

UČNI NAČRT PREDMETA / COURSE SYLLABUS**Predmet:** Povezani podatki in tehnologije semantičnega spleta**Course title:** Linked data and sematic web technologies

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Poslovna informatika, magistrski študijski program druge stopnje	-	Prvi ali drugi	Drugi ali tretji
The second cycle masters study programme Business informatics	-	First or second	Second or third

Vrsta predmeta / Course type

Izbirni / Elective

Univerzitetna koda predmeta / University course code:

4-PI-MAG-IP-PPTSS-2022-05-27

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
30	/	30	/	/	90	5

Nosilec predmeta / Lecturer: Doc. dr. Panče Panov / Asst. Prof. Panče Panov, PhD**Jeziki / Predavanja / Lectures:** Slovenski / Angleški**Languages: Vaje / Tutorial:** Slovenski / Angleški**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:****Prerequisites:**

- Za vključitev v delo ni specifičnih pogojev.
- Priporočeno je, da študent pozna osnove računalniškega programiranja in relacijskih podatkovnih baz.
- Pogoj za pristop k izpitu je priprava in zagovor projektne naloge.

- There are no specific requirements for this course.
- It is recommended that the student is familiar with the basics of computer programming and relational databases.
- To attend the exam, a student has to prepare and present a project assignment.

Vsebina:

1. Uvod v povezane podatke:
 - Definicije povezanih podatkov
 - Principi povezovanja podatkov
 - Opisovanje povezanih podatkov
 - Sestava aplikacij, ki uporabljajo povezane podatkov
2. Semantično modeliranje podatkov in tehnologije semantičnega spleta:
 - Uvod v semantično modeliranje podatkov
 - Ekspresivnost pri modeliranju
 - Sklad semantičnih tehnologij
3. Podatkovni model za povezane podatke (Okvir za opisovanje virov – RDF):
 - Osnovni konstrukti RDF modela
 - RDF slovarji
 - RDF grafi
 - Formati zapisa RDF grafov
4. Jezik za povpraševanje na semantičnem spletu (SPARQL):
 - Osnovni konstrukti jezika SPARQL
 - Vprašanja tipa Select
 - Vprašanja tipa Construct
 - Napredne SPARQL funkcije
5. Shema RDFS:
 - Uvod v shemo RDF
 - Razredi
 - Lastnosti
6. Jezik za predstavitev ontologij na spletu (OWL):
 - Osnovni konstrukti jezika OWL
 - Napredna uporaba razredov
 - Napredna uporaba lastnosti
 - Pregled različnih OWL profilov
7. Podatkovne baze za shranjevanje povezanih podatkov
 - Pregled sistemov za upravljanje podatkovnih baz

Content (Syllabus outline):

1. Introduction to linked data:
 - Definitions of linked data
 - The linked data principles
 - Describing linked data
 - Anatomy of a linked data application
2. Semantic data modelling and semantic web technologies:
 - Introduction to semantic data modelling
 - Expressivity in modelling
 - Semantic web technologies stack
3. Data model for linked data (Resource Description Framework - RDF):
 - RDF data model basic constructs
 - RDF vocabularies
 - RDF graphs
 - Serialization of RDF graphs
4. Language for querying the semantic web (SPARQL):
 - SPARQL language basic constructs
 - SPARQL Select queries
 - SPARQL Construct queries
 - SPARQL advanced features
5. RDF Schema:
 - Introduction to the RDF Schema
 - Classes
 - Properties
6. Ontology Web Language (OWL):
 - Basic OWL constructs.
 - Advanced use of classes
 - Advanced use of properties
 - Overview of different OWL profiles
7. Database systems for storing linked data
 - Overview of database management systems
 - Storage and indexing of RDF data
 - Query processing
 - Query federation

<ul style="list-style-type: none"> – Shranjevanje in indeksiranje RDF podatkov – Procesiranje vprašanj – Združevanje vprašanj <p>8. Integracija podatkov v različnih formatih in iz različnih virov RDFa, GRDDL, JSON-LD, CSV, R2RML, LDP</p> <p>9. Primeri uporabe tehnologij semantičnega spleta in povezanih podatkov</p>	<p>8. Integrating data of various formats and different sources:</p> <ul style="list-style-type: none"> – RDFa, GRDDL, JSON-LD, CSV, R2RML, LDP <p>9. Examples of use of semantic web technologies and linked data</p>
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Temeljni literatura in viri / Readings:

