

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Modeliranje z agenti
Course title:	Agent Based Modelling

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Informatika v sodobni družbi, magistrski študijski program druge stopnje	-	Prvi ali drugi	Drugi ali četrsti
Informatics in Contemporary Society, second cycle Masters Study Programme	-	First or second	Second or fourth

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code: 1-ISD-MAG-IP-MZA-2019-05-13

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	-	45	-	-	75	5

Nosilec predmeta / Lecturer:

Jeziki / Languages:	Predavanja / Lectures:	Slovenski, angleški / Slovene, English
	Vaje / Tutorial:	Slovenski, angleški / Slovene, English

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

Študent/študentka mora pred pristopom k izpitu pripraviti in zagovarjati empirično seminarsko nalogo.

Prerequisites:

The student is obliged to prepare and defend his/her assignments before the admission to the examination.

Vsebina:

- Uvod v modeliranje z agenti (MA), kdaj in zakaj uporabljati MA;
- Uvod v projekt, izbira teme MA projekta;
- Pregled in primerjava metodologij modeliranja, primerjava MA in drugih možnih metodologij za izbrani MA projekt;
- Simulacijski primeri: Kreativno Jedro: Simulacije in drugi projekti;
- Razvoj agentnega modela, Razvoj zasnove modela za izbrani MA projekt
- Pregled MA orodij, Izbira najbolj

Content (Syllabus outline):

- Introduction to agent based modelling (ABM), when and why to use ABM;
- Introduction to the project, choice of theme for the ABM project;
- Review of modeling methodologies, comparison of ABM and alternative methodologies for selected ABM project;
- Simulation examples: Creative Core: Simulations and other projects;
- Development of agent-based model, design of the model for selected ABM project;

primerne MA orodja za izbrani MA projekt;

- Delavnica z izbranimi MA orodji, implementacija enostavnega modela;
- Arhitekture agentnih modelov, izbira arhitekture za izbrani MA projekt;
- Verifikacija in validacija, načrtovanje verifikacije in validacije za izbrani MA projekt;
- Zbiranje in priprava podatkov, izbira vsaj enega vira podatkov za izbrani MA projekt;
- Analiza in predstavitev rezultatov, izvajanje simulacije in analiza modela in rezultatov simulacije;
- Upravljanje MA projekta;
- Priprava predstavitve projekta.

- Overview of ABM tools, choosing the most appropriate tools for selected ABM project;
- Workshop with selected tools, implementation of a simple model;
- Architectures of agent-based models, selection of architecture for the selected ABM project;
- Verification and validation, design verification and validation of the selected ABM project;
- Collection and preparation of data, selection of at least one data source for the selected ABM project;
- Analysis and presentation of results, implementation of simulation and analysis of the model and simulation results;
- ABM project Management;
- Preparation of project presentations.

Temeljni literatura in viri / Readings:

- Grigoryev, I. (2014) AnyLogic 7 in Three Days: A Quick Course in Simulation Modeling, AnyLogic North America.
- Borschchev A. (2013) The Big Book of Simulation Modeling. Multimethod Modeling with AnyLogic 6, AnyLogic North America.
- Railsback, S.F., Grimm V. (2011) Agent-Based and Individual-Based Modeling: A Practical Introduction, Princeton University Press.
- Gilbert, N. (2007) Agent-Based Models (Quantitative Applications in the Social Sciences), SAGE Publications.
- Gilbert, N., Troitzsch, K. (2005) Simulation for the Social Scientist, Open University Press.
- Miller J.H., Page, S.E. (2007) Complex Adaptive Systems: An Introduction to Computational Models of Social Life, Princeton University Press.

