universität innsbruck

supported by FWF project I 5943-N

ARI: Past, Present, Future

Aart Middeldorp

University of Innsbruck

Outline

1. **Past, Present, Future**
2. **Final Remarks**
3. **ISR 2024**

Outline

1. **Past, Present, Future**
2. **Final Remarks**
3. **ISR 2024**

Austria – Japan joint project about development of infrastructure for software tools that aim to automatically (dis)prove confluence, termination and related properties in variety of rewrite formalisms, in connecton with Confluence Competition (CoCo) and Termination and Complexity Competition (termCOMP)

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A To develop infrastructure to support the confluence and termination communities (including tool authors, competition organizers, and general researchers). Starting from the existing infrastructure for CoCo (including the Confluence Problems Database COPS and the community-serving web front end CoCoWeb), we will develop a collection of robust software tools for evaluating confluence, termination and complexity methods and tools.

Austria – Japan joint project about development of infrastructure for software tools that aim to automatically (dis)prove confluence, termination and related properties in variety of rewrite formalisms, in connecton with Confluence Competition (CoCo) and Termination and Complexity Competition (termCOMP)

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B To make tools participating in CoCo more reliable by formalizing techniques in the proof assistant Isabelle/HOL such that more (dis)proofs produced by the tools can be certified, in particular for the commutation and infeasibility categories.

Austria – Japan joint project about development of infrastructure for software tools that aim to automatically (dis)prove confluence, termination and related properties in variety of rewrite formalisms, in connecton with Confluence Competition (CoCo) and Termination and Complexity Competition (termCOMP)

- **A** To develop infrastructure to support the confluence and termination communities (including tool authors, competition organizers, and general researchers). Starting from the existing infrastructure for CoCo (including the Confluence Problems Database COPS and the community-serving web front end CoCoWeb), we will develop a collection of robust software tools for evaluating confluence, termination and complexity methods and tools.
- **B** To make tools participating in CoCo more reliable by formalizing techniques in the proof assistant Isabelle/HOL such that more (dis)proofs produced by the tools can be certified, in particular for the commutation and infeasibility categories.
- **C** To develop confluence and induction proving techniques for logically constrained rewrite systems (LCTRSs), a very expressive rewrite formalism in which rules are equipped with logical constraints which are checked by powerful SMT solvers.

Task A: Infrastructure

① problem format

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- ARI formats for TRS / CTRS / CSCTRS / MSTRS / LCTRS / multiple-TRS / INF

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- conversion tool between COPS and ARI

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? higher-order format(s)

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- ? higher-order format(s)
- adoption of ARI format by termCOMP

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- conversion tool between COPS and ARI
- ? higher-order format(s)
- adoption of ARI format by termCOMP
- presentation by Akihisa on Thursday

Task A: Infrastructure

① problem format

② duplicate checking

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- duplicate checking for TRS / CTRS / CSCTRS

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- ▸ duplicate checking for TRS / CTRS / CSCTRS
- ? MSTRS / LCTRS / multiple-TRS / INF
- ? complexity

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- ▸ duplicate checking for TRS / CTRS / CSCTRS
- ? MSTRS / LCTRS / multiple-TRS / INF
- ? complexity
- ▸ presentation by Nao today

Task A: Infrastructure

① problem format

② duplicate checking

③ tagging and query interface

Task A: Infrastructure

① problem format

② duplicate checking

③ tagging and query interface

- various tools for tagging

Task A: Infrastructure

① problem format

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- query interface for tags

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? querying meta information

Task A: Infrastructure

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? querying meta information

? certified tags

Task A: Infrastructure

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④ LiveView

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? reimplementation based on current limitations and future developments

