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Semantics of Programming Languages

Period 1, 5 hp (33% pace)

Instructors
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What is (formal) semantics?

- Semantics concern the *meaning* of a programming language and its constructs.
- Traditionally given in natural language, **but**
  - Complicated behaviour may be difficult or clumsy to express in natural language.
  - Descriptions of some behaviours may unintentionally be omitted – particularly tricky details such as (almost) simultaneous variable use in multi-tasking/threading languages.
- Formal semantics written in a mathematical notation can provide rigour, detail and completeness.

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Some uses of prog. lang. semantics

- Providing a reference for compiler and tool writers.
- Analysing the design of a programming language.
- Developing and validating implementations of programming languages and tools
- Developing and validating implementations of program analysis tools.
- Verifying the correctness of programs.
- Verifying security analyses.
- Useful in connection with abstract machine implementation such as the Java smartcard.

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What you will learn

- to explain and apply formal semantic descriptions of programming languages and other formal languages, particularly using operational semantics
- to construct simple semantic descriptions in operational semantics
- to apply methods to prove basic properties of semantic descriptions

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Relation to other courses

- This course complements the material in the Programming Theory course and is suitable as a companion course.
- Many of the technical methods have general application in computer science.
- The course teaches techniques that can be used to make precise many of the ideas taught in other courses such as
  - Compiler Design
  - Language Abstractions for Concurrent and Parallel Programming

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Course setup

- There will be no regular lectures other than an introductory lecture
- Groups meet twice a week in seminars to discuss and present a section of the course book, work through examples etc.
- Students should *prepare carefully* before each seminar by reading the course book and working through examples and exercises. ("Flipped classroom light.")
- No written exam. Students make several short presentations to the instructor to show their understanding of the course.