

# Database Theory

VU 181.140, SS 2018

## 0. General Information

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## Classes

- **Language.** This lecture will probably be held in English.
- **Place.**
  - Classes will be held in the [Seminarraum 188/2](#) (Favoritenstraße 9-11, 4th floor).
  - The quiz at the beginning of the semester will be [in the main building, HS 11 Paul Ludwik](#).
- **Time.**
  - Throughout the term: [Tuesdays, 9:00 – 11:00](#).
  - [additional classes \(if needed\)](#): Depending on the number of participants, additional classes might be needed for the students' presentations in June (details to be announced later).

## Outline

- 0. General Information
  - 0.1 Classes
  - 0.2 Prerequisites and Admission
  - 0.3 Quiz
  - 0.4 Communication
  - 0.5 Course Overview
  - 0.6 Assessment
  - 0.7 ECTS Breakdown
  - 0.8 Related Lectures
  - 0.9 DB Literature

## Prerequisites and Admission

- **Prerequisites.**
  - This course is designed for [master's students](#).
  - It is highly recommended to attend this course [after](#) the course [Formale Methoden der Informatik \(185.291\)](#).
- **Knowledge and skills required.**
  - basic knowledge of databases (cf. [VU Datenmodellierung](#))
  - basic knowledge in mathematical logic
  - introduction to complexity theory
  - in particular, the central concept of [“problem reduction”](#)
- **Admission.**
  - primarily for [master's students!](#)
  - [positive assessment in a quiz is required](#)
  - each student has at most two attempts

## Quiz

- **Goal.**
  - ensure that students have the required knowledge and skills
  - basic knowledge in mathematical logic and complexity theory;
  - in particular, the central concept of “**problem reduction**”.
- **Organization.**
  - **Student's card required!!**
  - **closed book** (no material allowed)
  - Being able to solve all questions of the exercise sheet of block 1 (complexity theory part) of the course “Formale Methoden der Informatik” clearly suffices for the quiz.
  - max. 10 credits; passed with  $\geq 5$ .
- **Time and place.**
  - Thursday, 8 March 2018, 16:00 - 18:00: HS 11 Paul Ludwik
  - Thursday, 15 March 2018, 16:00 - 18:00: HS 11 Paul Ludwik
  - 60 min actual working time

## Course Overview (Tentative Plan)

### Fundamental aspects of (relational) query languages

- Relational algebra vs. relational calculus vs. SQL
- Introduction to datalog
- Codd's Theorem: relational algebra vs. First-Order logic
- Trakhtenbrot's Theorem: some undecidability results
- Complexity of Query Evaluation
- (Acyclic) Conjunctive Queries
- Inexpressibility Results (Ehrenfeucht-Fraïssé Games, Locality)
- Beyond relational data

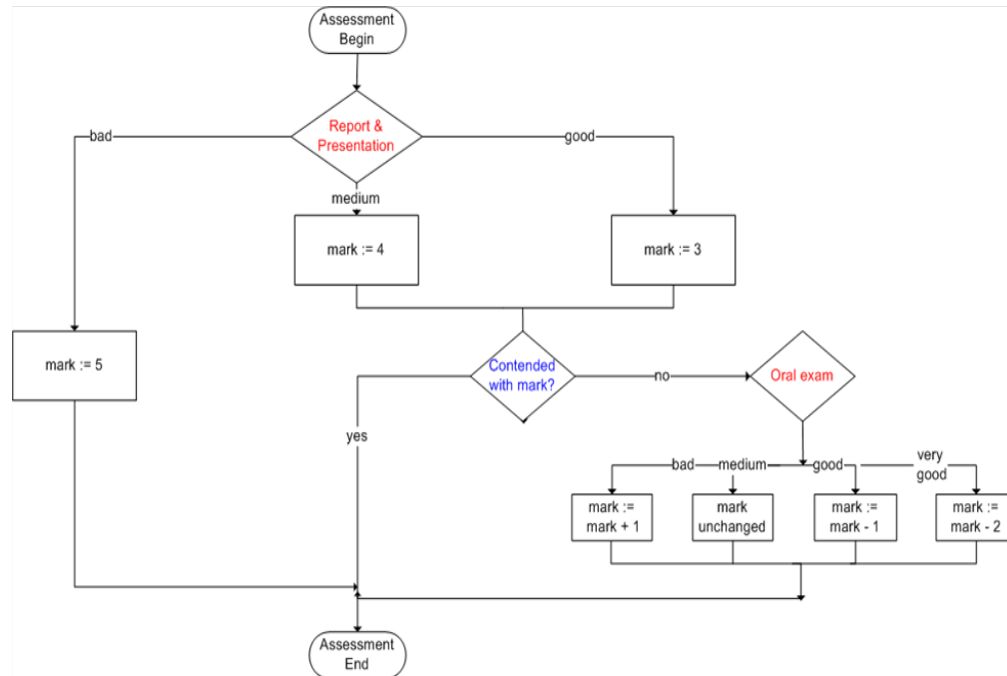
## Communication

- (during, after) classes
- Course Homepage:  
<http://www.dbai.tuwien.ac.at/staff/pichler/dbt>
- TISS: please check your mail address in TISS

