CP SC 462/662 (Section 1): Database Management Systems

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Objectives and Learning Outcomes:

1. Students shall understand conceptual modeling concepts and be able to use ER Model to design database applications.
2. Students shall be familiar with relational data models and be able to design relational database schemas from ER diagrams.
3. Students shall be able to use an industry standard query language (SQL) to query the relational databases.
4. Students shall understand the basic concepts of query optimization and learn simple query optimization techniques.
5. Students shall gain experience in designing and implementing web-based database systems.
6. Students shall improve oral and written communication skills through written and oral presentation of their projects.

Textbook: An Introduction to Database Systems, Eighth Edition, C. J. Date, Addison Wesley, 2004, ISBN: 0-321-19784-4.

Prerequisite: CpSc 322 or CpSc 360.

Instruction Approach:

The problem-based instruction approach, TEXNH, will be used in this course. Students are expected to learn database concepts through a semester-long multimedia database project. Specifically, students will be required to implement an online multimedia database system, MeTube, which is essentially a modified version of the popular YouTube system (http://www.youtube.com). This semester-long multimedia database project will be implemented through six phases with the necessary database concepts and techniques acquired in each phase by practice:

Phase I: Students will identify system requirements by exploring the YouTube system and by studying the project requirement specification provided by the instructor, and then use the Entity-Relationship (ER) model to complete a conceptual design of the MeTube database.

Phase II: Students will convert their conceptual designs into relational schemas and design the actual database tables for the MeTube system using the MySQL database management system based on their own relational database schemas. Students should normalize their database tables using normalization rules.

Phase III: Students will design complex SQL queries to insert and retrieve the information in their designed multimedia database, and evaluate the performance of their designed SQL queries.

Phase IV: Students will design the web interfaces for users to upload/insert information into to the multimedia database, to retrieve information from the multimedia database and present the data in appropriate formats.

Phase V: Students will test their MeTube system using various use cases, evaluate the system performance and usability, improve the system and optimize database and PHP programs.

Phase VI: Students will prepare a project report, demonstrate their MeTube system, and conduct an oral presentation on their project.

Content (tentative, may change during the semester):

1. ***Database Design Specification (1 hour*):** Learning database concepts; discussing the database architecture and design considerations.
2. ***Conceptual model and ER diagram (2 hours*):** Discussing ER Model; introducing EER diagram; studying how to use ER model to design a database system.
3. ***Relational data model and database schema (2 hours*):** Learning the relational data model and studying how to convert ER model to relational database schema.
4. ***Database normalization (2 hours*):** Introducing the functional dependency concepts; discussing the normal forms of relations, and the techniques used to perform the database normalization and the associated performance tradeoffs.
5. ***SQL language through MySQL (3 hours*):** Studying SQL language using MySQL DBMS system; learning how to install and manage the MySQL database; writing SQL queries for retrieving information from the database.
6. ***Index, key, and other constraints (2 hours):*** Discussing the concepts of indexing, key constraints, and integrity of the database.
7. ***Query Optimization (2 hours):*** Introducing the query processing and query optimization techniques. We will discuss how a DBMS system processes queries and introduce the options for query optimization. Normalization will also be revisited with the emphasis on the performance tradeoffs associated to normalization.
8. ***Web server, HTTP, HTML. PHP (4 hours):*** Discussing web server, HTTP protocols, HTML scripts and PHP programming.
9. ***HTTP form, script design and Multimedia presentation (3 hours)*:** Studying web form design and JavaScript. Discussing how to present multimedia data on the web page.
10. ***View, Triggers, and Stored Procedure (3 hours):*** Discussing the concepts of views, triggers and stored procedures; introducing transaction processing; studying the techniques for maintaining the data consistency.
11. ***Performance Evaluation and System Improvement (3 hours):*** Introducing the test case design, performance evaluation methods, and system improvement techniques.

Class Hours/Room: 11:00 AM ~ 12:15 PM, Tuesday and Thursday 415 Daniel Hall

Office Hours/Room: 9:30 AM ~ 10:30 PM, Tuesday and Thursday 305 McAdams Hall

Attendance Policy:

- It is very important to attend the class since the lecture content may be drawn from sources other than the textbook.
- Failure to attend the class most likely leads to missing some information that won't show in lecture notes or textbook. Such information is important for project and tests.
- Tardy may be punished by penalty point.
- The students can leave if the instructor does not show up in the classroom by 11:15AM.

Evaluation:

- **Project (40%):** Implement an online multimedia database system.
- **Quizzes (20%):** Up to ten quizzes will be given throughout the semester.
- **Midterm Exam (20%):** Cover the content studied in first half of the semester.
- **Final Exam (20%):** A comprehensive exam on content studied in the entire semester.
- **Penalty Points (-10%):** Students are required to attend the class. The instructor may penalize those who fail to attend the class without instructor's prior approval.
- **CpSc 662 Students:** More requirements on project and additional questions in quizzes or exams.

Project Policy:

- The project should be done by a team of three students (two-student team may be allowed).
- Each team must finish their project independently. Any form of cheating (including copying or reusing code from any source) will result in **0 (zero)** point for the project.
- Students must submit their project deliverables at the specified due dates. Late submission will not be accepted unless being approved by instructor.
- Intermediate results of the project will be evaluated and feedbacks will be given to improve the project.

Project Deliverables (Due dates will be posted online):

1. ER Diagram (10%)
2. Relational Schema and Database Tables (10%)
3. Design necessary database queries for MeTube System (10%)
4. System implementation, evaluation and demonstration (50%)
5. Final report (10%)
6. Presentation (10%)

Grading: A (90 - 100), B (80 - 89), C (70 - 79), D (60 - 69), F (0 - 59). (The scale may be curved down at the end of the semester if needed)

Q&A: Email questions to jzwang@cs.clemson.edu with subject "CPSC 462/662 Q&A".

Website: http://www.cs.clemson.edu/~jzwang/1101462/cpsc462.htm

References:

1. Fundamentals of Database Systems, Fifth Edition, Ramez Elmasri, Shamkant B. Navathe, Addison Wesley, 2007, ISBN: 0321369572.
2. Database Systems: The Complete Book, First Edition, Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer D. Widom, Prentice Hall, 2002, ISBN: 0-13-031995-3.
3. Database Management Systems, Third Edition, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 2002, ISBN: 0072465638.

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