

**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
Podatkovne znanosti, magistrski študijski program druge stopnje	-	Drugi	Četrtri
The second cycle masters study programme Data Sciences	-	Second	Fourth

**Vrsta predmeta / Course type**

Obvezni / Obligatory

**Univerzitetna koda predmeta /  
University course code:**

2-PZ-MAG-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:**

Ni posebnih pogojev za vključitev v delo.  
Pogoj za pristop k izpitu so opravljene vse obveznosti na vajah ter priprava in zagovor projektne naloge.

**Prerequisites:**

There are no special prerequisites for the inclusion in work.  
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 analyzed:

- 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 analyzing massive data)

### Temeljna literatura in viri / Readings:

- Robey, R. and Zamora, Y. (2021): Parallel and high Performance Computing, Manning.
- Kirk, D. B., Hwu, W. W. (2016): Programming Massively Parallel Processors, 3rd. Ed. Morgan Kaufman.
- Holmes, A. (2014): Hadoop in Practice, Manning.
- Leskovec, J. Rajaraman, A., Ullman, J. D. (2020): Mining of Massive Datasets, 3rd ed., Cambridge University Press. Dostopno prek: <http://www.mmids.org/>
- White T. (2015): Hadoop: The Definitive Guide, 4th ed., O’ Reilly Media, Inc.

### Cilji in kompetence:

*Učna enota prispeva k razvoju naslednjih splošnih in predmetno-specifičnih kompetenc:*

*Splošne kompetence:*

- sposobnost analitičnega in algoritmičnega razmišljanja;
- sposobnost obvladovanja in pretvorbe realnega problema v obliki lažje predstavljivega modela;

*Predmetno-specifične kompetence:*

- 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.

### Objectives and competences:

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

*General competences:*

- the ability of analytical and algorithmic thinking.
- the ability to manage and transform a real problem into a simplified model;

*Subject-specific competences:*

- 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:**

- Osvojitve naprednih znanj s področij visoko zmogljivega računalništva, paralelnega procesiranja ter 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.

**Knowledge and understanding:**

- Advanced knowledge from the fields of high performance computing, parallel processing and HADOOP.
- 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:**

- predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov);
- vaje (reševanje različnih problemov, implementacija algoritmov).

**Learning and teaching methods:**

- lectures with active students participation (explanations, discussion, questions, examples, problem solving);
- exercises (solving various problems, implementation of algorithms).

Delež (v %) /

Weight (in %) **Assessment:****Načini ocenjevanja:**

<ul style="list-style-type: none"> <li>• pisni izpit</li> <li>• projektna naloga</li> </ul>	50 % 50 %	<ul style="list-style-type: none"> <li>• written exam</li> <li>• project work</li> </ul>
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**Reference nosilca / Lecturer's references:**

- ZHAO, Guoqing, LIU, Shaofeng, LOPEZ, Carmen, LU, Haiyan, ELGUETA, Sebastian, CHEN, Huilan, MILEVA BOSHKOSKA, Biljana. Blockchain technology in agri-food value chain management : a synthesis of applications, challenges and future research directions. *Computers in industry*, ISSN 0166-3615. [Print ed.], 2019, vol. 109, str. 83-99
- 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. [Print ed.], 2018, vol. 266, no. 1, str. 269-277
- GRAŠIČ, Valerij, KOS, Andrej, MILEVA BOSHKOSKA, Biljana. Classification of incoming calls for the capital city of Slovenia smart city 112 public safety system using open Internet of Things data. *International journal of distributed sensor networks*, ISSN 1550-1477. [Online ed.], 2018, vol. 14, no. 9, str. 1-12, ilustr.
- 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](https://doi.org/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.