? automation for generation of test runs and problem selection

? automation of data export from StarExec for result tables

Task A: Infrastructure

① problem format

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④ LiveView

? reimplementation based on current limitations and future developments

? automation for generation of test runs and problem selection

? automation of data export from StarExec for result tables

▸ presentation by Fabian on Thursday

Task A: Infrastructure

① problem format

② duplicate checking

③ tagging and query interface

④ LiveView

⑤ StarExec and CoCoWeb

Task A: Infrastructure

① problem format

② duplicate checking

③ tagging and query interface

④ LiveView

⑤ StarExec and CoCoWeb

? automation of tool export to CoCoWeb

? preselection of tools in CoCoWeb based on input problem

Task A: Infrastructure

① problem format

② duplicate checking

③ tagging and query interface

④ LiveView

⑤ StarExec and CoCoWeb

? automation of tool export to CoCoWeb

? preselection of tools in CoCoWeb based on input problem

? StarExec will be decommissioned in 2026

Task A: Infrastructure

① problem format

② duplicate checking

③ tagging and query interface

④ LiveView

⑤ StarExec and CoCoWeb

⑥ equivalence of rewrite systems

Task B : Formalization and Certification

① commutation

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- (almost) development closed critical pairs (ITP 2023)

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- parallel critical pairs (CPP 2024)

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- (almost) development closed critical pairs (ITP 2023)
- parallel critical pairs (CPP 2024)
- certification for ACP, CSI, Hakusan

Task B : Formalization and Certification

① commutation

② infeasibility

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② infeasibility

- presentations by Dohan, Teppei, René on Thursday

Task B : Formalization and Certification

① commutation

② infeasibility

- ▸ presentations by Dohan, Teppei, René on Thursday
- ? certification for CO3, NaTT, Toma

Task B : Formalization and Certification

① commutation

② infeasibility

③ CPF format

Task B : Formalization and Certification

① commutation

② infeasibility

③ CPF format

- presentation by René on Thursday

Task B : Formalization and Certification

① commutation

② infeasibility

③ CPF format

④ formalization and certification for TRS / CTRS / GCR categories

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① commutation

② infeasibility

③ CPF format

④ formalization and certification for TRS / CTRS / GCR categories

- ▸ presentation by Dohan on Thursday
- ? certification for AGCP, CO3

Task C: Logically Constrained Rewrite Systems

① confluence

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① confluence

- strongly closed and (almost) parallel closed critical pairs (CADE 2023)

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- presentation by Jonas on Wednesday

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? labeling techniques

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① confluence

② implementation in CtrL

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- new tool for LCTRSs: CREST

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? LCTRS tool by Nagoya team

Task C: Logically Constrained Rewrite Systems

① confluence

② implementation in CtrL

③ rewriting induction

Task C: Logically Constrained Rewrite Systems

① confluence

② implementation in CtrL

③ rewriting induction

? rewriting induction for non-terminating LCTRSs

Task C: Logically Constrained Rewrite Systems

① confluence

② implementation in CtrL

③ rewriting induction

④ LCTRS category for CoCo

Task C: Logically Constrained Rewrite Systems

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④ LCTRS category for CoCo

- format and category for CoCo 2024 are fixed

Task C: Logically Constrained Rewrite Systems

① confluence

② implementation in CtrL

③ rewriting induction

④ LCTRS category for CoCo

- ▸ format and category for CoCo 2024 are fixed
- ? more LCTRSs in ARI database

Task C: Logically Constrained Rewrite Systems

① confluence

② implementation in CtrL

③ rewriting induction

④ LCTRS category for CoCo

- ▸ format and category for CoCo 2024 are fixed
- ? more LCTRSs in ARI database
- ? more confluence tools for LCTRSs

Task C: Logically Constrained Rewrite Systems

① confluence

② implementation in CtrL

③ rewriting induction

④ LCTRS category for CoCo

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① confluence

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④ LCTRS category for CoCo

- semantics of LCTRSs

Task C: Logically Constrained Rewrite Systems

① confluence

② implementation in CtrL

③ rewriting induction

④ LCTRS category for CoCo

- semantics of LCTRSs
- presentation by Takahito on Wednesday

Outline

1. Past, Present, Future

2. **Final Remarks**

3. ISR 2024

- slides (beamer and 4-up version) will be made available from

  https://ari-informatik.uibk.ac.at/meetings/final

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? bylaws for termCOMP SC

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? registrations for ISR 2024