Cilji in kompetence:

Cilji:

- definirati procesa modeliranja z agenti
- primerjati modeliranja z agenti z alternativnimi in komplementarnimi metodologijami in artikulacija relativnih prednosti in slabosti. Druge metodologije:
sistemska dinamika, simulacija diskretnih dogodkov, teorija iger, statistično modeliranje, analiza tveganja
- utemeljiti, kdaj in zakaj uporabiti modeliranje in simulacijo z agenti
- razložiti, kako zasnovati in razviti simulacije z agenti
- predstaviti način menedžmenta projektov agentnega modeliranja

Objectives and competences:

Objectives:

- define the ABM process
- compare ABM with alternative and complementary methodologies and articulation of the relative strengths and weaknesses. Other methodologies: system dynamics, discrete event simulation, game theory, statistical modeling, risk analysis
- justify when and why to use ABM
- explain how to design and develop simulations ABM
- present methods of ABM project management
- demonstrate the development of ABM with one or two tools
- explain how to perform verification and

- demonstrirati razvoj agentnih modelov z enim ali dvema orodjema
- razložiti, kako izvesti verifikacijo in validacijo modelov
- natančno opredeliti pogloblitve izzive in tehnike zbiranja in priprave/čiščenja podatkov za gradnjo modelov in izvajanje simulacijskih scenarijev
- razložiti postopek analize rezultatov simulacij
- opisati postopek in tehniko predstavitve rezultatov simulacije odločevalcem

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
- uporaba metodoloških orodij, tj. izvajanje, koordiniranje in organiziranje raziskav, uporaba raznih raziskovalnih metod in tehnik ter ocenitev njihove uporabnosti
- usposobljenost za samostojno in avtonomno uporabo, nadzor in vzdrževanje informacijske komunikacijske tehnologije v organizaciji
- sposobnost fleksibilne uporabe znanja v praksi
- poznavanje programskih orodij in metodologij za analizo podatkov ter simulacije diskretnih oziroma zveznih modelov

validation of models

- identify key challenges and techniques for the collection and preparation / cleaning of data for modelling and implementation of simulation scenarios
- explain the process of analyzing the results of simulations
- describe the process and technique of presentation of simulation results to decision makers

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
- use of methodological tools, i.e. implementation, coordination and organisation of research, use of various research methods and techniques and to evaluate their usefulness
- competence for independent and autonomous use, monitoring and maintenance of information communication technology in an institution
- ability to flexibly apply knowledge in practice
- knowledge of programming tools and methodologies for data analysis and simulation of discrete and continuous models

Predvideni študijski rezultati:

Znanje in razumevanje:

Študent/študentka pridobi znanja za:

- agentno modeliranje organizacijskih in socialnih problemov
- analizo vhodnih podatkov, priprava in statistična obdelava
- definicijo kriterijev in dinamično testiranje hipoteze pri izboru rešitve
- analizo zakonitosti delovanja kompleksnih adaptivnih sistemov

Intended learning outcomes:

Knowledge and understanding:

The student has the knowledge of:

- agent based modeling of organizational and social problems
- input data analysis, preparation and statistical processing
- definition of criteria and dynamical hypothesis testing at the solution selection
- analysis of behaviour of complex

adaptive systems

Metode poučevanja in učenja:

- *predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov)*
- *laboratorijske vaje (uporaba simulacijskih orodij)*
- *individualne in skupinske konzultacije (diskusija, dodatna razlaga, obravnava specifičnih vprašanj)*

Learning and teaching methods:

- *lectures with active students' involvement (explanation, discussion, questions, examples, problem solving)*
- *laboratory work (usage of simulation tools)*
- *individual and group consultations (discussions, supplementary explanations, treatment of specific questions)*

Delež (v %) /

Weight (in %) **Assessment:**

Načini ocenjevanja:

Način (pisni izpit, ustno izpraševanje, naloge, projekt):

- pisni/ustni izpit
- empirična seminarska naloga s poročili eksperimentalnih vaj ter predstavitev naloge

50

50

Type (examination, oral, coursework, project):

- written/oral examination
- empirical student assignment with the reports from experimental exercises together with the presentation of the assignment