Introduction

Lecture #1 of Advanced Model Checking

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Lehrstuhl 2: Software Modeling & Verification

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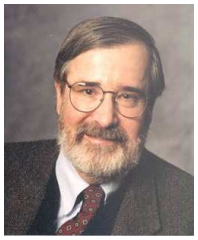
Model checking

- Automated model-based verification and debugging technique
  - model of system = Kripke structure $\approx$ labeled transition system
  - properties expressed in temporal logic like LTL or CTL
  - provides counterexamples in case of property refutation
- Various striking examples
  - Needham-Schroeder security protocol, storm surge barrier, C code
- 2008: Pioneers awarded prestigious ACM Turing Award



Course topics

- Abstraction
  - bisimulation, simulation, minimization algorithms
  - stutter-bisimulation, stutter trace-equivalence, divergence
  - preservation of temporal logical formulae
- Partial-order reduction
  - independence, ample set method, branching-time POR

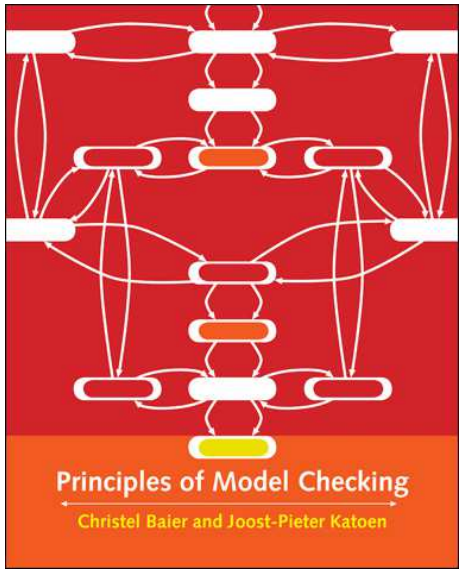
Course topics

- Reduced binary decision diagrams
  - Boolean functions, operations, CTL model checking with ROBDDs
- Timed automata
  - semantics, region equivalence, timed reachability, zone automata, DBMs

Course organization

- Lectures: twice per week
  - Tuesday 14:15–15:45 (5052)
  - Wednesday 10:15 - 12:45 (9U10)
  - Check web-page for dates!
- Exercises: once per week (Wed 14:15–15:45, 4201b, start: Oct 26)
  - marked exercises (40% of points needed)
  - assistants: Matthias Volk and Tim Quatmann
- Exam: to be determined
- Credits: 6 credits (M.Sc/B.Sc)

Principles of Model Checking



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Course material

- Course material:
  - book “Principles of Model Checking” (Baier & Katoen)
  - several copies are available in CS library
- Detailed overview:
  - Section 6.7: Symbolic model checking
  - Chapter 7: Abstraction
  - Chapter 8: Partial-order reduction
  - Chapter 9: Timed automata

Course Prerequisites

- Mandatory courses:
  - formal languages and automata theory, and
  - complexity theory and decidability, and
  - algorithms and data structures
- Preferred courses:
  - introduction to model checking, or
  - automata and reactive systems

Related Courses

- Modeling and Verification of Probabilistic Systems
  - compositional modeling of probabilistic systems
  - model checking of probabilistic models
- Automata Theory Courses
  - applied automata theory, infinite computations, . . .
- Modeling and Analysis of Hybrid Systems

- hybrid automata, reachability in hybrid automata, decidability . . .

- Satisfiability Checking
  - SAT solving algorithms, usage of SAT solving in verification . . .

Questions?