

I073	Static program analysis	L	P	S	ECTS 6
		2	1	1	

**Course objectives.** Introduce students with concepts of program analysis. Understanding the four basic approaches in program analysis: constraint-based analysis, abstract interpretation, type and effect systems and data-flow analysis.

**Prerequisites.** Bachelor in Computer Science.

**Course content.**

1. Introduction. Different type analysis. Lattice theory.
2. Dataflow analysis with monotone frameworks. Intraprocedural analysis.
3. Constraint based analysis. Safety (best safe result). Semantic correctness. Coinduction. Tarski theorem.
4. Abstract interpretation. Data flow analysis and constraint based analysis. Galois connections. Systematic design of Galois connections. Induced operations.
5. Type and Effect Systems: constrained based analysis. Semantic correctness. Soundness. Completeness.
6. Algorithms for data flow analysis and constraint based analysis. Techniques for solving the system of inequalities.

**LEARNING OUTCOMES**

No.	LEARNING OUTCOMES
1.	Understanding different approaches in program analysis.
2.	Being able to apply data-flow analysis approach.
3.	Being able to apply constraint based analysis.
4.	Understanding abstract interpretation approach in program analysis.
5.	Understanding types and effect systems approach in program analysis.

**RELATING THE LEARNING OUTCOMES, ORGANIZATION OF THE EDUCATIONAL PROCESS AND ASSESSMENT OF THE LEARNING OUTCOMES**

TEACHING ACTIVITY	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	POINTS	
					min	max
Attending lectures and exercises	1	1-5	Lecture attendance, discussion, teams work, independent work on given tasks and short written exams	Attendance lists, tracking activities, closed form exercises	0	4
Homework assignments	1	1-5	Independent work on given problems	Evaluation	0	4
Written exam (Mid-terms)	2	1-5	Preparing for written exam	Evaluation	25	46
Final exam	2	1-5	Revision	Oral exam	25	46

TOTAL	6				50	100
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**Teaching methods and student assessment.** Lectures and exercises are obligatory. The exam consists of a written and an oral part. Upon completion of the course, students can take the exam. Successful midterm exam scores replace the written exam. Exercises are both auditory and laboratory. Laboratory exercises include the usage of computers. Students can improve their grades by writing homework assignments and seminars.

**Can the course be taught in English:** Yes

**Basic literature:**

1. F. Nielson, H. R. Nielson, C. Hankin, Principles of Program Analysis, Springer Verlag, 1999.
2. A. Moller, M.I. Schwartzbach, Static Program Analysis, Aarhus University (lecture notes), 2018.  
<https://cs.au.dk/~amoeller/spa/spa.pdf>

**Recommended literature:**

1. B. Milewski, Category Theory for Programmers, series of blog posts by Bartosz Milewski  
(<https://github.com/hmemcpy/milewski-ctfp-pdf>)