T065001: Introduction to Formal Languages

(Kyoto University, Spring 2025)

Course goals:

After completing this course, the student should be able to:

- Explain the relationships between different classes of formal languages, automata, and grammars.

- Design an automaton or a grammar that accepts or generates a specified formal language, and conversely, determine the formal language that is accepted or generated by a specified automaton or grammar.

- Prove or disprove mathematical properties of formal languages, grammars, and automata.

- Use the diagonalization method or reductions to establish that certain languages are undecidable.

Prerequisite:

- An ability to think abstractly and to solve problems of a mathematical nature.

Lecturer:

- Dr. Jesper Jansson
  Office: Main Campus, Research Building No. 7, room 334
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Textbook:

- M. Sipser: "Introduction to the Theory of Computation, Third Edition", Cengage Learning, 2012. ISBN-13: 978-1133187790.

Assessment:

- A written examination at the end of the course.

Schedule:

- The lectures and the final examination will be held on Mondays, period 1 (8:45 a.m. - 10:15 a.m.) in: Seminar room 21, ILAS Building.
  Note that the last lecture has been rescheduled to 2025-07-17, which is a Thursday.

Date	Topic	Readings
2025-04-14	Introduction	Chapter 0
2025-04-21	Finite-state automata, regular languages, nondeterminism (1)	Chapter 1.1
2025-04-28	Finite-state automata, regular languages, nondeterminism (2)	Chapter 1.2
2025-05-05	*No lecture* (public holiday)	---
2025-05-12	Finite-state automata, regular languages, nondeterminism (3)	Chapter 1.3
2025-05-19	Finite-state automata, regular languages, nondeterminism (4)	Chapter 1.4
2025-05-26	Pushdown automata, context-free languages, grammars (1)	Chapter 2.1
2025-06-02	Pushdown automata, context-free languages, grammars (2)	Chapter 2.2
2025-06-09	Pushdown automata, context-free languages, grammars (3)	Chapter 2.3
2025-06-16	Turing machines (1)	Chapter 3.1
2025-06-23	Turing machines (2)	Chapters 3.2 - 3.3
2025-06-30	Decidability	Chapter 4
2025-07-07	Reducibility (1)	Chapter 5.1
2025-07-14	Reducibility (2)	Chapters 5.2 - 5.3
2025-07-17	Course summary	All chapters above
2025-07-21	*No lecture* (public holiday)	---
2025-07-28	Final examination	All chapters above
2025-08-04	Feedback	All chapters above