Seminar
Data-Aware Processes

Knowledge-Based Systems Group

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Introduction

Organizational Matters

Lecture Mode (as of today, 14:49)

- On Tuesdays, DS5
- Today: Kick-off Meeting
- Next Week: Concrete Research Papers
- From April 27 on: Office hours
  - Check with “Dates and Materials” on the Website
  - If nobody shows up, I’ll leave after 15 minutes
- Later: Presentations
- **Optional Discussion Session:** How (not) to present

Website: https://iccl.inf.tu-dresden.de/web/Seminar_Data-Aware_Processes_(SS2021)

Evaluation

Homework!

- Please check your examination requirements! + Tell me

Homework!

- Paper Summary:
  - self-selected research paper
  - 10 pages (guidelines will be provided)
- Presentation:
  - 20 minutes + discussion
  - Participate in the presentations of the other students

Topic Overview

Data-Aware Processes

Database Research

- Focus on
  - Data management,
  - Query languages, and
  - Database management systems (DBMS)
- Verification found in
  - Database (e.g., integrity) constraints,
  - Query optimization (!!), or
  - Transaction management
- But: the larger perspective often neglected

Process Modeling and Verification

- Almost always abstraction of systems *Labeled Transition Systems*
  - *Propositional state properties*
  - *Abstract actions as transition labels*
  - Often finite-state
- Data is often propositionally reduced to *good* and *bad*
- **Model Checking** has been the main driver of research in verification
  - Systems comprise a set of executions
  - Specifications logically describe sets of allowed executions
  - Model Checking boils down to algorithmically checking set inclusions
- But: data is often not propositional

Several Resolutions

- Relational Transducers (Transition Systems)
- Artifact-Centric Systems
- Data-Centric Dynamic Systems
- Knowledge and Action Bases (KABs)
- DB-nets

- Register Automata / Automata over Data Words
- Symbolic Finite Automata

Paper Categories and Contents

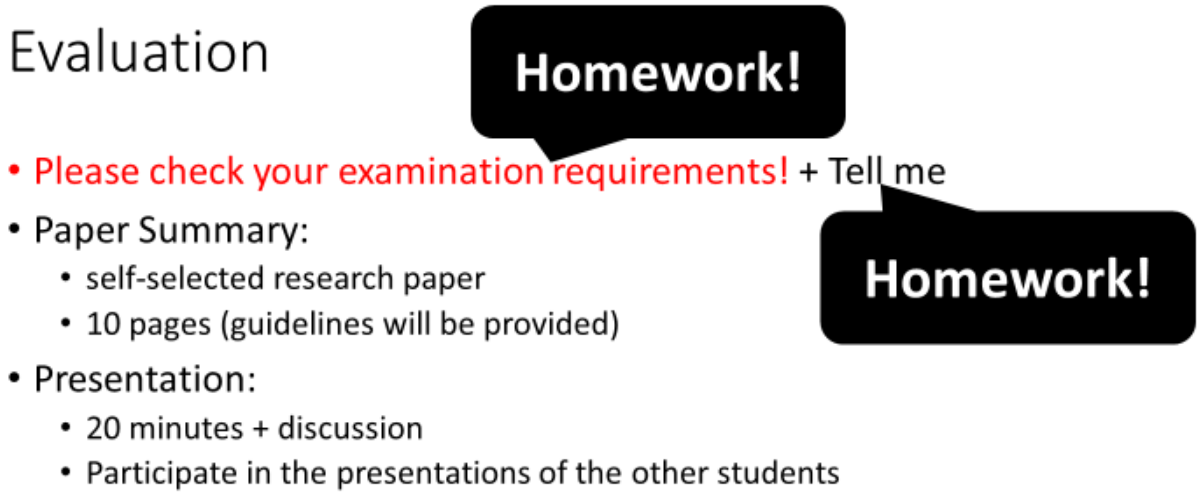
Starters

- Systems modeling aspects
- Property modeling aspects
- Verification techniques and algorithms

Main Dishes

- Model-theoretic considerations
- Expressive power
- Complexity and Decidability

Homework



Diego Calvanese, Giuseppe De Giacomo, and Marco Montali. 2013. **Foundations of data-aware process analysis: a database theory perspective**. In *Proceedings of the 32nd ACM SIGMOD-SIGACT-SIGAI symposium on Principles of database systems* (*PODS '13*). Association for Computing Machinery, New York, NY, USA, 1–12.

DOI: https://doi.org/10.1145/2463664.2467796

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Online Worldwide Seminar on Logic and Semantics (OWLS)

The seminar is held on Wednesdays at 2pm UTC

The next seminar starts in 1 day, 7 hours and 0 minutes.

Introduction

The *Online Worldwide Seminar on Logic and Semantics* is a new series of research talks, highlighting the most exciting recent work in the international computer science logic community. The scope of the seminar series is roughly that of the major computer science logic conferences

- 14 April 2021 (YR-OWLS). Joshua Moerman, RWTH Aachen, "Weighted Register Automata". *Chair: Nathanaël Fijalkow* (abstract)

Register automata are an extension of automata that deal with data, possibly from an infinite domain. Many algorithms from classical automata theory remain to work on deterministic register automata. However, the nondeterministic register automata are strictly more expression and some properties become undecidable. Motivated by a recent result that the subclass of unambiguous register automata has decidable equivalence, we investigate weighted register automata, the common generalisation of register automata and weighted automata. These include unambiguous register automata. We show that equivalence is also decidable for these automata. This improves the previous results in three ways: (a) we allow for more data domains; (b) the complexity is exponentially better; and (c) we allow automata with guessing. Most importantly, we feel that our main contribution is the development of the mathematical theory of so-called orbit-finitely spanned vector spaces, on which our decision procedure is based. In the talk I will mostly talk about these structures. This is joint work with Mikołaj Bojańczyk and Bartek Klin.