## Assessment

### Components

- 1 Individual work on **1 article from database theory research**
  - Details (e.g. assignment of articles) to be provided later
  - **Short written report** of this article (2–3 pages)
  - **Oral presentation** (ca. 20 min, depends on number of participants)
  - Sufficient to get **mark 3 (or worse)**
- 2 **Oral exam**
  - positive assessment of report & presentation required
  - exam not compulsory, but required for **marks 1 and 2**
- 3 **Quiz**
  - will be taken into account in case of intermediate marks



## ECTS Breakdown

3 ECTS corresponds to 75h of work for “standard students” fulfilling the prerequisites (i.e., VU Formale Methoden der Informatik - 185.291).

10 classes (including preparation):	25h
research article (report, presentation):	35h
preparation for oral exam:	15h
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in total:	75h

## Assessment of Report & Presentation

### Criteria of a good report & presentation

- reasonable effort (30 - 40 hours)
- basic understanding of the article
- honestly identify parts which you did not understand (give a justification: which prerequisites were missing?)
- relate the article to the contents of the course
- quickly check important background articles
- (presentation) being able to answer questions (in particular, those relating the article to the course)

## Some Related Lectures

- **Complexity Theory**  
181.142 – 2.0 VU – Komplexitätstheorie (in the summer term)  
Reinhard Pichler
- **Datalog**  
184.247 – 2.0 VU – Deduktive Datenbanken (in the winter term)  
Mantas Simkus
- **Logic**  
see <http://www.logic.at/lvas/>

## DB Literature

### Most Important DB-Conferences

- ACM SIGMOD:
  - “International Conference on Management of Data”
  - 2018 in Houston: <https://sigmod2018.org/>
- VLDB:
  - “International Conference on Very Large Data Bases”
  - 2018 in Rio de Janeiro: <http://vldb2018.lncc.br/>
- ICDE:
  - “IEEE International Conference on Data Engineering”
  - 2018 in Paris: <https://icde2018.org/>
- EDBT:
  - “International Conference on Extending Database Technology”
  - 2018 at TU Wien: <http://edbticdt2018.at>

### Most Important DB-Journals

- ACM TODS:
  - “ACM Transactions on Database Systems”
  - free access from TUWIEN domain via ACM digital library
  - <http://portal.acm.org/dl.cfm> → “Transactions” → “ACM Transactions on Database Systems (TODS)”
- VLDB Journal
  - free access from TUWIEN domain via University library
  - <http://www.ub.tuwien.ac.at/> → “E-Journals” → “Universitätsbibliothek der TU Wien” → search for “VLDB Journal”
- IEEE TKDE:
  - “IEEE Transactions on Knowledge and Data Engineering”
  - free access from TUWIEN domain via IEEE Xplore
  - <http://ieeexplore.ieee.org/Xplore/guesthome.jsp> → “Journals & Magazines”

### Most Important DB Theory Conferences

- ACM PODS:
  - “Symposium on Principles of Database Systems”
  - always in conjunction with SIGMOD
  - 2018 in Houston: <https://sigmod2018.org/>
- ICDT:
  - “International Conference on Database Theory”
  - since 2009 in conjunction with EDBT
  - 2018 at TU Wien: <http://edbticdt2018.at>

## Access To Articles

Access from the TUWIEN domain is free to (almost) all major conferences and journals.

- SIGMOD and PODS proceedings
  - free access from TUWIEN domain via ACM digital library
  - <http://portal.acm.org/dl.cfm> → “Proceedings” → {SIGMOD, PODS}
- VLDB proceedings:
  - free access from anywhere
  - <http://www.vldb.org/> → “VLDB Conferences”

## Access To Articles (continued)

- ICDE proceedings
  - free access from TUWIEN domain via IEEE Xplore Digital Library
  - <http://www.ieee.org/web/publications/xplore/> → search for "ICDE"
- EDBT and ICDT proceedings:
  - since 2008: ACM proceedings
    - ⇒ free access from TUWIEN domain via ACM digital library
  - formerly: proceedings in Springer LNCS Series
    - ⇒ free access from TUWIEN domain via University library
  - <http://www.ub.tuwien.ac.at/> → "eBooks" → "Springer Reihen"
    - "Lecture Notes in Computer Science" → search via volume (e.g., ICDT 2007 has volume 4353 of LNCS)

## Comfortable Search & Access via DBLP

- DBLP "Computer Science Bibliography"
- contains information on (almost) all relevant publications
- Overview: <http://www.informatik.uni-trier.de/~ley/db>
- Google-search, e.g., "DBLP <author>" or "DBLP <conference>"
- access to the article: via "EE"-field (electronic edition)
- free access from TUWIEN-domain as described above (e.g., ACM digital library, Springer Verlag, etc.)

## Alternative Search Methods

- Citeseer, e.g., Google-search: "citeseer <title of article>"
- <http://scholar.google.com> (keyword search)
- Authors' Homepages