

COSC 404 - Database System Implementation

Winter 2011 Term 2

Instructor: Dr. Ramon Lawrence
Class Schedule: 12:30 p.m. – 2:00 p.m. Monday/Wednesday
Location: FIP 250
Lab time/location: 9:30 a.m. – 11:30 a.m. Mondays at SCI 234
Office Hours: 2:00–3:30 p.m. Monday/Wednesday or by appointment
Office Location: ASC 349
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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.

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

- Attend **all** classes and prepare before attending class.
- Read the lecture notes **before** the lecture.
- Learn the material in the course and undertake sufficient effort to produce all the programming assignments and quality projects.
- Enjoy attending class and feel free to participate according to your personality. 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 Sylvie Desjardins at SCI 388, 807-8767.

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 breakdown 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>.

Equity, Human Rights, Discrimination and Harassment

UBC does not condone discrimination or harassment in classrooms, living or work environments on campus. For information about UBC's policies related to equity, human rights, discrimination or harassment please contact: Equity Advisor: ph. 250-807-9291; email equity.ubco@ubc.ca Web: www.ubc.ca/okanagan/equity

Missing an Exam

Only students who miss the final 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 final exam at a later time. A make-up exam may have a question format different from the regular exam. **There will be no make-up midterm exams.** If the reason for absence is satisfactory, 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 (W) | First day of classes. Introduction to course, discuss syllabus/project, WebCT |
| January 9 (M) | Storage I: Memory and Storage Devices, RAID |
| January 11 (W) | Storage II: OS File Interfaces, Representing Fields and Records |
| January 16 (M) | Storage III: Storing Records in Blocks, Pointer Swizzling, File Operations, Buffering, Buffer Replacement Strategies |
| January 18 (W) | Indexing I: Index Types, Primary Indexes, Multi-level Indexes, Secondary Indexes |
| January 23 (M) | Indexing II: Index Maintenance |
| January 25 (W) | Indexing III: B-Trees (insertion, deletion), B+-Trees |
| January 30 (M) | Indexing IV: Hash Indexes, Multi-Value Indexing, SQL Indexing in Practice |
| February 1 (W) | Query processing I: SQL/RA Review, Types of Operators, Iterators, One-pass Algorithms |
| February 6 (M) | Query processing II: Nested-Loop Joins, External Sorting, Two-Pass Sorting Algorithms, Sort-Join, Sort-Merge-Join |
| February 8 (W) | Query processing III: Hash Partitioning, Two-Pass Hash Algorithms, Hybrid Hash Join |
| February 13 (M) | Query processing IV: Index algorithms, Current Research Challenges |
| February 15 (W) | Query optimization I: Query Parsing/Translation, Relational Algebra Laws |
| February 20 (M) | No classes during Midterm Break. |
| February 22 (W) | No classes during Midterm Break. |
| February 27 (M) | Midterm Exam |
| February 29 (W) | Query optimization II: Heuristic Optimization, Physical Query Plans |
| March 5 (M) | Query optimization III: Cost-based Query Optimization |
| March 7 (W) | Transaction processing I: ACID Properties, Schedules, Conflict Serializability |
| March 12 (M) | Transaction processing II: View Serializability, Schedule Properties |
| March 14 (W) | Concurrency control I: Two-Phase Locking (2PL), Graph Protocols, Timestamps |
| March 19 (M) | Concurrency control II: Multiple Granularity Locking, Multi-versioning |
| March 21 (W) | Concurrency control III: SQL Transactions, Deadlock Handling, Wait-for Graph |
| March 26 (M) | Recovery I: Types of Failures, Log-Based Recovery, Undo Logging, Checkpoints |
| March 28 (W) | Recovery II: Redo and Undo/Redo Logging |
| April 2 (M) | Project presentations. |
| April 4 (W) | Project presentations. Final project due. Review for final exam. |
| Optional | R-Trees and Spatial Indexing |
| Optional | Parallel Databases |
| Optional | Distributed Databases: Replication, Fragmentation, 2PC and 3PC |
| Optional | Database Integration |

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

| Week | Dates | Topics Covered and Description |
|-------------|--------------|---|
| 1 | January 2 | No Lab First Week of Class |
| 2 | January 9 | Lab 1: Storage Issues |
| 3 | January 16 | Lab 1: Storage Issues (cont.) |
| 4 | January 23 | Lab 2: Indexing |
| 5 | January 30 | Lab 2: Indexing (cont.) |
| 6 | February 6 | Lab 3: Query Processing |
| 7 | February 13 | Lab 3: Query Processing |
| 8 | February 20 | No Lab During Midterm Break |
| 9 | February 27 | Lab 4: Query Optimization |
| 10 | March 5 | Lab 5: Transactions |
| 11 | March 12 | Lab 5: Transactions (cont.) |
| 12 | March 19 | Lab 6: Concurrency Control and Recovery |
| 13 | March 26 | Lab 6: Concurrency Control and Recovery (cont.) |
| 14 | April 2 | No Lab Last Week of Class |