

IA008: Computational Logic

Introduction

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Why Logic?

Logics are formal languages to make statements about mathematical objects.

They are used everywhere in computer science:

- ▶ databases (SQL)
- ▶ regular expressions
- ▶ software verification, hardware verification
- ▶ controller synthesis
- ▶ type systems
- ▶ SAT-solvers (optimisation)
- ▶ theorem provers

Basic logic problems

Model Checking

Given a model \mathfrak{M} and a formula φ , check whether $\mathfrak{M} \models \varphi$.

Satisfiability

Given a formula φ , check whether there is some model \mathfrak{M} with $\mathfrak{M} \models \varphi$.

Course organisation

Lectures

- ▶ **Tuesday, 10:00, A318**
- ▶ language: English
- ▶ slides and video recordings will be available in IS

Exercise classes

- ▶ exercises done by students
- ▶ come prepared

Examination

- ▶ final written exam (probably online)
- ▶ in English
- ▶ **k** and **z** completion possible

Prerequisites

- ▶ basic knowledge of logic
- ▶ propositional and first-order logic
- ▶ formula, model, satisfaction relation, entailment relation
- ▶ syntactic normal forms

Topics covered

- ▶ propositional logic, resolution
- ▶ first-order logic, proof calculi (tableaux and natural deduction)
- ▶ Prolog, databases
- ▶ expressive power, back-and-forth arguments
- ▶ modal logic
- ▶ induction
- ▶ many-valued logic (if time permits)