

UČNI NAČRT PREDMETA / COURSE SYLLABUS						
<b>Predmet:</b>		Teorija izračunljivosti				
<b>Course title:</b>		Computability theory				
<b>Študijski program in stopnja</b> Study programme and level		<b>Študijska smer</b> Study field		<b>Letnik</b> Academic year	<b>Semester</b> Semester	
Magistrski študijski program Matematika		ni smeri		1 ali 2	prvi ali drugi	
Master's study programme Mathematics		none		1 or 2	first or second	
<b>Vrsta predmeta / Course type</b>				izbirni		
<b>Univerzitetna koda predmeta / University course code:</b>				M2602		
<b>Predavanja</b> Lectures	<b>Seminar</b> Seminar	<b>Vaje</b> Tutorial	<b>Klinične vaje</b> work	<b>Druge oblike</b> študija	<b>Samost. delo</b> Individ. work	<b>ECTS</b>
45		30			105	6
<b>Nosilec predmeta / Lecturer:</b>		prof. Andrej Bauer, prof. Marko Petkovšek				
<b>Jeziki /</b> <b>Languages:</b>	<b>Predavanja /</b> <b>Lectures:</b>	slovenski/Slovene, angleški/English				
	<b>Vaje / Tutorial:</b>	slovenski/Slovene, angleški/English				
<b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b>				<b>Prerequisites:</b>		
<b>Vsebina:</b>				<b>Content (Syllabus outline):</b>		

<p>Turingovi stroji in izračunljive funkcije. Univerzalni stroj. Neodločljivi problemi in neizračunljive funkcije.</p> <p>Osnovni izreki in pojmi: Izrek s-m-n, izrek u-t-m, izrek o rekurziji, izračunljive in izračunljivo preštevne množice, njihove lastnosti, neseparabilne množice, Riceov izrek, Rice-Shapiro izrek.</p> <p>Računanje z oraklji, Turingove redukcije in stopnje.</p> <p>Dodatna vsebina: izračunljivi funkcionali, zveznost funkcionalov, izrek KLS, izračunljiva realna števila, osnovni rezultati izračunljive realne analize.</p>	<p>Turing machines and computable functions. Universal machine. Undecidable problems and non-computable functions.</p> <p>Basic theorems and notions: s-m-n and u-t-m theorems, recursion theorem, computable and computably enumerable sets and their properties, non-separable sets, Rice's theorem, Rice-Shapiro theorem.</p> <p>Oracle computations, Turing reducibility and degrees.</p> <p>If time permits: computable functionals, continuity of functionals, KLS theorem, computable real numbers, basic results in computable analysis.</p>
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#### Temeljni literatura in viri / Readings:

<p>J. E. Hopcroft, J. D. Ullman: Uvod v teorijo avtomatov, jezikov in izračunov, FER, Ljubljana, 1990. P. Odifreddi: Classical Recursion Theory, North-Holland, 1989.</p>
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#### Cilji in kompetence:

<p>Znanje osnovnih pojmov in rezultatov v teoriji izračunljivosti.</p>
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#### Objectives and competences:

<p>Knowledge of basic notions and results in computability theory.</p>
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#### Predvideni študijski rezultati:

<p>Znanje in razumevanje: Razumevanje povezav med računskimi pojmi, kot so Turingovi stroji, in osnovnimi matematičnimi pojmi, kot so množice števil. Uporaba: Snov predstavlja teoretično matematično podlago za računalništvo v splošnem smislu.</p>
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#### Intended learning outcomes:

<p>Knowledge and understanding: Understanding of the connections between computability notions, such as Turing machines, and basic mathematical notions, such as sets of numbers.</p> <p>Application:</p>
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<p>Refleksija:</p> <p>Vpliv pojma izračunljivosti na osnove matematike.</p> <p>Prenosljive spretnosti – niso vezane le na en predmet:</p> <p>Analitično in abstraktno razmišljanje o teoretičnih mejah računalništva.</p>	<p>The subject matter provides a general theoretical foundation for computer science.</p> <p>Reflection:</p> <p>The influence of the notion of computability on foundations of mathematics.</p> <p>Transferable skills:</p> <p>Analytic and abstract thinking about the theoretical frontiers of computer science.</p>

**Metode poučevanja in učenja:**

predavanja, vaje, domače naloge, konzultacije

**Learning and teaching methods:**

Lectures, exercises, homeworks, consultations

**Načini ocenjevanja:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt):  
izpit iz vaj (2 kolokvija ali pisni izpit)

ustni izpit

Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)

Delež (v %) /  
Weight (in %)

50%  
50%

**Assessment:**

Type (examination, oral, coursework, project):  
2 midterm exams instead of written exam, written exam

oral exam

Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

**Reference nosilca / Lecturer's references:**

Andrej Bauer:

– BAUER, Andrej. A relationship between equilogical spaces and Type Two Effectivity. Mathematical logic quarterly, ISSN 0942-5616, 2002, vol. 48, suppl. 1, str. 1-15 [COBISS.SI-ID 12033369]

- AWODEY, Steve, BAUER, Andrej. Propositions as [Types]. Journal of logic and computation, ISSN 0955-792X, 2004, vol. 14, no. 4, str. 447-471 [COBISS.SI-ID 13374809]

- BAUER, Andrej. First steps in synthetic computability theory. V: Proceedings of the 21st Annual Conference on Mathematical Foundations of Programming Semantics (MFPS XXI), (Electronic notes in theoretical computer science, ISSN 1571-0661, Vol. 155). Amsterdam: Elsevier, 2006, str. 5-31 [COBISS.SI-ID 14631001]

Marko Petkovšek:

- PETKOVŠEK, Marko, WILF, Herbert S., ZEILBERGER, Doron. A=B. Wellesley (Massachusetts): A. K. Peters, cop. 1996. VII, 212 str. ISBN 1-56881-063-6 [COBISS.SI-ID 4085337]

- PETKOVŠEK, Marko. Ambiguous numbers are dense. American mathematical monthly, ISSN 0002-9890, 1990, let. 97, št. 5, str. 408-411 [COBISS.SI-ID 8040537]

- PETKOVŠEK, Marko. Letter graphs and well-quasi-order by induced subgraphs. Discrete Mathematics, ISSN 0012-365X. [Print ed.], 2002, vol. 244, no. 1-3, str. 375-388 [COBISS.SI-ID 11414873]