

# IAoo8: Computational Logic

## Introduction

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# Why Logic?

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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

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

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## Satisfiability

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

# Course organisation

## Lectures

- ▶ **Thursday, 16:00, A318**
- ▶ language: English
- ▶ slides and video recordings will be available in IS

## Exercise classes

- ▶ exercises done by students
- ▶ come prepared

## Examination

- ▶ final written exam
- ▶ 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)