Introduction

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What is DBMS?

- Database is an integrated collection of data that models a real-world enterprise.
  - Entities (e.g., students, courses)
  - Relationships (e.g., Jane is taking CpSc 4620)
- A Database Management System (DBMS) is a software package designed to store and manage databases.
- Most Modern DBMS systems are:
  - Relational Database Systems.
  - Online accessible: It is hard to imagine that any database system designed in the Internet era cannot be accessed online.

Registration System
Course Management System
Billing System
Online Bookstore
Digital Library
Google
YouTube (http://www.youtube.com)
More...

Why do we study DBMS?

- Shift from computation to information
  - at the "low end": scramble to Web (a mess!)
  - at the "high end": scientific applications such as post genomic biomedical research.
- Datasets increasing in diversity and volume.
  - Digital libraries, Interactive video, Human Genome project, Online stores
  - ... need for DBMS exploding
- DBMS encompasses most of CS
  - OS, languages, theory, “AI”, multimedia, logic
- Most CS jobs are database related.

Course Objectives

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

Attribution

- Materials and lecture notes in this course are adapted from various sources, including the authors of the textbook and references, Internet, instructor's personal notes, instructor's friends, etc.
- The instructor has tried to attribute all authors of the course materials.
- If you think that the instructor may overlook something, please tell the instructor.
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, while learning the theories and techniques through lectures.
- MeTube system is essentially a modified version of the popular YouTube system (http://www.youtube.com).
- The modification to YouTube system includes adding the support of more media types, including graphics objects, video, audio, and animation clips.

MeTube System Development and Class Topics

- The entire instruction is centered with the development of the semester-long multimedia database project, MeTube.
- The database concepts and techniques will be acquired through the course of solving the problems faced in the MeTube system development.
- The course project consists of 6 integrated phases in which new theories or techniques will be learned along with the project development.

Phase 1: Requirement Analysis

- Explore the YouTube system and read project requirement document to identify system requirements.
- Design layout of the Web interface.
- Identify data to be stored.
- Concepts and techniques:
  - Business requirement identification
  - Design specification
  - Data modeling
  - ER model and diagram.
  - HTML, PHP, and other Web technologies

Phase 2: Relational Schema and Table Design

- Decide where to store the data
- Design the database and file structure to store the data
- Design relational schemas and then design the actual database tables
- Theories and techniques:
  - Relational data model
  - relational tables and their properties
  - Normalization
  - SQL language
  - MySQL database management system.

Phase 3: SQL Queries

- Design complex SQL queries to retrieve information from the multimedia database.
- Evaluate and optimize the queries.
- Theories and techniques:
  - Convert English queries into the corresponding SQL statements.
  - Execute the queries on the multimedia databases using command line interface and phpMyAdmin.
  - Performance evaluation and and query optimization.

Phase 4: Web Interface Design

- Design the web interfaces to retrieve information from the MeTube database.
- Retrieve information from the MeTube database and properly present the information online.
- Techniques:
  - Web Server, HTTP, and forms.
  - HTML/XHTML.
  - PHP, MySQL database access through PHP.
  - Web script for multimedia presentation.
Phase 5: Testing and Improvement
- Test the MeTube system using various use cases.
- Improve the MeTube system.
- Evaluate the system performance.
- Optimize the database and PHP program.

Concepts and techniques:
- Test case design
- Performance evaluation
- System optimization.
- views, triggers, and stored procedures.

Phase 6: Demo and Final Report
- Students need to give a demonstration to the instructor or TA.
- Students need to submit a final report to discuss their project.
  - ER diagrams
  - Queries
  - Design consideration
  - Implementation details
  - etc.

Attendance
- It is very important to attend the class since the lecture contents may be drawn from sources (internet, technical manual, etc.) other than the textbook.
- Failure to attend the course most likely leads to missing some information that won’t show in lecture notes or textbook.

Grading Policy
- 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.
- Quizzes (20%): Up to ten quizzes will be given throughout the semester.
- Project (40%): A team of 2 or 3 students will be assigned to implement the MeTube system.

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)
- CpSc 6620 Students: more requirements on project.

Textbook and References

Reference Sites
- World Wide Web Consortium (W3C): http://www.w3c.org/
- PHP official website: http://www.php.net/
- MySQL documents: http://dev.mysql.com/doc/
- PHP, MySQL, HTML Tutorials: http://www.w3schools.com/
## Course Website and Canvas

<table>
<thead>
<tr>
<th>Website:</th>
<th><a href="http://www.cs.clemson.edu/~jzwang/2104620/cpsc4620.htm">http://www.cs.clemson.edu/~jzwang/2104620/cpsc4620.htm</a></th>
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<tr>
<td>Canvas:</td>
<td><a href="https://www.clemson.edu/canvas/">https://www.clemson.edu/canvas/</a></td>
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- Check website and Canvas regularly for latest announcements, updates, and assignments.
- All lecture notes and assignments will be posted on website and Canvas before or after the class.
- Useful links will be posted there too.

## Important Issues

- A successful project is the essential part of the success in this class.
- Start the project from the first day.
- Ask questions if you have any doubts on anything.
- Tests will be limited to those content discussed in the class.