Outline

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Location Lecturers and Courses Schedule Final Remarks

University Center Obergurgl

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- superb location (at 1940 meters)

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- everything under one roof (lecture rooms, guest rooms, dining room, bar, sauna)

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ISR 2024

- three tracks

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- three tracks
  - **A** basic track on term rewriting

ISR 2024

- three tracks
  - **A** basic track on term rewriting
  - **B** basic track on lambda-calculus and type theory

ISR 2024

- three tracks
  - **A** basic track on term rewriting
  - **B** basic track on lambda-calculus and type theory
  - **C** advanced track

ISR 2024

- three tracks
  - **A** basic track on term rewriting
  - **B** basic track on lambda-calculus and type theory
  - **C** advanced track
- slots of 1.5 hours

ISR 2024

- three tracks
  - **A** basic track on term rewriting
  - **B** basic track on lambda-calculus and type theory
  - **C** advanced track
- slots of 1.5 hours
- 5 courses in advanced track with 4 slots each

ISR 2024

- three tracks
  - **A** basic track on term rewriting
  - **B** basic track on lambda-calculus and type theory
  - **C** advanced track
- slots of 1.5 hours
- 5 courses in advanced track with 4 slots each
- August 25 (arrival) – September 1 (departure)

ISR 2024

- three tracks
  - **A** basic track on term rewriting
  - **B** basic track on lambda-calculus and type theory
  - **C** advanced track
- slots of 1.5 hours
- 5 courses in advanced track with 4 slots each
- August 25 (arrival) – September 1 (departure)
- six days (Monday – Saturday)

ISR 2024

- three tracks
  - **A** basic track on term rewriting
  - **B** basic track on lambda-calculus and type theory
  - **C** advanced track
- slots of 1.5 hours
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- six days (Monday – Saturday)
  - five days with courses

ISR 2024

- three tracks
  - **A** basic track on term rewriting
  - **B** basic track on lambda-calculus and type theory
  - **C** advanced track
- slots of 1.5 hours
- 5 courses in advanced track with 4 slots each
- August 25 (arrival) – September 1 (departure)
- six days (Monday – Saturday)
  - five days with courses
  - full day excursion (rafting, hiking, climbing, trail running, . . .)

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   - Location
   - Lecturers and Courses
   - Schedule
   - Final Remarks

Lecturers

▸ Frédéric Blanqui	Inria
▸ Ugo Dal Lago	University of Bologna
▸ Herman Geuvers	Radboud University Nijmegen
▸ Nao Hirokawa	JAIST
▸ Cynthia Kop	Radboud University Nijmegen
▸ Aart Middeldorp	University of Innsbruck
▸ Niels van der Weide	Radboud University Nijmegen
▸ Sarah Winkler	Free University of Bolzano – Bozen

Lecturers

▸ Frédéric Blanqui	Inria	track C
▸ Ugo Dal Lago	University of Bologna	track C
▸ Herman Geuvers	Radboud University Nijmegen	track B
▸ Nao Hirokawa	JAIST	track C
▸ Cynthia Kop	Radboud University Nijmegen	track C
▸ Aart Middeldorp	University of Innsbruck	track A
▸ Niels van der Weide	Radboud University Nijmegen	track B
▸ Sarah Winkler	Free University of Bolzano – Bozen	track C

Courses in Track C

- Randomized Programming and Rewriting
- Interoperability of Proof Systems using Lambdapi
- SAT / SMT Solving and Applications in Rewriting
- Termination and Complexity in Higher-Order Term Rewriting
- Tools in Rewriting

Courses in Track C

▸ Randomized Programming and Rewriting	Ugo Dal Lago
▸ Interoperability of Proof Systems using Lambdapi	Frédéric Blanqui
▸ SAT / SMT Solving and Applications in Rewriting	Sarah Winkler
▸ Termination and Complexity in Higher-Order Term Rewriting	Cynthia Kop
▸ Tools in Rewriting	Nao Hirokawa

