Lecture 0 — Introduction

CSE205: Theory of Computation

Minseok Jeon

2026 Fall

Basic Information

Instructor: Minseok Jeon

- **Position:** Assistant professor in EECS, DGIST
- **Expertise:** Programming Languages
- **Office:** 211 E7 Bldg.
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- **Office Hours:** 9:00am–11:59am Mondays (by appointment)

TAs:

- Sanggyu Oh (sg549@dgist.ac.kr)
- D-TO

Course slides will be uploaded to:

- LMS
- https://dgistpl.github.io/courses/cse205/2026/

Goal of This Course

In this course, you will learn the most fundamental ideas in computer science:

- What is a computer?
- What is the unique characteristic of computers?
- What *can* be done by a digital computer?
- What *cannot* be done by a digital computer?

We answer these questions with precise mathematical models of computation.

RoadMap: Towards Understanding Turing Machines

We study three families of computational models of increasing power:

- **Finite Automata**
  - Regular expressions and languages
  - Applications: text search, pattern matching, lexical analysis
- **Pushdown Automata**
  - Context-free languages and grammars
  - Applications: compilers, programming languages, natural language processing
- **Turing Machines**
  - Decidability, the universal Turing machine
  - The ultimate model of what is computable

Overview

- **Part 0:** basic concepts, mathematical backgrounds.
- **Part 1:** finite automata (DFA, NFA), equivalence, regular languages, regular expressions, regular grammars, closure properties, the pumping lemma.
- **Part 2:** context-free grammars and languages, parsing and ambiguity, normal forms, pushdown automata, deterministic PDA, pumping lemma for CFLs, closure properties, decision algorithms.
- **Part 3:** Turing machines, Turing's thesis, variations of Turing machines, nondeterministic and universal Turing machines, recursively enumerable languages, computability, decidability, the halting problem, reduction, complexity, P/NP.

Course Materials

- Self-contained slides will be provided.
- Reference:
  - J. E. Hopcroft, R. Motwani, J. D. Ullman. *Introduction to Automata Theory, Languages, and Computation.* Third edition.

Grading

- Midterm exam (in class) — 45%
- Final exam (in class) — 45%
- Attendance and participation — 10%

Schedule (tentative)

Week 1	Introduction
Week 2	Finite Automata
Week 3	Regular Languages
Week 4	Properties of Regular Languages
Week 5	Context-free Languages
Week 6	Simplifications and Normal Forms
Week 7	Pushdown Automata
Week 8	Midterm exam
Week 9	Properties of Context-free Languages
Week 10	Turing Machines
Week 11	Other Models of Turing Machines
Week 12	A Hierarchy of Formal Languages
Week 13	Limits of Algorithmic Computation
Week 14	(optional) Computational Complexity
Week 15	TBD
Week 16	Final exam