Advanced compiler construction

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Summary
Students learn several implementation techniques for modern functional and object-oriented programming languages. They put some of them into practice by developing key parts of a compiler and run time system for a simple functional programming language.

Content
Part 1: implementation of high-level concepts
- functional languages: closures, continuations, tail call elimination,
- object-oriented languages: object layout, method dispatch, membership test.

Part 2: optimizations
- compiler intermediate representations (RTL, SSA, CPS),
- inlining and simple optimizations,
- register allocation,
- instruction scheduling.

Part 3: run time support
- interpreters and virtual machines,
- memory management (including garbage collection).

Keywords
compilation, programming languages, functional programming languages, object-oriented programming languages, code optimization, register allocation, garbage collection, virtual machines, interpreters, Scala.

Learning Prerequisites
Recommended courses
Computer language processing

Important concepts to start the course
Excellent knowledge of Scala and C programming languages

Learning Outcomes
By the end of the course, the student must be able to:

• Assess / Evaluate the quality of a compiler intermediate representation
• Design compilers and run time systems for object-oriented and functional programming languages
• Implement rewriting-based compiler optimizations
• Implement efficient virtual machines and interpreters
• Implement mark and sweep or copying garbage collectors

Teaching methods
Ex Cathedra, mini-project

Assessment methods
Continuous control (mini-project 80%, final exam 20%)

Supervision
Office hours  No
Assistants  Yes
Forum  Yes

Resources
Virtual desktop infrastructure (VDI)
No

Websites
• https://cs420.epfl.ch/