

Concurrent Programming - Course Outline

NWEN 303: 2013 Trimester 2

This document sets out the workload and assessment requirements for NWEN 303. 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.

Aim

The main aim of this course is to provide you with the core skills necessary to build concurrent systems for both multicore shared memory machines and distributed systems.

Objectives

On completing this course, you should be able to meet the objectives listed below. Note that as Concurrent Programming is part of the Engineering program at Victoria University of Wellington, BE graduates are expected to exhibit a number of graduate attributes at the completion of their degree. NWEN303's objectives contribute to the graduate attributes (GA) as indicated below. A full table of these attributes is available at [Graduate Attributes](#).

1. Identify the different types of concurrency problems that can occur in both shared memory models versus message passing models. (3(f))
2. Analyse a given program to identify where and why these problems might arise. 3(c))
3. Apply key concurrency control mechanisms and algorithms to avoid these problems in a concurrent program. (3(b))
4. Implement solutions to concurrent problems in code using current programming languages such as Java. (3(b)), 3(f))
5. Evaluate the "fitness to purpose" of solutions to concurrency problems using reasoning from first principles and experimentation. (3(b), 3(d))
6. Communicate the rationale for their design, implementation choices and the meaning of the results of their testing in project reports. (2(b))

The programming projects have been selected to give you the opportunity to achieve these objectives, resulting in:

1. Experience in writing concurrent programs for both shared memory and message passing systems.
2. An appreciation of design tradeoffs between different concurrency mechanisms and algorithms.
3. Familiarity with Java concurrency mechanisms and exposure to concurrency mechanisms used in other languages such as Ada and Erlang.

Topics

The course will cover the following topics:

1. Concurrency problems for shared memory and distributed systems.
2. Techniques for describing concurrent systems.
3. Java threading model and concurrency mechanisms.
4. Synchronisation and critical sections.
5. Critical sections and correctness criteria.
6. Semaphores and monitors.
7. Locks and lock-free solutions to concurrency problems.
8. Communication between processes.
9. Message passing versus tuple space abstractions (e.g. Linda) for concurrency control.
10. Ensuring mutual exclusion.
11. Determining if a system has terminated.
12. Implementing snapshots for debugging or error recovery.
13. Achieving consensus amongst processes, even in the presence of faults.

Assessment

Your grade for NWEN303 will be determined based on the following assessment weightings:

| Item | Weight | Due Dates |
|------|--------|-----------|
|------|--------|-----------|

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|--------------------------------------|-----|----------------------------|
| Six assignments | 10% | Fortnightly |
| Project 1: Shared-memory concurrency | 15% | End of mid trimester break |
| Project 2: Message passing | 15% | Last day of trimester |
| Final Examination (3 hours) | 60% | Examination period |

Practical Work

Assignments

The purpose of assignments is to provide opportunities for you to improve your understanding of concepts introduced in lectures. There will be six fortnightly assignments that are expected to be completed. Note that late assignments will only be accepted under exceptional conditions and with prior agreement by the course coordinator. Once model solutions for assignments are put up on the website it will be impossible to accept a late assignment.

Projects

There are two projects to be completed during this course. One will focus on shared-memory concurrency; the other will focus on message passing concurrency. As for the assignments, late submission is only acceptable under exceptional conditions and with prior agreement by the course coordinator.

Exam

There will be a three hour final exam in the official examination period 25 October - 16 November. The [timetable for final examinations](#) will be posted on the notice board outside the faculty office.

No computers, or programmable electronic calculators or similar devices will be allowed. Non-electronic foreign language dictionaries will be allowed.

Textbook

The textbook is Principles of Concurrent and Distributed Programming (Second edition), M. Ben-Ari, Addison-Wesley, 2006. ISBN: 0-321-31283-X. The cost of the text is around \$100. Copies are available in the Victoria University Bookshop and the book was used last year so second hand copies may be available. Anyone with a Safari subscription can also read the book online.

Lectures, Tutorials and Laboratories

A [schedule](#) of lecture topics, readings, and assignment due dates is available online

Lectures are: Tuesday 12.00-12.50pm and Wednesday 9.00-9.50am in Hugh Mackenzie 103.

Tutorials are: Thursday 12.00-12.50pm in Hugh Mackenzie 104.

Workload

In order to maintain satisfactory progress in NWEN 303, you should plan to spend an average of at least 10 hours per week on this paper. A plausible and approximate breakdown for these hours would be:

- Lectures and tutorials: 3 hours
- Readings: 3 hours
- Assignments, projects and lab work: 4 hours

School of Engineering and Computer Science

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

The notice board for NWEN 303 is located on the second floor of the Cotton Building.

Staff

The course organiser and lecturer for NWEN 303 is [Lindsay Groves](#). His contact details are:

- [Cotton 257](#)
- +64 4 463 5656
- Lindsay.Groves@ecs.vuw.ac.nz

Announcements and Communication

The main means of communication outside of lecture will be the NWEN 303 web area at http://ecs.victoria.ac.nz/Courses/NWEN303_2013T2/. There you will find, among other things, this document, the [lecture schedule](#) and [assignment handouts](#), and the [NWEN 303 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.

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 penalise anyone we find plagiarising, whether from students currently doing the course, or from other sources. Students who knowingly allow other students to copy their work may also be penalised. 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 (eg, as a comment in the code) who helped you in writing the method.

Mandatory Requirements

To pass NWEN 303 a student must obtain a minimum of a "D" on the final examination.

Passing NWEN 303

To pass the course, a student must satisfy mandatory requirements and gain at least a **C** grade overall.

Withdrawal

The last date for withdrawal from NWEN 303 with entitlement to a refund of tuition fees is Friday 26 July 2013. The last date for withdrawal without being regarded as having failed the course is Friday, 27 September 2013 - though later withdrawals may be approved by the Dean in special circumstances.

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](#)