COSC 404 - Database System Implementation
Winter 2009 Term 2

Instructor: **Dr. Ramon Lawrence**
Class Schedule: 11:30 a.m. – 12:30 p.m. Monday/Wednesday/Friday
Location: LIB 302
Lab time/location: 2:00 p.m. – 4:00 p.m. Wednesdays at SCI 234
Office Hours: 2:00–3:30 p.m. Monday/Wednesday or by appointment
Office Location: SCI 263
Phone: 807-9390
E-mail: ramon.lawrence@ubc.ca (preferred contact method)
Course URL: http://people.ok.ubc.ca/rlawrenc/404/

Course Description

Official Calendar: Fundamental concepts in constructing database systems including file organizations, storage management, system architectures, query processing/optimization, transaction management, recovery, and concurrency control. Additional topics may include distributed databases, mobile databases, and integration. OUC equivalent: COSC 404.

Prerequisite

- COSC 304 – Introduction to Database Systems

Marking and Evaluation

Assignments	**20 %**	(approximately 5-6 assignments)
Midterm Exam	**20 %**	
Final Exam	**40 %**	(cumulative, three hours)
Project	**20 %**	

Textbook and Reference Material (*Optional*)

Optional textbook: Hector Garcia-Molina, Jeffrey Ullman and Jennifer Widom, *Database Systems: The Complete Book (2nd edition)*, Prentice Hall, ISBN 0-131-87325-3, 2008.

Expectations

- I expect students to attend **all** classes and prepare before attending class. This includes reading relevant sections of the textbook and reviewing notes from previous lectures.
- I recommend all students download and read a copy of the lecture notes **before** the lecture.
- I expect all students to learn the material in the course and undertake sufficient effort to produce all the programming assignments and quality projects.
- I want all students to enjoy attending class and feel free to participate according to their own personalities. Feel free to ask questions by raising your hand or speaking out at appropriate times.
- Please actively participate in class discussions, questions, and problem solving exercises.
- **I want all students to pass the course, receive a good grade, and feel the course was beneficial.**

Homework Expectation

For this course, it is expected that you will spend *at least six hours per week in out-of-class preparation*.

Grievances and Complaints Procedures

A student who has a complaint related to this course should follow the procedures summarized below.

• The student should attempt to resolve the matter with the instructor first. Students may talk first to someone other than the instructor if they do not feel, for whatever reason, that they can directly approach the instructor.

• If the complaint is not resolved to the student's satisfaction, the student should go to the departmental chair Barbara Rutherford, at ART 334, 807-8734.

Your Responsibilities

Your responsibilities to this class and to your education as a whole include attendance and participation. You have a responsibility to help create a classroom environment where all may learn. At the most basic level, this means you will respect the other members of the class and the instructor and treat them with the courtesy you hope to receive in return. Inappropriate classroom behavior may include: disruption of the classroom atmosphere, engaging in non-class activities, talking on a cell-phone, inappropriate use of profanity in classroom discussion, use of abusive or disrespectful language toward the instructor, a student in the class, or about other individuals or groups.

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the break down of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences. A more detailed description of academic integrity, including the policies and procedures, may be found at http://web.ubc.ca/okanagan/faculties/resources/academicintegrity.html. **If you have any questions about how academic integrity applies to this course, please consult with your professor.**

Disability Services

If you require disability-related accommodations to meet the course objectives please contact the Coordinator of Disability Resources located in the Student development and Advising area of the student services building. For more information about Disability Resources or about academic accommodations visit http://okanagan.students.ubc.ca/current/disres.cfm.

Missing an Exam

Only students who miss an exam for a reason that corresponds to the University of British Columbia Okanagan's policy on excused absences from examinations will be permitted to take the exam at a later time. A make-up exam may have a question format different from the regular exam. If the reason for absence is satisfactory, the student may either take the exam, or if a midterm exam is missed, the student's final exam will be worth more of the final grade.

Course Outline

The course has a substantial amount of material to be covered in a short time. This requires the student make a strong effort to keep up with the material discussed in class. Below is an outline of the topics. The professor is not bound to these topics and timelines as they only serve as a general reference.

