UNSW Course Outline

COMP9315 Database Systems Implementation - 2024

Published on the 30 Jan 2024

General Course Information

Course Code : COMP9315
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Computer Science and Engineering
Delivery Mode : Multimodal
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate, Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course aims to introduce students to the detailed internal structure of database management systems (DBMSs) such as Oracle or SQL Server. DBMSs contain a variety of interesting data structures and algorithms that are also potentially useful outside the DBMS

context; knowing about them is a useful way of extending your general programming background. While the focus is on relational DBMSs, given that they have the best-developed technological foundation, we will also consider more recent developments in the management of large data repositories.

Relational DBMSs need to deal with a variety of issues: storage structures and management, implementation of relational operations, query optimisation, transactions, concurrency, recovery, security. The course will address most of these, along with a brief look at emerging database systems trends. The level of detail on individual topics will vary; some will be covered in significant detail, others will be covered relatively briefly.

An important aspect of this course is to give you a chance to explore the internals of a *real* DBMS: PostgreSQL. Lectures will discuss the general principles of how DBMSs are implemented, and will also illustrate them with examples from PostgreSQL where possible. Since DBMSs are very large pieces of software, it won't be possible to explore the entire PostgreSQL system in depth.

Course Aims

This course aims to introduce students to the detailed internal structure of database management systems (DBMSs) such as Oracle or SQL Server. DBMSs contain a variety of interesting data structures and algorithms that are also potentially useful outside the DBMS context; knowing about them is a useful way of extending your general programming background. While the focus is on relational DBMSs, given that they have the best-developed technological foundation, we will also consider more recent developments in the management of large data repositories.

COMP9315 forms part of the Databases major for both undergraduates and postgraduates.

Relationship to Other Courses

COMP9315 assumes that you have a strong background in C programming and a solid knowledge of data structures such as search trees and hash tables. A working knowledge, from the user prespective, of database systems (e.g. SQL) is also critical.

If you take COMP9315 without this background, you will struggle to pass the course.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Understand the internal architecture of large-scale (relational) data management systems
CLO2 : Evaluate data structures and algorithms for large-scale data manipulation and apply them in given scenarios
CLO3 : Analyze the performance of data-intensive systems
CLO4 : Understand techniques for implementing transactional behavior and reliable storage
CLO5 : Analyze the PostgreSQL database management system
CLO6 : Create new data types in PostgreSQL

Course Learning Outcomes	Assessment Item
CLO1 : Understand the internal architecture of large-scale (relational) data management systems	• Quizzes • Assignment 2 • Final Exam
CLO2 : Evaluate data structures and algorithms for large-scale data manipulation and apply them in given scenarios	• Quizzes • Assignment 2 • Final Exam
CLO3 : Analyze the performance of data-intensive systems	• Quizzes • Assignment 2 • Final Exam
CLO4 : Understand techniques for implementing transactional behavior and reliable storage	• Quizzes • Final Exam
CLO5 : Analyze the PostgreSQL database management system	• Assignment 1 • Final Exam
CLO6 : Create new data types in PostgreSQL	• Assignment 1

Learning and Teaching Technologies

Webcms3 | Echo 360

Learning and Teaching in this course

- Lectures are useful
- Theory exercises are useful
- Practical exercises are very useful
- Assignments are critical (do them yourself!)

Additional Course Information

The exam for this course in conducted in-person in the CSE labs, is invigilated, in a closed

environment (i.e. no internet access), on the CSE workstations, and requires you to write some small C programs.

There is *no* scope to to take exams online, remote, and non-invigilated.

If this does not appeal to you, do not take this course.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quizzes Assessment Format: Individual	15%	
Assignment 1 Assessment Format: Individual	15%	
Assignment 2 Assessment Format: Individual	20%	
Final Exam Assessment Format: Individual	50%	

Assessment Details

Quizzes

Assessment Overview

Over the course of the term, there will be a number of online quizzes which you do in your own time (via Moodle). These quizzes test your knowledge of content from the previous couple of weeks. They are useful both for review and assessment. The quizzes are worth a total of 15%, which is calculated by summing the marks for all quizzes and then scaling this into a mark out of 15. If you submit a quiz late, a late penalty applies to the mark for that quiz.

Course Learning Outcomes

- CLO1 : Understand the internal architecture of large-scale (relational) data management systems
- CLO2 : Evaluate data structures and algorithms for large-scale data manipulation and apply them in given scenarios
- CLO3 : Analyze the performance of data-intensive systems
- CLO4 : Understand techniques for implementing transactional behavior and reliable storage

Assignment 1

Assessment Overview

Implement a new data type in PostgreSQL.

