



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION

| | |
|-----------------------|-------------------------------------|
| Predmet: | Principi programskih jezikov |
| Subject Title: | Principles of Programming Languages |

| Študijski program Study programme | Študijska smer Study option | Letnik Year | Semester Semester |
|------------------------------------------------------------------------|--------------------------------|----------------|----------------------|
| Enovit magistrski študijski program druge stopnje Predmetni učitelj | | 4. ali 5. | 8. ali 9. |
| Five-year master's degree program Subject Teacher | | 4. ali 5. | 8. ali 9. |

Univerzitetna koda predmeta / University subject code:

| Predavanja Lectures | Seminar Seminar | Seminarske vaje Tutorial | Laborat. vaje Lab work | Terenske vaje Field work | Samostojno delo Individual work | ECTS |
|------------------------|--------------------|-----------------------------|---------------------------|-----------------------------|------------------------------------|------|
| 30 | | 2 | 28 | | 120 | 6 |

Nosilec predmeta / Lecturer:

Jeziki / Languages: Predavanja / Lecture:
Vaje / Tutorial:

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

Prerequisites:

Vsebina:

- Uvod v programske jezike: neformalna definicija programskih jezikov, delitve programskih jezikov, kratka zgodovina programskih jezikov.
- Vrednosti in tipi: delitev tipov, statično in dinamično preverjanje tipov, ekvivalenca tipov, vrste izrazov.
- Pomnilnik: spremenljivka, shranljive vrednosti, življenjska doba spremenljivk, vrste ukazov, izrazi s stranskimi učinki.
- Povezovanje: povezljive vrednosti, statični in dinamični doseg, vrste deklaracij, bločni ukazi in bločni izrazi, kvalifikacijski princip.

Content (Syllabus outline):

- Introduction to programming languages: informal definition of programming languages, classification of programming languages, brief history of programming languages.
- Values and types: type classification, static and dynamic type checking, type equivalence, kind of expressions.
- Storage: variable, storable values, variable lifetime, kind of commands, expressions with side effects.
- Binding: bindable values, static and dynamic scope, kind of declarations, block commands and block expressions, the

- Abstrakcije: princip abstrakcije, vrste abstrakcij, mehanizmi prenosa parametrov, korespondenčni princip, dosledni in normalni izračun.
- Ograjevanje: paketi, abstraktni tipi, objekti in razredi, generični moduli.
- Sistemi tipov: monomorfni in polimorfni sistem tipov, vrste polimorfizma. Generiki v programskem jeziku Kotlin.
- Objektno usmerjeno programiranje: objekt, razred, meta-razred. Razredni objektno usmerjeni jeziki in prototipni objektno usmerjeni jeziki.
- Vrste dedovanja: enkratno/večkratno, razredno/objektno, striktno/nestriktno, urejeno/neurejeno, dinamično/selektivno, običajno/mixin. Vgnezdjeni razredi v programskem jeziku java.
- Funkcijsko programiranje: značilnosti funkcijskih jezikov, uvod v programski jezik lisp/haskell.
- Uvod v programski jezik Kotlin.

- qualification principle.
- Abstractions: abstraction principle, kind of abstractions, parameter passing mechanisms, the correspondence principle, eager and normal evaluation.
- Encapsulation: packages, abstract types, objects and classes, generic modules.
- Type systems: monomorphic and polymorphic type systems, kind of polymorphisms. Kotlin generics.
- Object-Oriented programming: object, class, meta-class. Class-based object-oriented languages and prototype-based object-oriented languages.
- Kinds of inheritance: single/multiple, class-based/object-based, strict/non-strict, ordered/un-ordered, dynamic/selective, ordinary/mixin. Nested Java classes.
- Functional programming: characteristics of functional languages, introduction to Lisp/Haskell programming language.
- Introduction to programming language Kotlin.

Temeljni študijski viri / Textbooks:

- K.C. Louden: *Programming Languages: Principles & Practices*, Third Edition, Cengage Learning, 2013.
- P. Sestoft: *Programming Language Concepts*, Springer, Berlin, 2012.
- D. A. Watt: *Programming Language Design Concepts*, John Wiley, Chichester, 2004.

Cilji:

Cilj tega predmeta je razumevanje osnovnih konceptov programskih jezikov in razumeti bistvene razlike med funkcijskim, proceduralnim in objektno usmerjenim programiranjem.

Objectives:

The objective of this course is to understand the basic concepts of programming languages and to understand essential differences between functional, procedural and object-oriented programming.

