UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)			
Predmet:	Optimizacijske metode		
Course title:	Optimization methods		

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Interdisciplinarni univerzitetni študijski program Računalništvo in matematika	ni smeri	2	drugi
Interdisciplinary first cycle academic study programme Computer Science and Mathematics	none	2	second

Vrsta predmeta / Course type	obvezni / compulsory
Univerzitetna koda predmeta / University course code:	27210

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

Nosilec predmeta / Lecturer:	prof. dr. Marko Petkovšek, prof. dr. Arjana Žitnik

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.

Vsebina:	**Content (Syllabus outline):**

• Optimizacijske naloge in problemi, primeri, podobne in enakovredne naloge, • rešljivost, globalni in lokalni ekstremi, • lokalna optimizacija, konveksnost, reševanje v Rn, sedla, prirejene in dualne naloge, • Lagrangeova prirejenost, Karush-Kuhn-Tuckerjev izrek, numerični postopki, kazenske metode, • linearno programiranje, metoda simpleksov, dualne naloge, • diskretne optimizacijske naloge, zahtevnost problemov, pristopi k reševanju diskretnih nalog, primeri (predavatelj izbere nekatere izmed naslednjih tem: najcenejši razvoz, pretoki po omrežju, prirejanja in pokritja, barvanje grafov, razvrščanje v skupine, ...).	• Optimization problems, examples, similar and equivalent problems • solvability, global and local extrema, • local optimization, convex problems, solving in Rn, saddle points, associated and dual problems, • Lagrange duality, Karush-Kuhn-Tucker theorem, numerical algorithms, penalty methods, • linear programming, simplex method, dual problem, • discrete optimization problems, complexity, approaches to solving discrete optimization problems, examples (the lecturer chooses some of the following topics: transshipment problem, network flow, matchings and coverings, graph colorings, clustering...).

Temeljni literatura in viri / Readings:

Vašek Chvátal: Linear Programming, W. H. Freeman and Co., New York, 1983

B. H. Korte, J. Vygen: Combinatorial Optimization : Theory and Algorithms, 3. izdaja, Springer, Berlin, 2006.

Stephen Boyd, Lieven Vandenberghe: Convex Optimization, Cambridge University Press, Cambridge, 2004

V. Batagelj: Optimizacijske metode, Zapiski predavanj, Ljubljana.http://vlado.fmf.uni-lj.si/vlado/optim/opt1.pdfhttp://vlado.fmf.uni-lj.si/vlado/optim/lp.pdf

V. Batagelj, M. Kaufman: Naloge iz optimizacijskih metod, Ljubljana.http://vlado.fmf.uni-lj.si/vlado/optim/optnal.pdf

Jiří Matoušek, Bernd Gärtner: Understanding and Using Linear Programming, Springer 2007

M.Minoux: Mathematical programming. Theory and algorithms. Wiley, Chichester, 1986

M.S.Bazaraa, H.D.Sherali, C.M.Shetty: Nonlinear Programming, Theory and Algorithms. Wiley, New York 1993.

C.H.Papadimitriou, K.Steiglitz: Combinatorial optimization: Algorithms and complexity. Prentice-Hall, Englewood Cliffs, New Jersey 1990

Cilji in kompetence:

Podati v poenoteni obliki osnovna znanja o ``zvezni'' in kombinatorični optimizaciji.

Objectives and competences:

To provide a basic knowledge on ``continuous'' and combinatorial optimization in a unified way.

Predvideni študijski rezultati:

Znanje in razumevanje: Študent pridobi osnovno znanje o zvezni in kombinatorični optimizaciji. Obvlada temeljne optimizacijske postopke in jih zna uporabiti ob pomoči računalnika.

Uporaba: Reševanje optimizacijskih problemov v vsakdanjem življenju.

Refleksija: Pomen ustreznega modeliranja problemov iz uporabe za njihovo učinkovito reševanje.

Prenosljive spretnosti – niso vezane le na en predmet: Sposobnost predstavitve različnih praktičnih problemov v obliki matematičnih optimizacijskih nalog. Veščina uporabe izbranega programskega orodja za reševanje osnovnih optimizacijskih problemov.

Intended learning outcomes:

Knowledge and understanding: The student obtains basic knowledge about continuous and combinatorial optimization. He or she is familiar with basic optimization methods and knows how to solve them with a computer.

Application: Solving optimization problems from real life.

Reflection: The importance of modelling of problems for their effective resolution.

Transferable skills: The ability to present various everyday problems in the form of mathematical optimization tasks. Ability to use computer programs to solve basic optimization problems.

Metode poučevanja in učenja:

Learning and teaching methods:

predavanja, vaje, domače naloge, konzultacije	lectures, exercises, homeworks, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
domače naloge ali projekt		homeworks or project
pisni izpit	10%	written exam
ustni izpit	45%	oral exam
Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	45%	Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Marko Petkovšek:

ABRAMOV, Sergei A., PETKOVŠEK, Marko. Polynomial ring automorphisms, rational (w, [sigma])-canonical forms, and the assignment problem. Journal of symbolic computation, ISSN 0747-7171, 2010, vol. 45, no. 6, str. 684-708. [COBISS.SI-ID 15580505]

BRESSLER, Andrew, GREENWOOD, Torin, PEMANTLE, Robin, PETKOVŠEK, Marko. Quantum random walk on the integer lattice: examples and phenomena. V: AMS Special Sessions on Algorithmic Probability and Combinatorics, October 5-6, 2007, DePaul University, Chicago (Illinois), October 4-5, 2008, University of British Columbia, Vancouver (BC, Canada). LLADSER, Manuel (ur.), et al. Algorithmic probability and combinatorics : AMS special sessions on algorithmic probability and combinatorics, October 5-6, 2007, DePaul University, Chicago, Illinois, October 4-5, 2008, University of British Columbia, Vancouver, BC, Canada, (Contemporary mathematics, ISSN 0271-4132, 520). Providence: American Mathematical Society, cop. 2010, str. 41-60. [COBISS.SI-ID 15813977]

ABRAMOV, Sergei A., BARKATOU, Moulay A., VAN HOEIJ, Mark, PETKOVŠEK, Marko. Subanalytic solutions of linear difference equations and multidimensional hypergeometric sequences. Journal

of symbolic computation, ISSN 0747-7171, 2011, vol. 46, iss. 11, str. 1205-1228. [COBISS.SI-ID 16083033]

Arjana Žitnik:

MILANIČ, Martin, PISANSKI, Tomaž, ŽITNIK, Arjana. Dilation coefficient, plane-width, and resolution coefficient of graphs. Monatshefte für Mathematik, ISSN 0026-9255, 2013, vol. 170, no. 2, str. 179-193. [COBISS.SI-ID 1024499540]

PISANSKI, Tomaž, ŽITNIK, Arjana. Representing graphs and maps. V: BEINEKE, Lowell W. (ur.), WILSON, Robin J. (ur.). Topics in topological graph theory, (Encyclopedia of mathematics and its applications, ISSN 0953-4806, 128). Cambridge [etc.]: Cambridge University Press, cop. 2009, str. 151-180. [COBISS.SI-ID 15227481]

ŽITNIK, Arjana. Series parallel extensions of plane graphs to dual-eulerian graphs. Discrete Mathematics, ISSN 0012-365X. [Print ed.], 2007, vol. 307, iss. 3-5, str. 633-640. [COBISS.SI-ID 14183769]