

Computer Science 361

Database Systems

Spring 2009 syllabus

Current Catalog Description

An introduction to database processing with emphasis on database techniques, design, and modeling. Programming projects include implementation of selected database processing methods and the use of database software. Prerequisite: Computer Science 271 with a grade of C or better. (Spring)

TIME: 11:30 am – 1:00 pm Tuesday Thursday HS237

PREREQUISITES: Comp Sci-271 with a grade of C or better.

INSTRUCTOR: Dr. Wing Huen, HS221, 920-424-1324, huen@uwosh.edu

Office Hours: Tuesday Thursday: 9:30 a.m. to 11:30 a.m.; 1:00-2:00 p.m.
or by appointment.

Required Textbook

Ramakrishnan, R., Gehrke, J., Database Management Systems, 3rd ed.,
McGraw-Hill, 2003.

References

- Instructor's Notes at Q:\Shared\Huen\361
- Examples are available on Linux at /shared/huen/361
- Elmasri, R., C., Navathe, S., Fundamentals of Database Systems, 5th ed., Addison-Wesley, 2006.
- Silberschatz, A., Korth, H., Sudershan, S., Database Systems Concepts, 4th ed., McGraw-Hill, 2002.
- Date, C.J., An Introduction to Database Systems, 7th ed., Addison-Wesley, 2000.
- Ullman, J., Principles of Database and Knowledge-Base Systems, Volume I, Computer Science Press, 1988.
- Ricardo C. M., Database Illuminated, Jones Bartlett 2004
- Morrison J., Morrison, M., Guide to Oracle 9i, Course Technology, 2003.
- Earp R. Bagui S., Learning SQL, A Step-by-Step guide using Oracle, Addison Wesley
- SQL-Plus User's Guide and Reference
- Feuerstein S., Oracle PL/SQL Programming, O'Reilly & Associates, Inc.

Course Outcomes

At the conclusion of the course, students will be able to:

1. [Fundamental concepts of database design]
 - (a) model customer requirements of a relational database with an Entity-Relational diagram (E-R diagram)
 - (b) transform an E-R diagram to a database schema
 - (c) write a query to a relational database in SQL
 - (d) formulate a query to a relational database from the basic operators in relational algebra
 - (e) design a database to provide the necessary information for an organization while minimizing redundancy and null entries.
2. [SQL and PL/SQL]
 - (a) design and create a database using the Data Definition Language of a Database Management System
 - (b) write queries to a commercial relational database in an interactive mode (SQL-Plus of Oracle)
 - (c) develop database applications to access a commercial relational database (Oracle), implement complex business rules, and generate reports in Oracle PL/SQL
3. [Design of “good” relations, Schema Refinement, Concept of normalization and other theoretical issues]
 - (a) formulate the integrity constraints in the form of functional dependencies
 - (b) eliminate extraneous attributes in a functional dependency
 - (c) eliminate redundant functional dependencies
 - (d) develop a cover from a set of functional dependencies
 - (e) evaluate a proposed relational schema and determine whether it is in Third-Normal-Form (3NF) or Boyce-Codd-Normal-Form (BCNF)
 - (f) implement a normalization program that checks whether a proposed relational schema is in 3NF or BCNF
 - (g) decompose proposed relational schemas that are not in 3NF or BCNF into 3NF or BCNF
4. [Basic file organization and various file structure methods]
 - (a) determine the access time of records based on the file organization and file structure
 - (b) specify the type of stable and non-stable storage in the design of a database management system.
 - (c) analyze the requirements and select the design of an index (Hash, B+ tree)

- (d) organize data on disk to minimize disk accesses for various queries.
5. [Algorithms and implementation of large database systems]
(a) analyze the need of a database operator (scan, equality search, range search, insert, delete etc) and determine an appropriate and/or efficient algorithm (external sorting, hash, B+, clustered vs. unclustered, various join algorithms) in its implementation.
(b) Implement a Relational Operation (Example: Join)
6. [Transaction processing, concurrency issues, and recovery]
(a) identify and prevent deadlocks in concurrent database accesses
(b) be able to describe the recovery process of databases
(c) design the data structure and program of a database recovery mechanism
(d) provide accurate, consistent, and efficient transactions within the context of concurrency issues and the possibility of various kinds of failures, such as a system crash.

