

Advanced Database Design and Implementation - Course Outline

SWEN 432: 2016 Trimester 1

This document sets out the workload and assessment requirements for SWEN 432. It also provides contact information for staff involved in the course. If the contents of this document are altered during the course, you will be advised of the change by an announcement in lectures and/or on the course web site. A printed copy of this document is held in the School Office.

SWEN 432 is an advanced course in database and information systems. Databases and information systems facilitate handling of large amounts of information. The information we want to process is now more complicated than it used to be. We require more intelligent, application-specific, and sophisticated systems to do processing.

This year the course will examine the following two contemporary fields in the database systems area:

- Cloud Databases, and
- Data Warehousing.

Cloud Database field will comprise approximately 70% of the course and will consider questions like: what is Database as a Service (DaaS), what are main features of cloud databases and how they differ from traditional databases, and what are CAP and BASE trade-offs in cloud database implementations. Further, three specific data models used to deploy cloud database management systems will be considered. Details of three cloud database management systems (Apache's *Cassandra*, *MongoDB*, and Amazon's *Dynamo*) implementations will also be presented. Four practical assignments will use *Cassandra* and *MongoDB* to demonstrate issues in designing, building and querying cloud databases relying on two different data models.

The Data Warehouse field will comprise approximately 30% of the course and will consider questions like: what is a Data Warehouse and what is it used for, how is data organized in a Data Warehouse, what operations and queries are executed against a Data Warehouse, SQL:1999 standard and Data Warehouse, query accelerating techniques, what are the contemporary Data Warehouse architectures, and the issues of implementing a data Warehouse as a Cloud Database. An assignment will use PostgreSQL to demonstrate issues in designing, building and querying Data Warehouses.

Main Course Learning Objectives

By the end of the course, students should be able to:

1. Demonstrate a comprehensive understanding of cloud database structures and mechanisms they use to achieve high availability, scalability, network partition tolerance, and eventual consistency.
2. Set up cloud database clusters on the local host, design, implement, and query cloud NoSQL databases using two different cloud database management systems (*Cassandra* and *MongoDB*), and
3. Design, implement, and query a relational Data Warehouse.

Extended Course Learning Objectives

1. Set up cloud database clusters on the local host, implement and query cloud NoSQL databases, and implement, and query a relational Data Warehouse, and thus develop the ability to solve practical engineering problems (BE graduate attribute 3(f)),
2. Analyze a part of the real world and design a corresponding: *Cassandra* database schema, collection of *MongoDB* database document layouts, and Data Warehouse relational star schema, and thus develop the ability to formulate and build efficient models of complex systems using principles of engineering science and mathematics, and also develop the ability to synthesize a solution and make design documentation BE graduate attribute 2(b)), (BE graduate attribute 3(b)), and BE graduate attribute 3(c)),
3. Use available web sources to learn about: cloud database management systems, and on-line analytical processing systems, and acquire an ability to define complex queries against a cloud database or relational Data Warehouse and thus develop the ability to look for additional information from pertinent sources (BE graduate attribute 3(d)),
4. Analyze properties and usage of a set of queries, or documents, decide on the most appropriate kind of a database management system, implement the database, and thus develop ability to formulate the problem and create a solution that models behavior of a part of the real world (BE graduate attribute 3(c)),
5. Read, critically analyze, and write reports on research and professional articles in an area covered by the course and thus develop the ability to communicate effectively in a written form (BE graduate attribute 2(b)).

Knowledge assumed of participants

Before you enroll in SWEN 432 you are expected to have passed SWEN304 OR COMP302. Particularly, you will need to

be familiar with the following topics:

- Relational Data Model,
- Transactional ACID (Atomicity, Consistency, Isolation, Durability) database properties,
- Structured Query Language (SQL),
- Relational Functional Dependencies and Normal Forms,
- *PostgreSQL* Database Management System.

You must also have a good understanding of English and be able to write clearly.

Recommended Reading

Have a look at [reading links](#). It is a reading list of material that may be of use. You will also find there a link to *PostgreSQL*.

Lectures

SWEN 432 is a trimester 1 course. The trimester starts on 29 February. The examination period at the end of the course is 10 June - 29 June.

A [schedule](#) of lecture topics and tentative assignment due dates is available on-line. Lectures for SWEN 432 are:

- Tuesday 14:10 to 15:00 in MYLT102,
- Thursday 14:10 to 15:00 in MYLT102,
- Friday 14:10 to 15:00 in MYLT102.

Assignments

There will be five assignments. A tentative assignment schedule is given [here](#). In principle, each assignment will be issued on Monday and due on Friday next week. In your answers to assignment questions, you are expected to communicate your solutions in a clear way and, if needed, to present a proper design documentation. If you think you need more information than covered in lectures, use [reading links](#), where you will find additional sources.

The assignment **one** asks you to design, and build a small cloud database and to exercise querying and updating it using *Cassandra*. The assignment **two** asks you to perform the set-up of a *Cassandra* cluster, and experiment with a number of performance and consistency issues. The assignment "three" asks you to design and build a small cloud database collection and to exercise querying and updating it using *MongoDB*. The assignment **four** asks you to perform the set-up of a *MongoDB* cluster, and experiment with a number of performance and consistency issues. Finally, the assignment "five" asks you to design, and build a small Data Warehouse and to exercise OLAP specific queries using *PostgreSQL*. By doing the assignments, you achieve the extending course learning objectives one, two, three, and four.

Assignments will be handed out in lectures. You will find all necessary information about assignments and files needed [here](#). Assignments should be submitted [electronically](#). Any assignment submitted after the due date will be penalized at the rate of 5% per day (a weekend counts as one day). Approval to submit assignments late without penalty will only be granted in exceptional circumstances and if the arrangement is made prior to the due date. Any medical excuse must be accompanied by a doctor's certificate.

