

IA008: Computational Logic

Introduction

Achim Blumensath

blumens@fi.muni.cz

Faculty of Informatics, Masaryk University, Brno

Why Logic?

Logics are formal languages to make statements about mathematical objects.

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

Basic logic problems

Model Checking

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

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)