CSCI 685: Advanced Topics in Database Management Systems

Pre-requisites:  CSCI 485 or 585

Time:  Fall 2013, Monday and Wednesday 10 to 11:20

Instructor:  Professor Shahram Ghandeharizadeh, shahram@usc.edu, 213-740-4781

Office:  SAL 208

TA:  Jason Yap, jyap@usc.edu, SAL 102

Introduction and Purposes

This course introduces students to advanced topics in the area of database management systems. Topics include: query optimization techniques, cache management, parallel and distributed database systems, extendible storage management techniques, data availability techniques, data mining and knowledge discovery, stream data management, multidimensional data analysis, decision support, spatial index structures, expedited software development using ORMs, peer-to-peer and sensor data management, continuous media (audio and video clips). It covers both the standard techniques beyond the undergraduate level, and some advanced topics of active research. It assumes student familiarity with a conceptual data modeling tool such as Entity-Relationship (ER) data model, a logical data model such as the relational data model, SQL as a commercial query language, normal forms and logical data design, physical characteristics of storage devices such as magnetic disks and memory, physical design of a database using persistent data structures such as B+-tree and Hash indexes, concurrency control and crash recovery techniques.

Course Requirements and Grades

There are no required text books. The reading material is based on recently published technical papers available via the ACM/IEEE/Springer digital libraries. All USC students have automatic access to these digital archives.

Grading breakdown

- Midterm 1, Oct 7, 2013: 30%
- Midterm 2, Dec 4, 2013: 30%
- Class project: 30%
- Homework assignments: 10%

Course Readings/Class Sessions

The reading material for the course is organized chronologically and based on a specific theme. This material is tentative and might be fine tuned using different publications. We will make adjustments to the list as new manuscripts (currently under review) are accepted for publication.

Week 1: Introduction and review of transactions, concurrency control and crash recovery protocols. This topic is covered by most introductory textbooks in the area of databases, e.g., Chapters 14, 15 and 16 of Database Systems Concepts, sixth edition, by Silberschatz, Korth and Sudarshan.

Suggested Reading:


Weeks 2-4: Alternative Architectures


*Suggested Reading:*

**Week 5: Programming database management systems**


*Suggested Reading:*

**Week 6: Data availability techniques**

**Week 7, 8: Advanced index structures**


**Week 9: Performance Modeling**

*Suggested Reading:*

**Weeks 10, 11: Multi-core CPUs**


*Suggested Reading:*
**Week 12: Beyond SQL and relational data model**


**Week 13-14: Data Center Scale Data Stores**


*Suggested Reading:*


**Week 15: Flash Memory**


*Suggested Reading:*


**Class Project**

The class project requires students to investigate an innovative concept. This might be either conceptual or involve a prototyping effort. With the first, a student (team) explores design alternatives underlying the concept. They start by identifying the broader topic. After surveying the relevant literature, they produce a survey like paper that may include a discussion of future extensions. With a prototyping effort, a student (team) investigates implementation of a design. Such implementations may employ a relational storage manager such as Berkeley DB. Given the explosion of open software releases in the area of databases, there are many opportunities for such projects. In each case, an outstanding project may develop novel extensions that result in a publication.

**Statement for Students with Disabilities**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.—5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

**Statement on Academic Integrity**

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one’s own academic work from misuse by others as well as to avoid using another’s work as one’s own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section
11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/.

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/