<ul style="list-style-type: none"> • Allemang, D., Hendler, J., and Gandon, F. (2020). Semantic Web for the Working Ontologist: Effective Modeling for Linked Data, RDFS, and OWL (3rd. ed.). Association for Computing Machinery, New York, NY, USA. • Wood, D., Zaidman, M., Ruth, L., and Hausenblas, M. (2014). Linked Data: Structured data on the Web. Manning Publications Co. • Curé, O. and Blin, G (2015). RDF Database Systems: Triples Storage and SPARQL Query Processing. Morgan Kaufmann publications • Szeredi, P., Lukácsy, G., Benkő, T., & Nagy, Z. (2014). The Semantic Web Explained: The Technology and Mathematics behind Web 3.0. Cambridge University Press. • Panov, P. Prosojnice iz predavanj in vaj pri predmetu Povezani podatki in tehnologije semantičnega spleta, Moodle, FIŠ.
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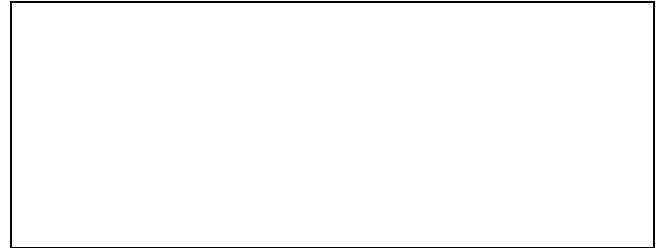
Cilji in kompetence:

<p>Splošne kompetence:</p> <ul style="list-style-type: none"> • Sposobnost pridobivanja, selekcije, ocenjevanja in umeščanja novih informacij in zmožnost njihove interpretacije za reševanje poslovnih problemov • Sposobnost iskanja virov in pridobivanja podatkov za potrebe digitalizacije poslovanja. • Sposobnost fleksibilne uporabe znanja v praksi. <p>Predmetno-specifične kompetence:</p> <ul style="list-style-type: none"> • Sposobnost gradnje podatkovnih množic, ki vsebujejo povezane podatke; • Sposobnost predelovanja povezanih podatkov; • Sposobnost povpraševanja povezanih podatkov;

Objectives and competences:

<p>General competences:</p> <ul style="list-style-type: none"> • The ability to obtain, select, evaluate and embed the new information, as well as to interpret them to solve business problems. • The ability to find sources and obtain data for the needs of digitalization of business. • The ability of flexible usage of knowledge in practice. <p>Subject-specific competences:</p> <ul style="list-style-type: none"> • Ability to construct linked data datasets; • Ability to process linked data; • Ability to query linked data; • Ability to store linked data in RDF databases; • Ability for an independent development of software solutions that deal with linked data.
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- Sposobnost shranjevanja povezanih podatkov v RDF podatkovne baze;
- Sposobnost neodvisnega razvijanja programskih rešitev, ki vključujejo povezane podatke.



Predvideni študijski rezultati:

Intended learning outcomes:

Študenti bodo zmožni:

Students will be able to:

- aplicirati principe za gradnjo povezanih podatkov;
- vrednotiti tehnologije semantičnega spleta, ki se uporabljajo za delo s povezanimi podatki;
- uporabiti različne tehnike in formalizme za predelovanje povezanih podatkov;
- uporabiti različne tehnike in formalizme za povpraševanje množic povezanih podatkov;
- analizirati različne sisteme za upravljanje baz podatkov, ki se uporabljajo za shranjevanje povezanih podatkov;
- načrtovati in izvesti programske rešitve, ki uporabljajo povezane podatke.

- apply the concept of linked data and principles for linked data construction;
- evaluate the set of semantic web technologies used to deal with linked data;
- use the techniques and formalisms for processing linked data;
- use techniques and formalisms for querying linked data;
- analyze different database management systems used for storing linked data; and
- design and implement a software system that uses linked data.

