

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Algoritmi
<b>Course title:</b>	Algorithms

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 / Course type**

Obvezni / Obligatory

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

2-RST-MAG-A-2019-03-05

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
45	-	45	-	-	120	7

**Nosilec predmeta / Lecturer:**

**Jeziki / Languages:**

**Predavanja / Lectures:**

Slovenski / Slovenian, Angleški / English

**Vaje / Tutorial:**

Slovenski / Slovenian, Angleški / English

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

Pogoj za vključitev v delo je poznavanje temeljnih podatkovnih struktur, zaželeno pa je tudi poznavanje osnovnih konceptov algoritmov (npr. opravljen predmet Uvod v algoritme na prvi stopnji študija).

Pogoj za pristop k izpitu so opravljene in pozitivno ocenjene vse obveznosti na vajah.

**Prerequisites:**

A knowledge of fundamental data structures is required for a student to attend the course. Additionally, a knowledge and understanding of basic algorithmic concepts will be helpful (e.g., the knowledge obtained at Introduction to Algorithms at the first study cycle).

To attend the exam, a student has to submit all assignments given, and have them positively evaluated.

**Vsebina:**

**Content (Syllabus outline):**

- Požrešna metoda (razvrščanje intervalov, najkrajše poti v grafih, grupiranje, Huffmanovi kodi).
- Deli in vladaj (Urejanje z zlivanjem, štetje inverzij, iskanje najbližjih točk).
- Dinamično programiranje (uteženo razvrščanje intervalov, memoizacija, vsote podmnožic in problem nahrbtnika, najkrajše poti v grafih, poravnava zaporedij).
- Pretoki v omrežjih (Problema maksimalnega pretoka in minimalnega prereza, Problem prirejanja v dvodelnih grafih, Izdelava anket, razporejanje letal).
- Razred NP (redukcije v polinomskem času, SAT, NP-polni problemi, problemi razbitij, barvanje grafov).
- Aproksimacijski algoritmi (požrešni algoritmi in meje optimalnosti, pokritja množic, pokritja vozlišč, Problem disjunktih poti, Problem nahrbtnika).
- Randomizirani algoritmi (minimalni prerez, MAX 3-SAT, Randomizirani deli in vladaj).

- Greedy method (Interval scheduling, Shortest paths in graphs, Clustering, Huffman codes).
- Divide and Conquer (Mergesort, Inversions counting, Finding the closest points).
- Dynamic programming (Weighted interval scheduling, Memoization, Subset sums and knapsack, Shortest paths in graphs, Sequence alignment).
- Network flows (Maximum flow and Minimum cut problems, Bipartite matching problem, Survey design, Airline scheduling).
- Class NP (Polynomial-time reductions, SAT, NP-complete problems, Partitioning problems, Graph coloring).
- Approximation algorithms (Greedy algorithms and bounds on the optimum, Set cover, Vertex cover, Disjoint paths problem, The knapsack problem).
- Randomized algorithms (Minimum cut, MAX 3-SAT, Randomized Divide and conquer).

#### Temeljni literatura in viri / Readings:

- CORMEN, Thomas, LEISERSON, Charles, RIVEST, Ronald in STEIN, Clifford (2001) Introduction to Algorithms, 2. izdaja, MIT Press, Cambridge.
- KLEINBERG, Jon, TARDOS, Eva (2006) Algorithm Design, Addison Wesley, USA.
- KONONENKO, Igor (1996) Načrtovanje podatkovnih struktur in algoritmov. Ljubljana, Založba FE in FRI.
- KORTE, Bernhard, VYGEN, Jens (2008) Combinatorial Optimization. Springer Verlag, Berlin Heidelberg.
- MOTWANI, R., RAGHAVAN, P. (1995) Randomized Algorithms, Cambridge University Press, Cambridge.

#### Cilji in kompetence:

#### Objectives and competences:

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

- Poznavanje pomena kakovosti in prizadevanje za kakovost strokovnega dela skozi avtonomnost, samoiniciativnost, (samo)kritičnost, (samo)refleksivnost in (samo)evalviranje v strokovnem delu.
- Sposobnost fleksibilne uporabe znanja v praksi.
- Sposobnost algoritmičnega razmišljanja.
  
- Sposobnost oblikovanja in razvoja naprednih algoritmov za specifična opravila, določena s problemom.
- Sposobnost primerjave in izbire primernih algoritmov ter orodij za implementacijo le-teh.
- Poznavanje in sposobnost za uporabo širokega spektra komponent potrebnih za celovit razvoj algoritmov.
- Sposobnost interpretacije in modeliranja danega problema v obliki algoritma.

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

- Familiarity with the importance of quality, striving to maintain the quality of professional work through practicing autonomous behaviour, showing initiative, as well as through (self-)criticism, (self)reflection and (self-)evaluation.
- The ability of the flexible use of knowledge in practice.
- Ability of algorithmic thinking.
  
- Ability to design and develop advanced algorithms for problem specific tasks.
- The ability of comparison and selection of appropriate algorithms and tools for implementation of algorithms.
- Knowledge of and ability to use a wide range of components necessary for full development of algorithms.
- The ability to interpret and model the given problem in a form of an algorithm.

### **Predvideni študijski rezultati:**

Znanje in razumevanje:

- Študentje se bodo spoznali s teoretičnimi osnovami in praktičnimi vidiki razvoja algoritmov.
- Študentje bodo sposobni v izbranem programskem jeziku napisati program ter uporabiti najnovejša programska orodja za implementacijo izbranega algoritma.
- Bistveno bodo izboljšali znanje programiranja algoritmov.

Prenosljive spretnosti:

- Študentje bodo sposobni prenosa znanja na druga področja, vključujoč splošno algoritmično znanje, razvoj novih algoritmov in programov za reševanje problemov iz prakse v obliki aplikacij.

### **Intended learning outcomes:**

Knowledge and understanding:

- Students will get acquainted with theoretical basics and practical aspects of the development of algorithms.
- Students will have the ability to code and use some of the latest software tools that implement state-of-the-art algorithms.
- Significantly will upgrade programming knowledge of algorithms.

Transferable skills:

- Students will be able to transfer their obtained knowledge to other areas, involving the use of general algorithmic knowledge, develop new algorithms and programs to solve a given problem in the form of applications.

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**Metode poučevanja in učenja:**

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

**Learning and teaching methods:**

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

**Načini ocenjevanja:**

Delež (v %) /

Weight (in %)

**Assessment:**

<ul style="list-style-type: none"><li>• pisni izpit</li><li>• projektna naloga</li></ul>	<p>50 %</p> <p>50 %</p>	<ul style="list-style-type: none"><li>• written exam</li><li>• project assignment</li></ul>
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