

# AAA528: Computational Logic

## Lecture 0 — Course Overview

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# Basic Information

Instructor: Hakjoo Oh

- **Position:** Professor in CS, Korea University
- **Expertise:** Software Analysis, Programming Languages
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- **Office Hours:** by appointment

# About This Course

- *Computational logic*
  - ▶ Logic for reasoning about program behavior
  - ▶ Why study logic?
    - ★ Logic is the mathematical basis of software
    - ★ Just as calculus is the basis of science and engineering
    - ★ Used for designing, implementing, and verifying software
- *Program verification*
  - ▶ Techniques for proving that programs meet their specifications

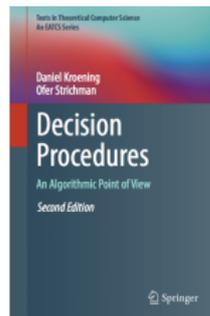
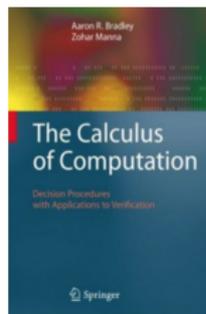
# Topics

Computational logic and its application to program verification.

- Propositional logic
- First-order logic
- First-order theories
- Program verification

# Course Materials

- Aaron R. Bradley and Zohar Manna. The Calculus of Computation. Springer
- Daniel Kroening and Ofer Strichman. Decision Procedures. Springer



- Materials from related courses:
  - ▶ Computer-Aided Reasoning for Software. Univ. of Washington  
<https://courses.cs.washington.edu/courses/cse507/17wi/>
  - ▶ Automated Logical Reasoning. Univ. of Texas at Austin  
<http://www.cs.utexas.edu/~isil/cs389L/>

## Schedule (tentative)

Weeks	Topics
Week 1 (3/3, 3/5)	OCaml Programming (online lecture videos)
Week 2 (3/10, 3/12)	Propositional Logic
Week 3 (3/17, 3/19)	First-order Logic and Theories
Week 4 (3/24, 3/26)	SAT/SMT Solvers
Week 5 (3/31, 4/2)	Program Verification (Partial Correctness)
Week 6 (4/7, 4/9)	Program Verification (Total Correctness)
Week 7 (4/14, 4/16)	Automated Invariant Inference
Week 8 (6/2)	Project Presentation (online)

# Grading (tentative)

- Programming project – 80%
  - ▶ The goal is to implement a program verifier with automated invariant inference.
  - ▶ Implementation will be done in OCaml (<https://ocaml.org>).
  - ▶ Detailed specifications will be provided during the lectures.
- Attendance – 20%
  - ▶ Attendance is mandatory for every class. Unapproved absences may result in an F.

# TODO

Install Z3 on your machine.

- <https://github.com/Z3Prover/z3>
- A tutorial in Python:  
<https://ericpony.github.io/z3py-tutorial/guide-examples.htm>