

Syllabus: Principles of Database Systems

Course Description:

Topics include database concepts and architecture, data modeling, formal query languages such as relational algebra, commercial query language SQL, database access from application programs and a brief examination of advanced concepts including transactions, distributed databases, security and XML.

Text Book:

Hector Garcia Molina, Jeffrey Ullman, Jeniffer Widom: Database Systems : The Complete Book, Pearson, Prentice Hall.

Contents (subject to Change):

1. Introduction: History of Databases
2. Relational Database Modeling
 1. The relational model of data
 2. Basics of the relational model
 3. Defining a relational scheme in SQL
 4. An Algebraic Query Language
 5. Constraints on Relations
3. Design Theory for Relational Databases
 1. Functional Dependencies
 2. Rules about Functional Dependencies
 3. Design of Relational Database Schemas
 4. Decomposition
 5. Third Normal Form
 6. Multivalued Dependencies
 7. Algorithmic discovery of multivalued dependencies
4. High Level Database Models
 1. Entity / Relationship Models
 2. Design Principles
 3. Constraints in the E/R Model
 4. Weak Entity Sets
 5. From E/R diagrams to Relational Designs
 6. Converting Subclass Structures to Relations
 7. Unified Modeling Language
 8. From UML to Relations
 9. Object Definition Language
 10. From ODL design to Relational Designs
5. Algebraic and Logical Query Languages
6. Advanced SQL
 1. Constraints and Triggers
 2. Views and Indices
 3. Transactions and Concurrency Control
7. Query Execution and Optimization
8. Distributed Databases
9. Security and user authorization, Privacy Protection
10. Non-relational Databases

1. Object-Relational Model
2. Semistructured Data
3. Graph-based Databases
4. Column-store Databases

Software Used

I expect you to install

- MySQL
- Python 3.13
- DuckDB
- Neo4j

Grading

Weekly Homework (in printed, word-processed form, no electronic submission without explicit exception) 30%

Midterm Examination 30%

Final Examination 40%

Instructor

Thomas Schwarz, SJ, CU

Course Web Page

tschwarz/mscs.mu.edu/Classes