



Trends and Pearls of Model Checking

Introduction

Winter Semester 2018/19; 10 October, 2018

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RWTH Aachen University

<https://moves.rwth-aachen.de/teaching/ws-1819/tpmc/>

Overview

Outline

Overview

Aims of this Seminar

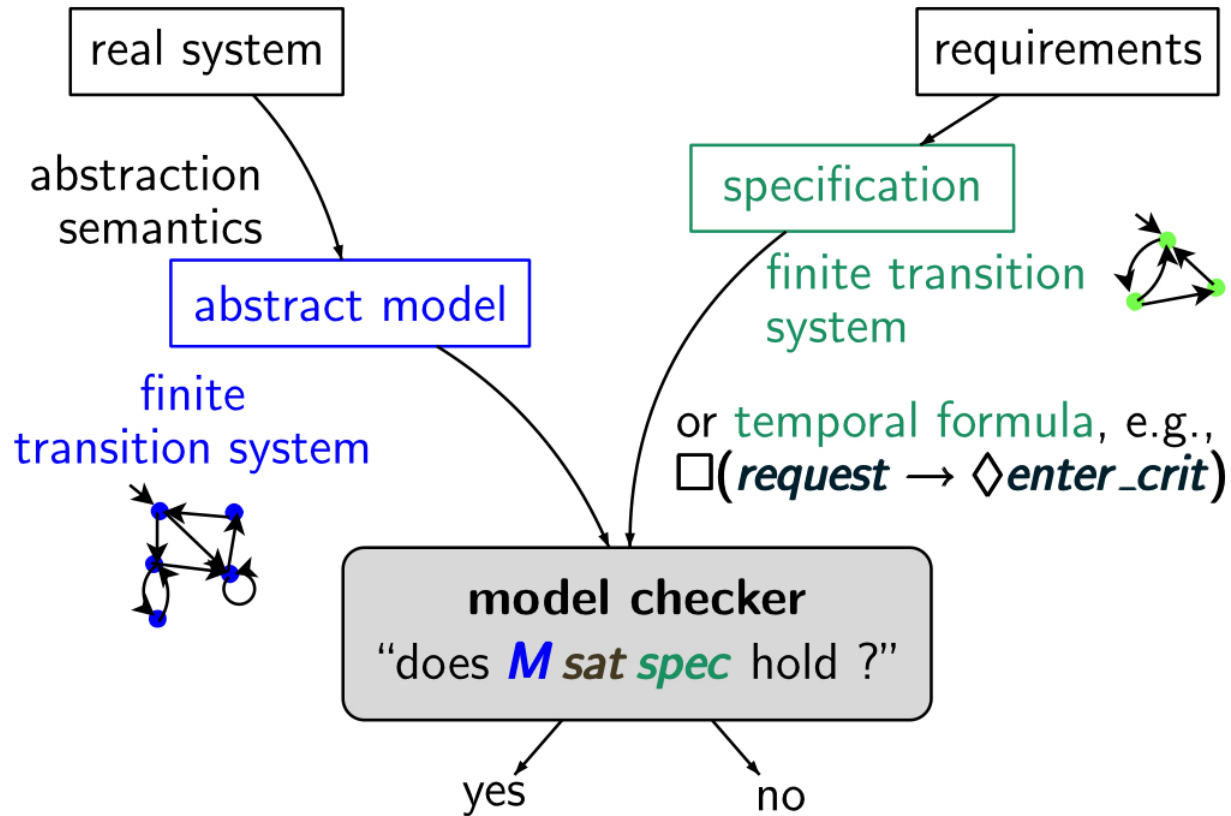
Important Dates

Topics

Final Hints

Overview

Model Checking



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Goals

Aims of this seminar

- **Independent understanding** of a scientific topic
- Acquiring, reading and understanding **scientific literature**
- Writing of your **own report** on this topic
- **Oral presentation** of your results