Predvideni študijski rezultati:

Znanje in razumevanje:

Po zaključku tega predmeta bo študent sposoben

- identificirati slabosti in prednosti posameznega programskega vzorca,
- izbrati primeren programski jezik za rešitev dane naloge,
- razumeti različne koncepte programskih jezikov,
- identificira koncepte programskih jezikov, s pomočjo katerih se bo hitreje naučil novega programskega jezika
- razume osnovne koncepte funkcijskih jezikov
- uporabljati trenutno aktualne objektno usmerjene jezike (Java, Kotlin, idr.)
- izdelati namizno aplikacijo (Compose Desktop)

Prenosljive/ključne spretnosti in drugi atributi:

- *Spretnosti komuniciranja:* ustni zagovor laboratorijskih vaj, pisno izražanje pri pisnem izpitu.
- *Uporaba informacijske tehnologije:* uporaba različnih prevajalnikov in interpreterjev.
- *Reševanje problemov:* načrtovanje in implementacija programov z uporabo različnih programskih vzorcev.

Intended learning outcomes:

Knowledge and understanding:

On completion of this course the student will be able to

- identify shortcomings and advantages of particular programming language,
- select suitable programming language to solve particular problem,
- understand different concepts of programming languages,
- identify concepts of programming languages with the aim of quickly learning a new programming language
- understands basic concepts of functional programming
- use modern object-oriented programming languages (Java, Kotlin, etc.)
- implement a desktop application (Compose Desktop)

Transferable/Key skills and other attributes:

- *Communication skills:* oral lab work defence, manner of expression at written examination.
- *Use of information technology:* use of different compilers and interpreters.
- *Problem solving:* program design and implementation using different programming paradigms.

Metode poučevanja in učenja:

- predavanja,
- laboratorijske vaje,
-

Teaching and learning methods:

- lectures,
- lab work,
-

| | | Delež (v %) / Weight (in %) | Assessment methods: |
|----------------------------|----|------------------------------------|---------------------|
| Načini ocenjevanja: | | | |
| Sprotni način | 50 | Constant assessment methods | |
| • laboratorijske vaje, | 25 | • lab work, | |
| • 1. kolokvij, | | • 1st midterm examination, | |



| | | |
|----------------|----|----------------------------|
| • 2. kolokvij. | 25 | • 2nd midterm examination. |
|----------------|----|----------------------------|

Opomba:

Kolokvija se lahko nadomestita s pisnim izpitom v deležu 50 %.

Note:

The midterm examinations may be replaced by written exam in the weight of 50%.

Reference nosilca / Lecturer's references:

- LEBER, Žiga, ČREPINŠEK, Matej, MERNIK, Marjan, KOSAR, Tomaž. RNGSGLR: generalization of the context-aware scanning architecture for all character-level context-free languages. Mathematics, ISSN 2227-7390, July 2022, vol. 10, no. 14, 48 str., doi: 10.3390/math10142436. [COBISS.SI-ID 115277827].
- SLIVNIK, Boštjan, KOVAČEVIĆ, Željko, MERNIK, Marjan, KOSAR, Tomaž. On comprehension of genetic programming solutions : a controlled experiment on semantic inference. Mathematics, ISSN 2227-7390, Sep. 2022, vol. 10, iss. 18, str. 1-17, ilustr. <https://www.mdpi.com/2227-7390/10/18/3386>, doi: 10.3390/math10183386. [COBISS.SI-ID 122033411].
- KOSAR, Tomaž, ZHENLI, Lu, MERNIK, Marjan, HORVAT, Marjan, ČREPINŠEK, Matej. A case study on the design and implementation of a platform for hand rehabilitation. Applied sciences, ISSN 2076-3417, 2021, vol. 11, iss. 1, str. 1-21, ilustr., doi: 10.3390/app11010389. [COBISS.SI-ID 45500163].
- KOSAR, Tomaž, GABERC, Sašo, CARVER, Jeffrey C., MERNIK, Marjan. Program comprehension of domain-specific and general-purpose languages: replication of a family of experiments using integrated development environments. Empirical software engineering, ISSN 1382-3256, 2018, vol. 23, iss. 5, str. 2734-2763, doi: 10.1007/s10664-017-9593-2. [COBISS.SI-ID 21123606]
- KOSAR, Tomaž, BOHRA, Sudev, MERNIK, Marjan. A systematic mapping study driven by the margin of error. The Journal of Systems and Software, ISSN 0164-1212. [Print ed.], Oct. 2018, vol. 144, str. 439-449, doi: 10.1016/j.jss.2018.06.078. [COBISS.SI-ID 21580566].