Essay

Writing an essay is an important part of your assessment. The essay helps you to achieve the course objective seven. You will find the essay title and description in [essay 2016 guidelines](#). The essay is *due on Friday 15 April*. You may find it useful to consult also [general](#) essay guidelines. Your essay should not exceed 7000 words. Submit the essay electronically as a .pdf file, and also print it and hand in a hard copy into the hand-in box. There will be no essay presentations this year. The mark you get for your essay will be based on how interesting the content of your essay is, how readable the essay is, and how good your analysis of the problem is.

Workload

In order to maintain satisfactory progress in SWEN 432, you should plan to spend an average of at least 10 hours per week, which includes attending lectures, solving assignments, writing essay, reading literature and reviewing lecture material.

School of Engineering and Computer Science

The School office is located on level three of the Cotton Building ([Cotton 358](#)).

Staff

The course organizer and lecturer for SWEN 432 is: Pavle Mogin. His contact details are:

- [Pavle Mogin](#)

- Room: [Cotton 331](#)
- Phone: +64 4 463 5233 x 7527
- email: Pavle.Mogin@ecs.vuw.ac.nz
- Office hours: Tuesday 3 to 4 pm

[Aaron Morton](#) is going to deliver two lectures on Cassandra, as a guest lecturer.

Your class representative is:

- Name: Lucy French
- email: frenchlucy1@myvuw.ac.nz

Announcements and Communication

The main means of communication outside of lecture will be email and the SWEN 432 web area at http://ecs.victoria.ac.nz/Courses/SWEN432_2016T1/. There you will find, among other things, this document, the [lecture schedule](#), [assignment handouts](#), and the [SWEN 432 Forum](#). The forum is a web-based bulletin board system. Questions and comments can be posted to the forum, and staff will read these posts and frequently respond to them.

Assessment

Your grade for SWEN 432 will be determined from your work on the essay, assignments, and the final examination, as follows:

| Item | Weight | Week Due |
|-------------------|--------|----------|
| Essay | 15% | 6 |
| Assignment 1 | 5% | 4 |
| Assignment 2 | 5% | 5 |
| Assignment 3 | 5% | 8 |
| Assignment 4 | 5% | 9 |
| Assignment 5 | 5% | 12 |
| Final examination | 60% | |

Each assignment contains a number of questions worth 100 marks in total. Your answers to questions will be assessed according to their accuracy. You may find more about the assessment of the essay in [essay 2016 guidelines](#).

Final Examination

The [timetable for final examinations](#) will be available from the University web site and will be posted on a notice board outside the faculty office. The final examination will be two hours long. No computers, or similar device will be allowed in the final examination. Only paper non-English to English dictionaries and simple calculators will be permitted. The study and examination period for trimester T1 is 6 June to 29 June.

Plagiarism

Working Together and Plagiarism We encourage you to discuss the principles of the course and assignments with other students, to help and seek help with programming details, problems involving the lab machines. However, any work you hand in must be your own work. The [School policy on Plagiarism](#) (claiming other people's work as your own) is available from the course home page. Please read it. We will penalize anyone we find plagiarizing, whether from students currently doing the course, or from other sources. Students who knowingly allow other students to copy their work may also be penalized. If you have had help from someone else (other than a tutor), it is always safe to state the help that you got. For example, if you had help from someone else in writing a component of your code, it is not plagiarism as long as you state (e.g., as a comment in the code) who helped you in writing the method.

Mandatory Requirements

To satisfy mandatory requirements of SWEN 432, a student must:

- hand in an essay, and
- achieve at least 40% of all marks for the assignments.

Passing SWEN 432

To pass SWEN 432, a student must satisfy mandatory requirements, achieve at least a D grade for the exam, and gain at least a **C-** grade overall.

Course Withdrawal

The last date for withdrawal from SWEN 432 with entitlement to a refund of tuition fees is Friday 11 March 2016. The last date for withdrawal without being regarded as having failed the course is Friday 13 May 2016 -- though later withdrawals may be approved by the Dean in special circumstances.

You will no longer be liable for the applicable course fees if you apply for a withdrawal by completing a Change of Course form (available from your Faculty Student Administration Office) or apply in writing on or before Friday, 11 March 2016.

Rules & Policies

Find key dates, explanations of grades and other useful information at <http://www.victoria.ac.nz/home/study>.

Find out about academic progress and restricted enrolment at <http://www.victoria.ac.nz/home/study/academic-progress>.

The University's statutes and policies are available at <http://www.victoria.ac.nz/home/about/policy>, except qualification statutes, which are available via the Calendar webpage at <http://www.victoria.ac.nz/home/study/calendar> (See Section C).

Further information about the University's academic processes can be found on the website of the Assistant Vice-Chancellor (Academic) at <http://www.victoria.ac.nz/home/about/avcacademic>

All students are expected to be familiar with the following regulations and policies, which are available from the school web site:

[Grievances](#)

[Student and Staff Conduct](#)

[Meeting the Needs of Students with Disabilities](#)

[Student Support](#)

[Academic Integrity and Plagiarism](#)

[Dates and Deadlines including Withdrawal dates](#)

[School Laboratory Hours and Rules](#)

[Printing Allocations](#)

[Expectations of Students in ECS courses](#)

The School of Engineering and Computer Science strives to anticipate all problems associated with its courses, laboratories and equipment. We hope you will find that your courses meet your expectations of a quality learning experience.

If you think we have overlooked something or would like to make a suggestion feel free to talk to your course organiser or lecturer.

[Course Outline as PDF](#)