Aims of this Seminar

Requirements on Report

Your report

- Independent writing of a report of **10-15 pages**
- **Complete** set of references to all consulted literature
- **Correct citation** of important literature
- **Plagiarism**: taking text blocks (from literature or web) without source indication causes immediate **exclusion from this seminar**
- **Language**: German or English
- We expect the **correct usage** of spelling and grammar
 - ≥ 10 errors per page \implies abortion of correction
- Font size **12pt** with “standard” page layout
- Report **template** is available on seminar web page

Aims of this Seminar

Requirements on Talk

Your talk

- Talk of about **30 minutes**
- Finish **in time**. Overtime is bad
- Focus your talk on the **audience**
- **Descriptive** slides:
 - \leq 15 lines of text
 - use (base) colors in a useful manner
- **Language:** German or English
- No spelling mistakes please!
- Ask for **questions**
- Presentation **template** is available on seminar web page

Aims of this Seminar

Final Preparations

Preparation of your talk

- Setup laptop and projector **ahead** of time
- Use a (laser) **pointer**
- **Number** your slides
- Multiple **copies**: laptop, USB, web
- Have **backup slides** ready for expected questions

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Deadlines

- Mon, 29 Oct. 2018: Detailed outline of report due
- Mon, 19 Nov. 2018: One chapter of report due
- Mon, 10 Dec. 2018: Full report due
- Mon, 14 Jan. 2019: Presentation slides due
- Mon/Tue, 11/12 Feb. 2019: Seminar talks

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Missing a deadline causes **immediate exclusion** from the seminar

Important Dates

Selecting Your Topic

Procedure

- You obtain(ed) a list of topics of this seminar.
- Indicate the preference of your topics (first, second, third).
- Return sheet by **Monday (15 Oct.), before 15:00** via e-mail (`matthias.volk@cs.rwth-aachen.de`) or to secretary.
- We do our best to find an adequate topic-student assignment.
 - disclaimer: no guarantee for an optimal solution
- Assignment will be published on website by Tuesday.
- Then also your **supervisor** will be indicated.

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Withdrawal

- You have up to **three weeks** to refrain from participating in this seminar.
- Later cancellation (by you or by us) causes a **not passed** for this seminar and reduces your (three) possibilities by one.

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Schemes

Ch 15: CEGAR for Model Checking

- Counterexample Guided Abstraction Refinement
- Instead of model checking on the full transition system do model checking on an abstraction.
- If the abstraction is too coarse, use the model checking result to refine the abstraction

Topic 5

Sat-Based Model Checking: IC3

- Encode the transition relation into propositional logic
- Use a SAT solver to find invariants

Topic 4

Ch 20: Deduction for Model Checking

- Use logic propositions to describe both system and property
- Proof obligations via theorem provers
- Use model checking techniques for automation

Topic 7

Ch 14: Interpolation

- Interpolants are small symbolic explanations that help to identify “critical regions” of the symbolic

Topic 6

Concurrency

Ch 18: Model Checking Concurrent Programs

- How to handle communication structures such as: locks, wait-notify, notify-all?

Topic 10

Ch 21: Model Checking Parameterized Systems

- Model checking for any number of parallel components.
- 4 Techniques by Example

Topic 11

Ch 12: Compositional Reasoning

- Making assumptions about other processes simplifies proving correctness of a single process
- and
- Prove (local) assumptions

Topic 12

Extended Logics and Models

Ch 26: Mu-Calculus and Model Checking

- Generalises many logics used in Model Checking
- How does model checking work? And why is this an interesting logic?

Topic 8

Ch 17: Model Checking Procedural Programs

- Recursion leads to push-down systems
- How to do model checking?

Topic 9

Tools & Practices

Ch 24: Temporal Logics for Hardware Verification

- How to specify functional specifications for hardware

Topic 3

Tool: Dafny

- deductive proving of program correctness

Topic 2

Tool: T2

- automatic model checking of C code

Topic1

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Some Final Hints

Hints

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- Be **proactive**! Look for **additional** literature and information.
- Discuss the content of your report with other students.
- Be **proactive**! Contact your supervisor **on time**.
- Prepare the meeting(s) with your supervisor.
- Forget the idea that you can prepare a talk in a day or two.

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We wish you success and look forward to an enjoyable and high-quality seminar!