Date	Topics Covered and Description
January 4 (M)	**First day of classes. Introduction to course, discuss syllabus/project, WebCT**
January 6 (W)	Storage I: Memory and Storage Devices
January 8 (F)	Storage II: RAID, Operating System File Interfaces
January 11 (M)	Storage III: Representing Data Fields and Records
January 13 (W)	Storage IV: Storing Records in Blocks, Pointer Swizzling
January 15 (F)	Storage V: File Operations, Buffering, Buffer Replacement Strategies
January 18 (M)	Indexing I: Index Types, Primary Indexes, Multi-level indexes
January 20 (W)	Indexing II: Secondary Indexes, Index Maintenance
January 22 (F)	Indexing III: B-Trees (insertion)
January 25 (M)	Indexing IV: B-Trees (deletion), B+-Trees
January 27 (W)	Indexing V: Hash Indexes
January 29 (F)	Indexing VI: Multi-Value Indexing, SQL Indexing in Practice
February 1 (M)	Query processing I: SQL/RA Review, Types of Operators, Iterators
February 3 (W)	Query processing II: One-pass Algorithms, Nested-Loop Joins
February 5 (F)	Query processing III: External Sorting, Two-Pass Sorting Algorithms
February 8 (M)	Query processing IV: Sort-Join, Sort-Merge-Join
February 10 (W)	Query processing V: Hash Partitioning, Two-Pass Hash Algorithms, Hybrid Hash Join
February 12 (F)	Query processing VI: Index algorithms, Current Research Challenges
February 15 (M)	**No classes during Midterm Break.**
February 17 (W)	**No classes during Midterm Break.**
February 19 (F)	**No classes during Midterm Break.**
February 22 (M)	Query optimization I: SQL grammar, Query Parsing and Translation
February 24 (W)	Query optimization II: Relational Algebra Laws, Heuristic Query Optimization
February 26 (F)	Query optimization III: Physical Query Plans, Estimating Operator Cost
March 1 (M)	Query optimization IV: Cost-based Query Optimization
March 3 (W)	Transaction processing I: Overview, Transaction States, ACID Properties, Schedules
March 5 (F)	Transaction processing II: Conflict Serializablity, Precedence Graphs
March 8 (M)	Transaction processing III: View Serializablity
March 10 (W)	Concurrency control I: Locks, Two-Phase Locking (2PL), Lock Conversions
March 12 (F)	Concurrency control II: Graph Protocols, Timestamps, Multiple Granularity Locking
March 15 (M)	Concurrency control III: Multi-versioning, Transaction Isolation Levels
March 17 (W)	Concurrency control IV: Deadlock Handling, Starvation, Wait-for Graphs
March 19 (F)	Recovery I: Types of Failures, Log-Based Recovery, Undo Logging, Checkpoints
March 22 (M)	Recovery II: Undo/Redo Logging
March 24 (W)	R-Trees and Spatial Indexing
March 26 (F)	Parallel Databases
March 29 (M)	Distributed Databases: Replication, Fragmentation, 2PC and 3PC
March 31 (W)	Database Integration
April 2 (F)	**Good Friday. University closed.**
April 5 (M)	**Easter Monday. University closed.**
April 7 (W)	**Project presentations.**
April 9 (F)	**Project presentations. Final project due. Review for final exam.**

Laboratory times: The laboratory time will be spent on written and programming lab assignments.

Week	Dates	Topics Covered and Description
1	January 6	**No Lab First Week of Class**
2	January 13	Lab 1: Storage Issues
3	January 20	Lab 1: Storage Issues (cont.)
4	January 27	Lab 2: Indexing
5	February 3	Lab 2: Indexing (cont.)
6	February 10	Lab 3: Query Processing
7	February 17	**No Lab During Midterm Break**
8	February 24	**Midterm Exam In Lab**
9	March 3	Lab 4: Query Optimization
10	March 10	Lab 5: Transactions
11	March 17	Lab 5: Transactions (cont.)
12	March 24	Lab 6: Concurrency Control and Recovery
13	March 31	Lab 6: Concurrency Control and Recovery (cont.)
14	April 7	**No Lab Last Week of Class**