

## Fundamentals of Programming Languages (C003241)

Course size (nominal values; actual values may depend on programme)

Credits 6.0      Study time 165 h      Contact hrs 45.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	Dutch	lecture	30.0 h
		seminar: coached	15.0 h
		exercises	

Lecturers in academic year 2018-2019

Scholliers, Christophe      WE02      lecturer-in-charge

Offered in the following programmes in 2018-2019

	crdts	offering
<a href="#">Master of Science in Computer Science</a>	6	A
<a href="#">Master of Science in Computer Science Engineering</a>	6	A
<a href="#">Master of Science in Computer Science Engineering</a>	6	A

Teaching languages

Dutch

Keywords

programming languages, type systems, operational semantics, lambda calculus

Position of the course

This course introduces the student to the formal study of programming language and the mathematical techniques used for that purpose.

Contents

The courses covers in a formal manner

- syntax
- operational semantics
- type systems
- program analysis based on abstract interpretation a.o.
- the most important properties of syntax, semantics, type systems and related proof methods, including
  - type preservation
  - progress
  - Curry-Howard isomorphism
  - logical relations
  - ...

The study is performed on the basis of the simply typed lambda-calculus and various extensions, such as

- primitive types
- tuples
- records
- sum types
- polymorphism
- ...

Not all topics are covered every year.

Initial competences

Experience with the practical use of a programming language, e.g. by means of the Programming/Programming 1 course.

Knowledge of first order logic and basic mathematical proof techniques such as induction.

## Final competences

- 1 To formalize informal statements about programming languages.
- 2 To prove properties of programming languages.
- 3 To use the most important concepts of type systems and abstract interpretation creatively in new applications.
- 4 To appreciate the formal treatment of programming languages.

## Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

## Conditions for exam contract

This course unit cannot be taken via an exam contract

## Teaching methods

Lecture, seminar: coached exercises

## Extra information on the teaching methods

alternating lectures and exercise sessions

## Learning materials and price

- Types and Programming Languages , Benjamin C. Pierce  
The MIT Press, ISBN 0-262-16209-1, ca. 60 EUR
- course notes, free
- website, free

## References

- Hennessy, M. (1990). The semantics of programming languages. Wiley. <http://www.scss.tcd.ie/Matthew.Hennessy/slexternal/reading.php>
- Winskel, G. (1993). The formal semantics of programming languages. MIT Press.
- Carl Gunter. Semantics of Programming Languages. MIT Press, 1992. (ISBN 0-262-07143-6)
- Robert Harper. Practical Foundations for Programming Languages. Working draft, 2006. (online, as PDF)
- Shriram Krishnamurthi. Programming Languages: Application and Interpretation. (online, as PDF)
- Mitchell, John C.. Foundations for Programming Languages.
- John C. Reynolds. Theories of Programming Languages. Cambridge University Press, 1998. (ISBN 0-521-59414-6)
- Kenneth Slonneger and Barry L. Kurtz. Formal Syntax and Semantics of Programming Languages. Addison-Wesley.
- Robert D. Tennent (1991). Semantics of Programming Languages. Prentice-Hall.
- H. Nielson and F. Nielson (1993) Semantics with Applications. A formal Introduction. Wiley

## Course content-related study coaching

interactive support on the electronic teaching system Minerva (forums, e-mail), appointments for personal support

## Evaluation methods

end-of-term evaluation and continuous assessment

## Examination methods in case of periodic evaluation during the first examination period

Oral examination

## Examination methods in case of periodic evaluation during the second examination period

Oral examination

## Examination methods in case of permanent evaluation

Assignment

## Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

## Calculation of the examination mark

project assignments: 40%

oral exam: 60%

Students can only pass the course if they obtain a grade equal or higher than 10/20.