COP 6731 Theory and Implementation of Database Systems

Credits: 3 credits

Text book, title, author, and year: Documents posted on Blackboard

Reference materials: Reading assignments from Oracle Database on-line documentation.

Specific course information:

Catalog description: The investigation of the fundamental principles and practices of relational database processing and design. Topics include SQL, embedded SQL, integrity constraints, triggers, transaction processing, normalization of tables, query optimization, and the relational algebra. Oracle 12c and, to a lesser extent, Microsoft SQL Server are used as vehicles in these investigations.

Prerequisites: The ability to program in C or C++. This course satisfies the Computer Systems requirement for the MSCE degree and MSCS degree, and counts as an elective for any CS or CE degree.

Specific goals for the course: Understand the structure, intelligent use, and implementation of relational database systems.

Brief list of topics to be covered:

1. An overview of relational database systems.
2. Query processing with the relational database language SQL in Oracle, using the SQL Developer IDE. No prior knowledge of SQL is assumed in this course.
3. Database programming with SQL: embedded SQL and dynamic SQL in Oracle PRO*C. Web programming with PRO*C using CGI. No prior knowledge of Web programming is assumed in this course.
4. The PL/SQL relational database programming language. Using PL/SQL to implement Web applications, and to code stored procedures and triggers.
5. SQL-92 query expressions and explicit join operators.
6. SQL-1999 Subquery factoring and recursive queries.
7. SQL-92 relational integrity constraints and SQL-1999 database triggers. Which constraints can be implemented in Oracle and SQL Server declaratively, and which have to be implemented with triggers.
8. SQL Views and updating views using triggers.
9. Theoretical basis of relational database languages: relational calculus and relational algebra.
10. Transaction processing: recovery and concurrency control.
11. Relational database design: normalization of tables, physical database administration.
12. Data warehousing, OLAP queries, and business intelligence (BI).
13. Comparison of Oracle and Microsoft SQL Server with respect to the storage structures they support.
14. Query optimization using available storage structures. Using the Explan Plan command to examine the execution plan chosen by the query optimizer. Process and memory structure of the Oracle server.
15. SQL-1999 object-relational features: Object and collection types.
16. Comparison of SQL interfaces for programming languages: Embedded SQLs like PRO*C and SQLJ vs call level interfaces like JDBC vs ORMs like .NET Linq to Entities.
17. Evaluation of Date's criticisms of SQL regarding its divergence from the relational model.
18. Oracle NoSQL and a discussion of Oracle Big Data SQL vs Microsoft PolyBase.