Metode poučevanja in učenja:

Learning and teaching methods:

- *Predavanja z aktivno udeležbo študentov (razlaga, diskusija, vprašanja, primeri, reševanje problemov);*
- *Vaje, kjer študentje na primerih ponovijo temeljne koncepte, predstavljene na predavanjih;*
- *Laboratorijske vaje, kjer se študenti seznanijo s programskimi orodji za procesiranje, povpraševanje in shranjevanje povezanih podatkov.*

- *Lectures with active participations by the students (explanation, discussion, questions, cases, problems solving);*
- *Tutorials, where students will recall, reinforce, and shed light on the concepts and methods introduced at lectures;*
- *Lab work, where students will learn state-of-the-art software processing, querying and storing linked data.*

Načini ocenjevanja:

Delež (v %) / **Assessment:**

Weight (in %)

Način (pisni izpit, ustno izpraševanje, naloge, projekt):		Type (examination, oral, coursework, project):
Pisni izpit	60 %	Written Exam
Projektna naloga	40 %	Project assignment

Reference nosilca / Lecturer's references:

- Tolovski, I., Džeroski, S., Panov, P. (2020). *Semantic annotation of predictive modelling experiments*. In: *Proceedings of 23rd International Conference on Discovery Science, DS 2020, Thessaloniki, Greece, October 19-21, 2020, Lecture notes in computer science Vol. 12323, 124-139* [COBISS.SI-ID 37131267]
- Kostovska, A., Džeroski, S., Panov, P. (2020). *Semantic description of data mining datasets: an ontology-based annotation schema*. In: *Proceedings of 23rd International Conference on Discovery Science, DS 2020, Thessaloniki, Greece, October 19-21, 2020, Lecture notes in computer science Vol. 12323, 140-155*. [COBISS.SI-ID 37133315]
- Kostovska, A., Tolovski, I., Maikore, F., Soldatova, L., Panov, P. (2019). *Neurodegenerative disease data ontology*, In: *Proceedings of 22nd International Conference on Discovery Science DS 2019, Split, Croatia, October 28-30, 2019, Lecture notes in computer science Vol. 11828, 235-245*. [COBISS.SI-ID 32864807]
- Tolovski, I., Kostovska, A., Simidjievski, N., Todorovski, L., Džeroski, S., Panov, P. (2019) *Towards reusable process-based models of dynamical systems : a case study in the domain of aquatic ecosystems*, In: *Proceedings of 42nd International Convention MIPRO 2019, May 20 -24, 2019, Opatija, Croatia, pp. 1110-1115*. [COBISS.SI-ID 32541991]
- Lawrynovicz, A., Esteves, D., Panov, P., Soru, T., Džeroski, S., Vanschoren, J. (2017) *An algorithm, implementation and execution ontology design pattern*. *Studies on the semantic web, vol. 32, 55-68*, IOS Press. [COBISS.SI-ID 31363623]
- Panov, P., Soldatova, L., Džeroski, S. (2016) *Generic ontology of datatypes*, *Information sciences, vol. 329, 900-920*. [COBISS.SI-ID 28796199]
- Soldatova, L., Panov, P., Džeroski, S. (2015) *Ontology engineering : from an art to a craft*, In: *12th International Experiences and Directions Workshop on OW, OWLED, 2015 revised and selected papers, Lecture notes in computer science, vol. 9557, 174-181*. [COBISS.SI-ID 29448231]
- Panov, P., Soldatova, L., Džeroski, S. (2014) *Ontology of core data mining entities*, *Data mining and knowledge discovery, Vol. 28, no. 5/6, 1222-1265*. [COBISS.SI-ID 27814439]
- Panov, P., Soldatova, L., Džeroski, S. (2013) *OntoDM-KDD: ontology for representing the knowledge discovery process*, In: *Proceedings of 16th International Conference on Discovery Science, DS 2013, Singapore, October 6-9, 2013. Lecture notes in computer science vol. 8140, 126-140*. [COBISS.SI-ID 27143207]