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

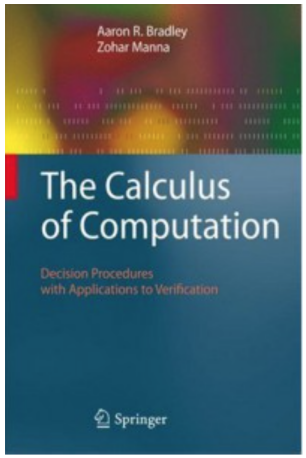
Topics

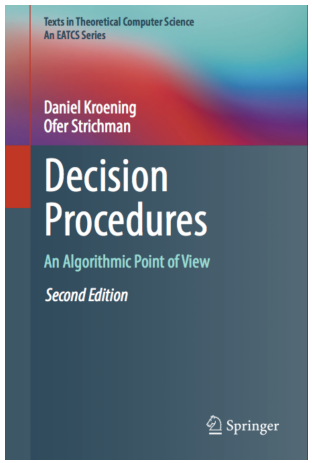
Computational logic and its application to program verification.

- 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)

8 lectures + 5 hands-on sessions + 2 exams

Weeks	Topics
Week 1	Introduction
Week 2	Propositional Logic
Week 3	First-order Logic
Week 4	First-order Logic
Week 5	First-order Theories
Week 6	SMT Solvers
Week 7	Mid-term exam
Week 8	Program Verification
Week 9	Program Verification
Week 10	Program Verification
Week 11	Invariant Generation
Week 12	Invariant Generation
Week 13	Temporal Logic
Week 14	Temporal Logic
Week 15	Final exam

Grading (tentative)

- Quiz (hands-on sessions) – 40%
  - Implementing a SAT solver
  - Z3 tutorial
  - SAT/SMT application 1 (boolean function synthesis)
  - SAT/SMT application 2 (bounded model checking)
  - Program verification
- Mid-term exam – 20%
- Final exam – 20%
- Attendance – 10%
  - 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`