University of St.Gallen

Course and Examination Fact Sheet: Autumn Semester 2021

7,264: Data Handling: Databases

ECTS credits: 4

Overview examination/s

(binding regulations see below)
Decentral - Active participation (5%)
Examination time: term time
Decentral - examination paper written at home (individual) (95%)
Examination time: term time

Attached courses

Timetable -- Language -- Lecturer
7,264,1.00 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 conceptional 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 and indications of the learning and teaching design

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

The contents of the course are taught in classical lecture style. Students can ask questions anytime. To engage students they are encouraged to solve smaller problems during the lectures. For every part of the course, there is a larger in-class exercise. Solutions to both smaller and larger problems will be discussed in the lectures.

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

In the case of the President's Board having to implement new directives due to the SARS-CoV-2 pandemic in AS2021, the course information listed above will be changed as follows:

- The course will be conducted online via the platform Zoom.
- The recordings of the course will not be saved.
- The lecturer will inform via StudyNet and e-mail on the changed implementation modalities of the course.

The examination information listed below would be changed as follows:

- There are no changes necessary to the examination information.

Examination information

Examination sub part/s

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1. Examination sub part (1/2)

Examination time and form
Decentral - Active participation (5%)
Examination time: term time

Remark
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Examination-aid rule
Active classroom participation

In the "Active classroom participation" examination form, regular participation in class is assessed.

The assessment criteria can be as follows:

- Requests to speak enrich the discussion (productive) / requests to speak disturb the discussion (counterproductive);
- Requests to speak are correct/requests to speak are incorrect;
- Requests to speak are frequent/average/rare;
- No requests to speak, but students follow the lesson/no requests to speak and students do not noticeably follow the lessons.

Supplementary aids
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Examination languages
Question language: English
Answer language: English

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2. Examination sub part (2/2)

Examination time and form
Decentral - examination paper written at home (individual) (95%)
Examination time: term time

Remark
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Examination-aid rule
Term papers

Written work must be written without outside help according to the known citation standards, and a declaration of authorship must be attached, which is available as a template on the StudentWeb.

Documentation (quotations, bibliography, etc.) must be carried out universally and consistently according to the requirements of the chosen/specified citation standard such as e.g. APA or MLA.

The legal standard is recommended for legal work (cf. by way of example: FORSTMOSER, P., OGOREK R., SCHINDLER B., Juristisches Arbeiten: Eine Anleitung für Studierende (the latest edition in each case), or according to the recommendations of the Law School).

The reference sources of information (paraphrases, quotations, etc.) that has been taken over literally or in the sense of the original text must be integrated into the text in accordance with the requirements of the citation standard used. Informative and bibliographical notes must be included as footnotes (recommendations and standards e.g. in METZGER, C., Lern- und Arbeitsstrategien (latest edition)).

For all written work at the University of St.Gallen, the indication of page numbers is mandatory, regardless of the standard chosen. Where page numbers are missing in sources, the precise designation must be made differently: chapter or section title, section number, article, etc.

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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 are 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 is 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, 26 August 2021);
- Examination information (regulations on aids, examination contents, examination literature) for decentralised examinations: in CW 42 (Monday, 18 October 2021);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 42 (Monday, 18 October 2021);

Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the registration period in CW 45 (Monday, 8 November 2021).