



Course and Examination Fact Sheet: Autumn Semester 2020

7,330: Data Handling: Databases

ECTS credits: 4

Overview examination/s

(binding regulations see below)

Decentral - Active participation (25%)

Examination time: term time

Decentral - examination paper written at home (individual) (75%)

Examination time: term time

Attached courses

Timetable -- Language -- Lecturer

[7.330.1.00 Data Handling: Databases](#) -- Englisch -- [Grossniklaus Michael](#)

Course information

Course prerequisites

- **Mathematics:** algebra, discrete mathematics, statistics
- **Computer Science:** elementary programming skills

Learning objectives

After completion of the course, students will have acquired the skills to use database systems in order to manage and process large data sets. This entails knowledge about conceptual data modeling using the Entity-Relationship model as well as creating, manipulating, and query databases using SQL. Students will also have a basic understanding of the internal operation of such systems in terms of query optimization and transaction management.

Course content

The course will provide a basic overview of the functionality, architecture, and implementation of database systems as a foundation for computer-based information systems. A database system is a **general-purpose platform** to manage and process data. Information is represented, stored, and managed according to a **data model**, while it is queried (retrieved) and manipulated using a **special-purpose language**. The course is organized around three main parts, which follow the steps that are typically required to design, use and maintain a database. The first part is dedicated to data modelling. Conceptual database design is introduced based on the Entity-Relationship (ER) model, whereas logical database design is studied in the context of the relational model of data and its normal forms. The second part is dedicated to database languages. After presenting the relational algebra as a formal foundation, the course will provide a thorough introduction into SQL, which is currently the most widely-used and most important database language. The third and final part of the course is dedicated to the benefits that arise for database users due to the platform-based approach. In this part, the course will give a brief overview of the internal structures and functioning of a database system, such as currency control, indexing, and query processing.

Apart from the theoretical background, the course will feature a practical project that will enable students to apply the new knowledge by going through the process of setting up and querying their own database. These practical assignments will be based on the open-source database management system PostgreSQL, which students will install on their own computers as it is available for many operating systems and platforms.

Course structure

Part I: Data Modelling



- Introduction and Overview
- Data Modelling with the ER Model
 - Entities, Attributes, and Relationships
 - Constraints
 - Extended ER models and UML
- Relational Database Design Theory
 - Relational model of data
 - Normal forms and normalization
 - Translating ER models to relational models

Part II: Database Languages

- Relational Database Languages
 - Relational algebra
 - Equivalences of the relational algebra
- SQL
 - Basic queries (SELECT... FROM... WHERE...)
 - Advanced queries: nested and recursive queries
 - Other functionalities: database management and data manipulation

Part III: Database Systems

- Transactions, Concurrency Control, and Recovery
 - Schedules and serializability
 - Logging
- Indexing
 - Hash-based indexes
 - Tree-based indexes
- Query Processing
 - Query optimization
 - Query evaluation

Course literature

- Alfons Kemper und André Eickler: Datenbanksysteme: Eine Einführung (9. Auflage), 2013
- Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems (3rd Edition), McGraw-Hill, 2002

Additional course information

The course will be conducted entirely online. Information on how to participate will be made available via StudyNet. In the case of a second lockdown, no additional steps will be necessary to attend the course.

Examination information

Examination sub part/s

1. Examination sub part (1/2)

Examination time and form

Decentral - Active participation (25%)

Examination time: term time

Remark

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Examination-aid rule

Practical examination

No examination-aid rule is necessary for such examination types. The rules and regulations of the University of St. Gallen apply



in a subsidiary fashion.

Supplementary aids

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Examination languages

Question language: English

Answer language: English

2. Examination sub part (2/2)

Examination time and form

Decentral - examination paper written at home (individual) (75%)

Examination time: term time

Remark

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Examination-aid rule

Term papers

Term papers must be written without anyone else's help and in accordance with the known quotation standards, and they must contain a declaration of authorship which is a published template in StudentWeb.

The documentation of sources (quotations, bibliography) has to be done throughout and consistently in accordance with the chosen citation standard such as APA or MLA.

For papers in law, the legal standard is recommended (by way of example, cf. FORSTMOSER, P., OGOREK R. et SCHINDLER B., Juristisches Arbeiten: Eine Anleitung für Studierende, newest edition respectively, or according to the recommendations of the Law School).

The indications of the sources of information taken over verbatim or in paraphrase (quotations) must be integrated into texts in accordance with the precepts of the applicable quotation standard, while informative and bibliographical notes must be added as footnotes (recommendations and standards can be found, for example, in METZGER, C., Lern- und Arbeitsstrategien, newest edition respectively).

For any work written at the HSG, the indication of the page numbers is mandatory independent of the chosen citation standard. Where there are no page numbers in sources, precise references must be provided in a different way: titles of chapters or sections, section numbers, acts, scenes, verses, etc.

Supplementary aids

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Examination languages

Question language: English

Answer language: English

Examination content

All three parts of the course, i.e., "Data Modeling", "Database Languages", and "Database Systems" will be part of the examination. Student are expected to be able to create an ER data model for a specific use case application, to map it into the relational model, and to write SQL queries against the resulting relational database. Furthermore, students need to be able to explain the algorithms that are implemented by the components of a database management system, e.g., index structures or transaction control.

Examination relevant literature

The slides used in the course is the main basis for the examination. Additionally, the following books provide further reference.

- Alfons Kemper und André Eickler: Datenbanksysteme: Eine Einführung (9. Auflage), 2013



- Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems (3rd Edition), McGraw-Hill, 2002

Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are binding and takes precedence over other information, such as information on StudyNet (Canvas), on lecturers' websites and information in lectures etc.

Any references and links to third-party content within the fact sheet are only of a supplementary, informative nature and lie outside the area of responsibility of the University of St.Gallen.

Documents and materials are only relevant for central examinations if they are available by the end of the lecture period (CW51) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 42 are relevant for testing.

Binding nature of the fact sheets:

- Course information as well as examination date (organised centrally/decentrally) and form of examination: from bidding start in CW 34 (Thursday, 20 August 2020);
- Examination information (regulations on aids, examination contents, examination literature) for decentralised examinations: in CW 42 (Monday, 12 October 2020);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 42 (Monday, 12 October 2020);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the registration period in CW 44 (Thursday, 29 October 2020).