Institute for Symbolic Artificial Intelligence

Martina Seidl (Head of Institute)

Postdocs
Max Heisinger
Clemens Hofstadler
Meena Leemhuis (TT Prof.)
Adrian Rebola-Prado

PhD Students
Sidhant Bhavnani
Simone Heisinger
David Kattermann
Tereso del Rio Almajano
Cynthia Peyrer
Peter Pfeiffer
Paul Seip

JOHANNES KEPLER
UNIVERSITÄT LINZ

The Institute

- **Homepage:** *https://www.jku.at/institut-fuer-symbolic-artificial-intelligence/*
- **Where you know us from**
  - Logic
  - Formal Models

- ***Our research interests***
  - Symbolic reasoning techniques for logic, e.g., SAT, QBF
  - Solving problems with logic
  - Combining learning with reasoning
  - Educational games

Bachelor Thesis

Type of the thesis (depends on topic):

- Practical with implementation / tool evaluation
- Theory only
- Literature study /survey
- …

Procedure (no fixed starting date):

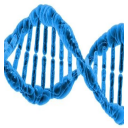
- Select topic from http://teaching.pages.sai.jku.at/thesis-starters/
- Make individual appointment with supervisor
- Discuss your interests & potential topics (literature is provided)
- Choose concrete topic
- Agree upon milestones and schedule
- Produce content (regular meetings with supervisor)
- Write up thesis

Symbolic Reasoning

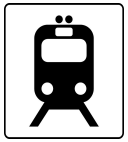

Planning


Security


Verification


Bio-Informatics

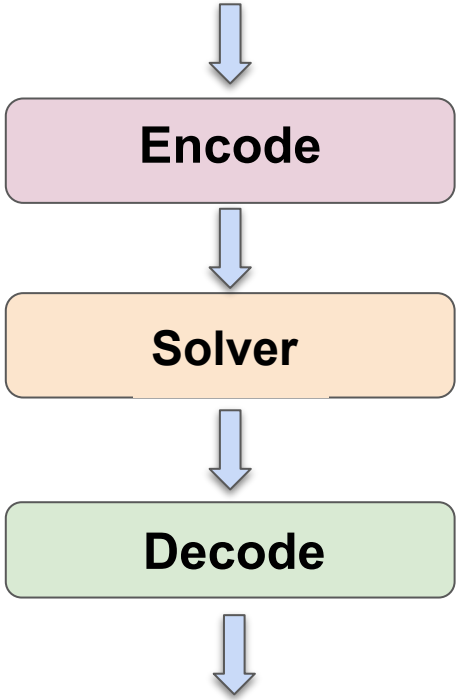

Games


Safety


Code Repair


Logistics

...



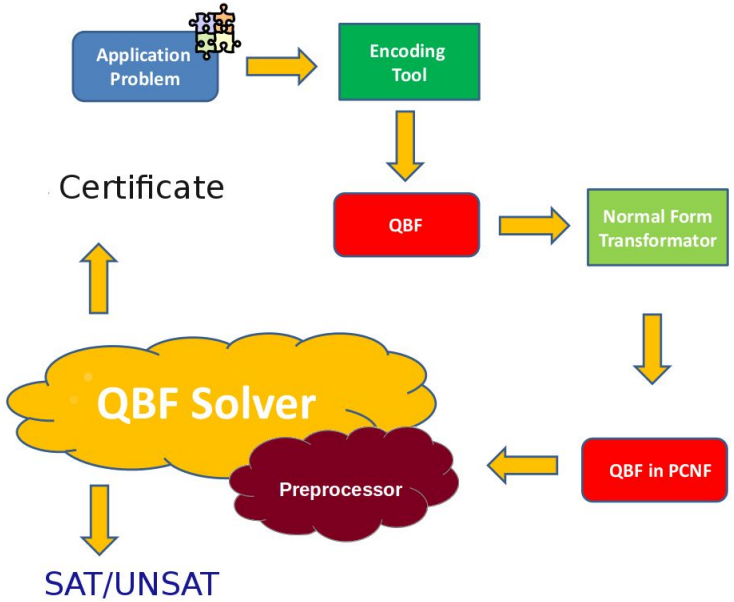
Reasoning Beyond SAT

Quantified Boolean Formulas = Propositional Logic + Quantifiers

⇒ more succinct problem encodings
⇒ more challenging to solve

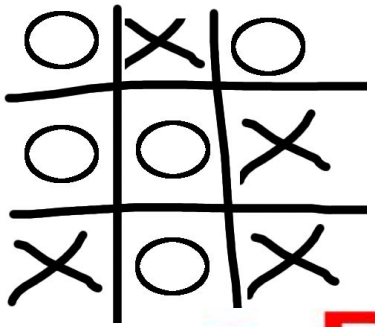
Tasks

- Evaluate & tune solvers
- Develop novel formula simplification techniques
- Generate proofs & certify results
- Count solutions