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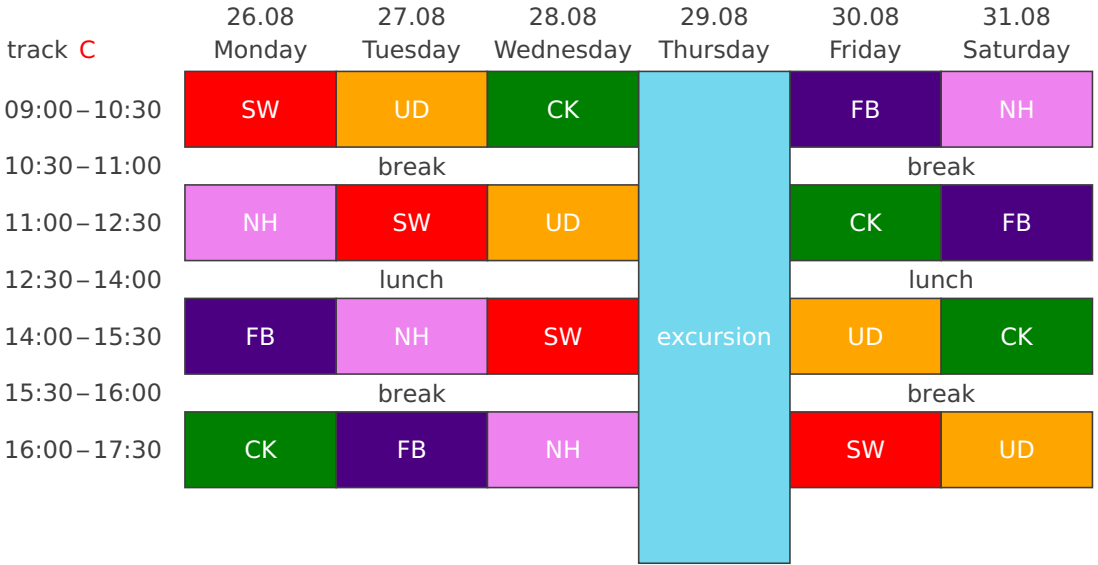
track A
26.08 Monday
27.08 Tuesday
28.08 Wednesday
29.08 Thursday
30.08 Friday
31.08 Saturday
09:00 – 10:30
10:30 – 11:00
11:00 – 12:30
12:30 – 14:00
14:00 – 15:30
15:30 – 16:00
16:00 – 17:30
1
4
7
e4
12
break
break
2
5
e3
10
13
lunch
lunch
3
e2
8
excursion
11
e6
break
break
e1
6
9
e5
test


track A & B
26.08 Monday
27.08 Tuesday
28.08 Wednesday
29.08 Thursday
30.08 Friday
31.08 Saturday
09:00 – 10:30
10:30 – 11:00
11:00 – 12:30
12:30 – 14:00
14:00 – 15:30
15:30 – 16:00
16:00 – 17:30
1
4
7
e4
12
break
break
2
5
e3
10
13
lunch
lunch
3
e2
8
excursion
11
e6
break
break
e1
6
9
e5
test


track C
26.08 Monday
27.08 Tuesday
28.08 Wednesday
29.08 Thursday
30.08 Friday
31.08 Saturday
09:00 – 10:30
10:30 – 11:00
11:00 – 12:30
12:30 – 14:00
14:00 – 15:30
15:30 – 16:00
16:00 – 17:30
SW
UD
CK
FB
NH
break
lunch
excursion

3rd International School on Rewriting

ISR2008

Obergurgl

Austria

Introductory Course

Advanced Topics

Early Registration

May 1 2008

July 21 – 26

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Remarks

- (optional) test in tracks A & B for students that require ECTS certificate

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- early registration deadline: May 1

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- `http://cl-informatik.uibk.ac.at/isr24/`