

Algorithms and Theory (ALT)

Our local faculty

Chris Brzuska

Corinna Coupette

Tommi Junttila

Petteri Kaski

Barbara Keller

Sándor Kisfaludi-Bak

Russell W. F. Lai

Pekka Orponen

Alexandru Pălar

Jussi Rintanen

Jukka Suomela

Jara Uitto

algorithms.fi

Introductions

- Me: Jara Uitto, ALT track responsible
 - I teach PAT, CS-E3190 and Combinatorics of computation (period V)
 - Studied at HY and ETH
 - My favorite topic: Combinators – seem to be useful everywhere
- Who are you?
 - Background?
 - Favorite topic?
 - If you were an animal, which one?

Helsinki Algorithms Community

HALT Helsinki Algorithms & Theory

algorithms.fi

Research

*We are researchers who build the foundations of the modern computerized and networked world. We design and implement fast and reliable algorithms. We explore new kinds of computational settings and study the fundamental limitations of **what can be computed efficiently**.*

Current activities

Helsinki Algorithms & Theory Days · August 28–29, 2025

HIIT Foundations Friday · monthly, on Fridays at 11.15

HIIT Frontier Friday · monthly, on Fridays at 11.00

Helsinki CS Theory Seminar · weekly, on Wednesdays at 14.15

Helsinki Logic Seminar · weekly, on Wednesdays at 12.00

Who?

- Anyone interested in **mathematics** of algorithms and automated reasoning
- Anyone interested in the advanced design, analysis, and applications of **algorithms**
- **Programmers** who *really* want to understand the computer — from individual logic/quantum gates to top-tier supercomputers
- Anyone interested in a **research career** in academia, industry, or public service

Why?

- Curriculum grounded in **leading-edge research** at the department
- Algorithms are part of the critical infrastructure driving **science**, **technology**, and **society**
- Understand the **foundations** and learn to push the **frontiers** of new technologies (e.g. quantum computing, cryptography)
- Fundamentals withstand the **test of time** (e.g. Euclid's algorithm, a key element of modern cryptography, dates back more than 2000 years)

Discussion: Formal Verification

- Are programming skills useful anymore?
- Who knows what AI generated code does?
- Can we verify it?
 - Would be cool if we could!
- Can AI produce code and a proof that the code works?

Course Selection

Code	Course name	ECTS	Teaching
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Compulsory CS core courses, 15 ECTS

For Algorithms and Theory (ALT) study track

CS-E3190	Principles of Algorithmic Techniques	5	I-II/1st year
CS-E3220	Declarative Programming	5	I-II/1st year
CS-E4700	Logic and Hard Computational Problems	5	I-II/1st year

Choose at least 10 ECTS

Computer Science core courses

CS-C3170	Web Software Development	5	I-II, III-V, summer/1st year
CS-C3130	Information Security	5	I/1st year
CS-E4190	Cloud Software and Systems	5	I-II/1st year
CS-E4715	Supervised Machine Learning	5	I-II/1st year
ELEC-E7852	Computational Design and Interaction	5	II/1st year
CS-C3100	Computer Graphics	5	2026-2027: no teaching, 2027-2028: I-II
CS-E4780	Scalable Systems and Data Management	5	I-II/1st year

Choose at least 15 ECTS

Algorithms and Theory (ALT): Track courses

CS-E4340	Cryptography	5	I-II
CS-E4370	Applied Cryptography	5	III-IV
CS-E4500	Advanced Course in Algorithms	5	III-IV
CS-E4510	Distributed Algorithms	5	I-II
CS-E4530	Computational Complexity Theory	5	III-IV
CS-E4800	Artificial Intelligence	5	III-IV
CS-E4720	Computational Geometry	5	III-IV
CS-C3260	Practical Quantum Computing	5	I-II
CS-E5485	Algorithms and Society	5	2026-2027: no teaching, 2027-2028: I

- Try to get compulsory done asap
- CS core intended to give glimpse outside of just algorithms
- Track courses are hopefully fun with algorithms
 - I am responsible for accepting exceptions

<https://www.aalto.fi/en/programmes/masters-programme-in-computer-communication-and-information-sciences/curriculum-2026-2028>

Community and events

- **Helsinki Algorithms and Theory (HALT) research community**
 - Website: <https://algorithms.fi>
 - Community Slack space: <https://aaltoalc.slack.com>
 - Email list: <https://list.aalto.fi/mailman/listinfo/cstheory-seminar>
- Regular events
 - Puzzle and Pizza Night (monthly, next: Wed 7 Sept)
 - [Helsinki CS Theory Seminar](#) (weekly, Wednesdays)
 - [HIIT Frontier Friday](#) (monthly, TBA)
 - [HIIT Foundations Friday](#) (monthly, TBA)
 - [Helsinki Algorithms and Theory Days](#) (annual, next: Thu 27–28 Aug)

Puzzle and Pizza Night:

 +  = NP-Hard to Resist

“Tired of reducing every problem to SAT? Ready to tackle solvable puzzles with your friends? Join us for **Puzzle & Pizza Night**—where the toppings are plentiful, the puzzles are tricky, and the runtime is only bounded by the opening hours of the CS-Building. Whether you’re into graph theory, combinatorics, or just combin(ing) mozzarella with tomato, this event is designed for optimal enjoyment. Come hungry. Leave puzzled.”

 **Location:** CS Building Room A123

 **Time:** 7th September 18:00

 **Audience:** Computer Science students interested in mingling with peers and puzzles

FAQ: Theses

- Not relevant just yet but once you start thinking about a Master's thesis and how to get a topic
 - Just be in contact directly!
 - Become a TA
 - Summer internships

Summary

- **Helsinki Algorithms and Theory (HALT)** research community
 - Community Slack space: [#alc2025](https://aaltoalc.slack.com)
- **Algorithms, Logic, and Computation** track [curriculum 2024–26](#)
 - **Personal Study Plan (“HOPS”)** — compact/long major (40/60 ECTS)
 - Contact points for track
 - Study coordinator **Meeri Heimo** and planning officer **Anu Kuusela** (studentservices@aalto.fi, appointments via [MyStudies](#))
 - Track responsible professor **Jara Uitto** (appointments via [MyStudies](#))
- [Starting your studies page](#) at the School of Science
- **Puzzle and Pizza Night: 7 Sept 18:00 CS Building Room A123**

Now?

- An example puzzle
 - Find an oriented 3-cycle in an oriented complete graph
- Natural numbers game?
 - <https://adam.math.hhu.de/#/g/leanprover-community/nng4>