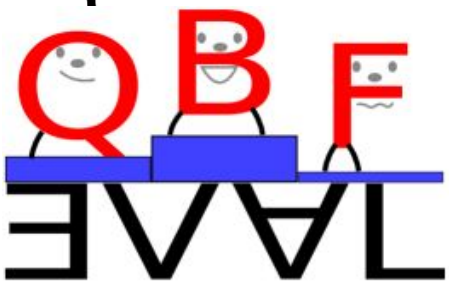
Encodings for Planning in SAT/QBF

1. Formulate planning problems in SAT or QBF
   Example: find a winning strategy for TicTacToe
   (if there is any)
2. Solve them with SAT or QBF solvers



Tasks

- Generate problem encodings
- Evaluate state-of-the-art tools on new encodings
- Tune encodings
- Contribute benchmarks to tool competitions



Supervised by Mena Leemhuis

Welcome to Iltis

An interactive, webbased system for learning formal foundations of computer science

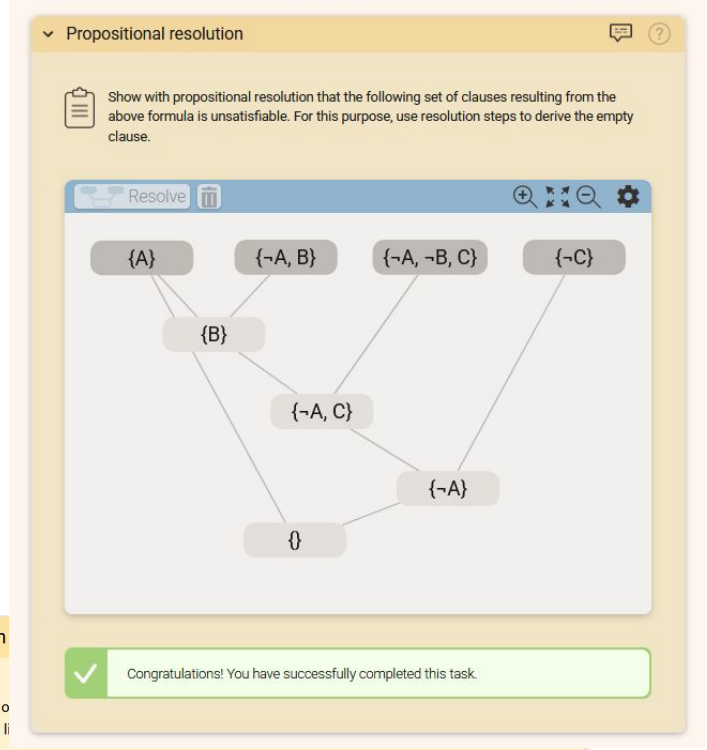
https://iltis.rub.de/

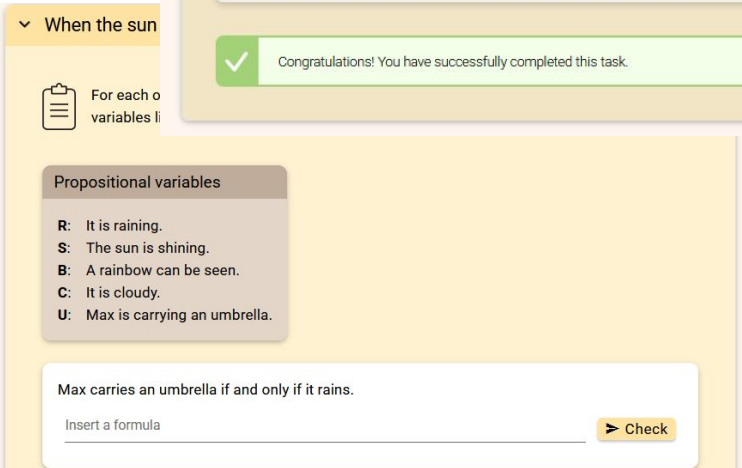
Possible to extend given tasks or model an entirely new class of tasks

explain users' mistakes and give helpful hints

Possible thesis topic: Extending the system with new exercises

Connection of symbolic approaches with explanation techniques





(Selection of) Possible Concrete Topics

- Potential projects directions:
  - Encoding of some reasoning problem (e.g., solving a puzzle) as logical formula
  - Evaluation and comparison of reasoning tools
  - Implementation of (a part of) a solver / reasoning tool
  - Connection of reasoning with learning techniques (BILAI Project)
  - Neuo-Symbolic AI

- Example topics can be found here: http://teaching.pages.sai.jku.at/thesis-starters/
  - The webpage will be updated on a regular basis
  - Not all topics are shown on the webpage

- General information: **Contact us!**

Questions?