Prerequisites by Topic

- Programming proficiency in C++ and Java
- Data structures concepts and implementation (Computer Science 271)

Major Topics Covered in the Course

1. Overview of DBMS; the E-R model
2. The Relational Model
3. SQL, Oracle, and MSSQL
4. PL/SQL
5. Relational Database Design
6. Architecture of a DBMS
7. File Organization
8. Hashing
9. Indexing
10. External Sorting
11. Implementation of Relational Operations
12. Query Optimization
13. Transaction Processing; Concurrency Control; Recovery
14. Architecture/Features of the Oracle DBMS (if time permits)

REQUIREMENTS: You are expected to learn all of the material presented in the lectures and study the related chapters in the textbook. Written homework and programming assignments are also a requirement of the course. Homework assignments must be turned in on time; late homework will not be accepted and will be recorded as zero points. Programs with syntax errors will not be accepted. Programs that are turned in late will have their point totals reduced by 20% for each day that it is late. Both homework and programs are due at the beginning of the class period on the announced due date. Therefore a program turned in at the end of the class period on the due date will be considered to be 1 day late. Both the hard copy and the electronic version must be submitted on time. A program that is more than 4 days late will not be accepted.

All programs must be written in the PL/SQL or SQL*Plus language on the Oracle DBMS on the Linux network.

COURSE OUTLINE

Week	Week of	Topics	Notes
1	2/3, 2/5	Overview(2), ER Model (1)	
2	2/10, 2/12	ER Model(2), Relational Model(1)	
3	2/17, 2/19	ER to Relations Mapping, DDL(2), RA(1)	ER Homework
4	2/24, 2/26	Relational Algebra(RA) (2), SQL (1)	RA Homework
5	3/3, 3/5	SQL, Review, and Oracle PL/SQL (1.5), Exam 1 on 3/5	
6	3/10, 3/12	SQL and Oracle PL/SQL(3)	
7	3/17, 3/19	Relational Database Design(3)	SQL Oracle Assignment 1 due 3/17
	3/22-3/29	Spring break	
8	3/31, 4/2	Relative DB Design(1), Architecture of a DBMS(1)	SQL MSSQL Assignment 2 due 3/31
9	4/7, 4/9	File Organization(2), Review	Normal Form Homework; PL/SQL Assignment 3 Due 4/9
10	4/14, 4/16	Exam 2 on 4/14 , Hashing(2)	File Org Homework
11	4/21, 4/23	Indexing(3)	Normal Form Assignment 4 Due 4/23
12	4/28, 4/30	External Sorting(1), Implementation of Relational Operations(2)	

13	5/5, 5/7	Query Optimization(1), Transaction Processing; Concurrency Control; Recovery (2)	JOIN implementation Assignment 5 due 5/7
14	5/12, 5/14	Recovery(1), Review, Exam 3 on 5/14	

COURSE GRADE:	3 Exams	51%
	5 Programming Assignments	35%
	4 Homework	10%
	Class participation	4%

Likely Exam Dates

- Exam 1: Thursday 3/5, 2009
- Exam 2: Tuesday 4/14, 2009
- Exam 3: Thursday 5/14, 2009

To earn a final grade of C or better in the course, you must earn a grade of C or better on at least one exam. The final course grade will be determined by the following percentage cutoffs:

Score	Grade
92-100	A
89-91	AB
82-88	B
79-81	BC
72-78	C
69-71	CD
57-68	D
< 57	F

The course grade will be reduced by one letter grade (e.g. C to CD) for each unacceptable homework assignment. An assignment is unacceptable if

1. it is not handed in by the final due date, or
2. it is not a reasonable attempt to solve the assigned problem

The course grade will be reduced by three letter grades (e.g. C to F) if you hand in a program which is not your own work or your team's work if you choose to form a two-person team. An assignment has the same expectation of academic honesty as an in-class exam. Cheating will not be tolerated and will be vigorously punished.

Make-up Exam:

If you are unable to take a scheduled exam, you may take a make-up exam provided that you do **BOTH** of the following steps, which are subject to the instructor's approval:

1. Make arrangements *prior* to the scheduled exam (for last minute emergencies, telephone me or leave a message at 424-1324). No after-the-fact notifications will be

accepted.

2. Have a written medical excuse signed by the attending physician or a note from the Dean of Students Office.

Only one make-up exam will be given. It will be a comprehensive exam given in the last week of semester.

ATTENDANCE: Attendance is expected but not required. If you should miss a lecture for any reason, it is your responsibility to get the class notes from another (reliable) student. You should do this immediately so that you can schedule an office hour shortly thereafter to clarify anything you do not understand. But the missed in-class written or oral quizzes cannot be made up.

What is this class participation stuff? How does one "participate" in a subject like this?

Prepare for the class by completing the required reading.

Do well on the oral or written quizzes.

"Research has demonstrated that after a lecture, students recall 62% of the information. However, only 45% is recalled by students after 3-4 days and in 8 weeks only 24% of the information is recalled. If a quiz or exam was administered after the lecture, recall was doubled at the 8-week period. It is interesting that many faculty members appear to ignore the potential impact which quizzes and tests can have upon learning." -- Bonwell C.C., Eison J.A.: *Active Learning: Creating Excitement in the Classroom*. Washington, DC: George Washington University, 1991.