Syllabus

General Information

Database Management Concepts and Applications

Instructor: Yong Zhao, 523N

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Course Meeting Times

Lectures:

Tuesday 8:15AM – 11:00 AM

Wednesday 8:15AM – 11:00 AM,

Office Hours:

Monday 9:30AM – 12:30 PM, 2:00PM – 5:00PM

Course Description

This course covers a number of advanced topics in the development of database management systems (DBMS) and the modern applications of databases. The topics discussed include relational model, SQL query language, query processing and optimization, OLTP and OLAP, data warehousing, NoSQL databases, transaction, advanced concurrency control and recovery, parallel and distributed data systems, and data processing with emerging hardware. Much of the course material will be drawn from a number of papers in the database literature.

This course also includes a course project to help students get hands-on experience on the design, implementation, testing, and evaluation of a database system, and to better understand the concepts, application, optimization and performance in databases.

Course Objectives

The course is designed to give students a solid background in database management systems, particularly relational database management systems (DBMSs), as well as the topics and applications in the database field. We will examine such systems from two perspectives: the design and implementation of a DBMS, and the use of such a DBMS, and help the students being proficient in SQL database query.

We will also cover topics related to relational database, such as database analytics and data warehousing, big data management systems such as NoSQL databases. We will also cover critical topics such as transaction, query processing and optimization, concurrency, and parallel and distributed databases. The goal is for the students to understand the industry of data management as a whole and what are the challenges and solutions when we are facing the big data era, and how to apply the related concepts and methodologies to database and data management applications.

Prerequisite

Data Structure

Class Schedule

Lecture slides will be available for copying or posted on blackboard.

1. Introduction and background
2. Relational data model
3. Database management system
4. SQL
5. Database design
6. Query processing & optimization
7. Advanced transaction processing
8. OLTP & OLAP
9. Data warehousing
10. NoSQL databases
11. Parallel & distributed databases

Learning Outcome

At the end of the class, the students should be able to understand the key concepts and applications related to database management.

The students should also be able to:

- Use relational algebra to express database queries.
- Use SQL to interact with database management systems.
- Design appropriate database tables, using functional dependencies and normal forms.

- Understand the working mechanism of transactions, query processing and optimization.
- Understand, compare, and implement the fundamental concurrency control algorithms.
- Understand data management and systems for structured and non-structured data, large scale data.
- Identify trade-offs among database systems techniques and contrast distributed/parallel alternatives for both on-line transaction processing and on-line analytical workloads.
- Interpret and comparatively criticize database system architectures.

Grades

Grades will be based on homework, course project and final exam.

Homework and attendance: 30%

Course project: 30%

Final Exam: 40%

Collaboration and Academic Honesty Policy

Individual work on all homework and examinations is required, Cheating and copying other students' homework/exam are strictly prohibited. Any violation of this policy will be treated severely.

Collaboration amongst students to understand the course material and to work on course projects is strongly encouraged, however each student should take on different/distinguishable responsibilities in the course projects.

Course Reading Material

Textbook – Database Management Systems (3rd edition) - by Raghu Ramakrishnan and Johannes Gehrke, McGraw Hill, 2003.