CS 425 Database Organization - Fall 2017
Undergraduate Section

3:15 pm - 4:30 pm, Mondays + Wednesdays, SB 104

Instructor: Boris Glavic, Stuart Building 226 C, Phone: 312 567 5205, Email: `bglavic@iit.edu`

Office Hours: Monday, 12:00 pm - 1:00 pm

Instructor Webpage: `www.cs.iit.edu/~glavic/`

Course Webpage: `www.cs.iit.edu/~cs425/`

Course Description:

Databases management systems are a crucial part of most large-scale industry and open-source systems. This course familiarizes students with important concepts of database systems and design. We will learn how to design a database using the **Entity-Relationship** model, how query and modify a database using the **declarative SQL** language, and study APIs for write application programs that use a database system to persist data. Furthermore, the course given an overview of important database systems techniques such as **indexing**, **query optimization and execution**, **concurrency control**, and **recovery**.

Students will develop a database application as a course project. Starting from assessing the application requirements, over designing the database schema, and implementing the application.

Course Material:

The following text book is required reading material for the course.

Silberschatz, Korth, and Sudarshan , **Database System Concepts** , 6th Edition , McGraw Hill , 2010

Other good introductory books on databases are:

Elmasri and Navathe , **Fundamentals of Database Systems** , 6th Edition , Addison-Wesley , 2003
Ramakrishnan and Gehrke , **Database Management Systems** , 3nd Edition , McGraw-Hill , 2002
Garcia-Molina, Ullman, and Widom, **Database Systems: The Complete Book**, 2nd Edition, Prentice Hall, 2008

The slides will be made available on the course webpage.

Prerequisites:

- *Courses:* One of CS 331, CS 401, or CS 403

Students with Disabilities

Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Center for Disability Resources. The Center for Disability Resources (CDR) is located in 3424 S. State St., room 1C3-2 (on the first floor), telephone 312 567.5744 or `disabilities@iit.edu`.

Course Details:

The following topics will be covered in the course:

- The relational data model
- Database modelling and design
  - The Entity-Relationship (ER) model
  - Database design and normalization
- SQL
  - Data-definition language (DDL)
  - Data-manipulation language (DML)
- Formal relational languages
  - Relational algebra
  - Tuple and domain calculus
- Database Architecture
- Database System Concepts
  - Transactions processing and concurrency control
  - Recovery
  - Indexing
  - Query processing and optimization
  - Security and access control

Workload and Grading Policies:

Course Project:
There will be a semester long practical project. This will be an implementation of an application on top of a database. The application will use the database to persist and query its data. Students will develop the project in groups of up to three students.

Midterm and Final Exam:
There will be a midterm and final exam covering the topics of the course.

Homework:
There will be several homework assignments during the course. The main objective of these assignments is for you and the instructor to evaluate how well you internalized the topics covered in the course.

Grading Policies:

See the course webpage for policies regarding late assignments and plagiarism.

- Course Project: 20%
- Midterm Exam: 25%
- Final Exam: 35%
- Homework Assignments: 20%

Course Objectives:

After attending the course students should be able to:

1. Design and model a design scenario using relational data modeling, which includes:
   - Analyze the design anomalies.
   - Construct Entity Relationship Diagram.
   - Analyze and Construct Functional Dependencies for the business rules.
   - Analyze Functional Dependencies to identify Primary keys.
   - Analyze and Perform Normalization and Normal Forms.
   - Define referential integrities.
   - Create relational database design schemas in 3-NF/BCNF for a design scenario of the size of ca. 8-10 tables.
2. Solve abstract relational language, such as relational algebra problems.
3. Solve database transactions by using Structured Query Language (SQL), used by RDBMSs.
4. Explain the general concept of the additional topics such as: Query Optimizations, Concurrency Control, Recovery, structured data and text, and data warehousing.
5. Implement a relational database application, using a commercial/open source RDBMS (such as Oracle or mysql). This includes both the design and the implementation of an application that uses a relational database management system for the storage of the data and provides a user interface for the insertion, deletion, update and query of the data in this database by a user.