of operational research*, ISSN 0377-2217. 2018, vol. 266, no. 1, str. 269-277.
- BOŠKOSKI, Pavle, PERNE, Matija, RAMEŠA, Martina, BOSHKOSKA, Biljana Mileva. Variational Bayes survival analysis for unemployment modelling. *Knowledge-based systems*. [Print ed.]. 11 Oct. 2021, vol. 229, [article no.] 107335, str. 1-11, graf. prikazi, tabele. ISSN 0950-7051. DOI: 10.1016/j.knosys.2021.107335
- ANDONOVIKJ, Viktor, BOŠKOSKI, Pavle, EVKOSKI, Bojan, REDEK, Tjaša, BOSHKOSKA, Biljana Mileva. Community analysis in Slovenian labour network 2010-2020. *Journal of decision systems*. 2022, vol. 31, suppl. 1, str. 308-318. ISSN 1246-0125.