Assignments are submitted online. Assignment submissions will be marked based on how accurately they satisfy the requirements. Assignments will be auto-marked via a large test suite; a subset of these tests will be made available for you to check your code while developing the assignment. Standard UNSW late penalties apply.

Course Learning Outcomes

- CLO5 : Analyze the PostgreSQL database management system
- CLO6 : Create new data types in PostgreSQL

Assignment 2

Assessment Overview

Implement a piece of database technology.

Assignments are submitted online. Assignment submissions will be marked based on how accurately they satisfy the requirements. Assignments will be auto-marked via a large test suite; a subset of these tests will be made available for you to check your code while developing the assignment. Standard UNSW late penalties apply.

Course Learning Outcomes

- CLO1 : Understand the internal architecture of large-scale (relational) data management systems
- CLO2 : Evaluate data structures and algorithms for large-scale data manipulation and apply them in given scenarios
- CLO3 : Analyze the performance of data-intensive systems

Final Exam

Assessment Overview

The Final Exam will be conducted in the CSE labs, in a closed environment but with access to documentation, and will involve written-answer analytical questions and implementation exercises (C programming).

There is a hurdle requirement on the final exam. If you do not score at least 40% (20/50) on the exam (after scaling), you cannot pass the course. If you score very poorly (<40%) on the exam, but your overall course score exceeds 50%, you will be awarded a grade of UF (which counts as a

fail).

Course Learning Outcomes

- CLO1 : Understand the internal architecture of large-scale (relational) data management systems
- CLO2 : Evaluate data structures and algorithms for large-scale data manipulation and apply them in given scenarios
- CLO3 : Analyze the performance of data-intensive systems
- CLO4 : Understand techniques for implementing transactional behavior and reliable storage
- CLO5 : Analyze the PostgreSQL database management system

Hurdle rules

Must score at least 40% on final exam to pass the course

General Assessment Information

All assessment tasks are to be completed individually.

Quizzes and assignments can be submitted multiple times before the deadline.

Autotesting will be provided for assignments.

Assignments will be automarked, which will include the autotests plus extra tests.

Marks are based solely on your code's ability to compile and pass the tests.

Code will be plagiarism-checked and contract-cheating-checked; violations result in zero marks for that item.

Grading Basis

Standard

Requirements to pass course

- quizzes = total mark for Quizzes (out of 15)
- ass1 = mark for Assignment 1 (out of 15)
- ass2 = mark for Assignment 2 (out of 20)
- exam = mark for Final Exam (out of 50)
- total = quizzes + ass1 + ass2 + exam
- grade = UF if exam < 20/50
- grade = FL if total < 50
- grade = PS|CR|DN|HD, otherwise

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	Course Intro, DBMS review, Rel Alg (RA), PostgreSQL, Catalogues
Week 2 : 19 February - 25 February	Lecture	Storage: Disks, Files, Buffers, Pages, Tuples; Cost Models
Week 3 : 26 February - 3 March	Lecture	Relational Algebra Operations: Scanning, Sorting, Projection
Week 4 : 4 March - 10 March	Lecture	Selection: Heaps, Sorted Files, Hashed Files, Indexes, B-trees
Week 5 : 11 March - 17 March	Lecture	Selection: N-d Hashing, N-d Trees, Signatures, Similarity Matching
Week 6 : 18 March - 24 March	Lecture	Flexibility Week (no classes, no new topics)
Week 7 : 25 March - 31 March	Lecture	Joins: Nested Loop, Sort-Merge, Hash Join
Week 8 : 1 April - 7 April	Lecture	Query Processing, Optimisation, Execution
Week 9 : 8 April - 14 April	Lecture	Transactions: Isolation, Concurrency Control, Durability, Recovery
Week 10 : 15 April - 21 April	Lecture	Trends in DBMSs

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

The following table lists the tentative schedule. Students will be informed of any changes during the lecture and by announcements on the Webcms3 notice page.

Course Resources

Prescribed Resources

All of the resources for the course are accessible via the Webcms3 site.

Course Evaluation and Development

During the term, send feedback on any issues with how the course is running.

At the end of term, provide feedback via MyExperience. Constructive criticism in the Comments is useful.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	John Shepherd					Yes	Yes

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their

streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School Contact Information

CSE Help! - on the Ground Floor of K17

- For assistance with coursework assessments.

The Nucleus Student Hub - https://nucleus.unsw.edu.au/en/contact-us

- Course enrolment queries.

Grievance Officer - grievance-officer@cse.unsw.edu.au

- If the course convenor gives an inadequate response to a query or when the course convenor does not respond to a query about assessment.

Student Reps - stureps@cse.unsw.edu.au

- If some aspect of a course needs urgent improvement. (e.g. Nobody responding to forum queries, cannot understand the lecturer)