Concurrent Programming - Course Outline
NWEN 303: 2014 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.

Contents of this document:

Course Organisation

Staff

The course organiser for NWEN 303 is Ian Welch. The lecturers for the course are Ian Welch and Marco Servetto. Their contact details are:

- *Ian Welch*
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- *Marco Servetto*
- Cotton 258
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The Class Rep for NWEN 303 will be elected during the first week of the course.

Class/lab Times and Room Numbers

Lectures for NWEN 303 are on Mondays and Fridays from 1510-1600 in Murphy room LT220 and tutorials are on Tuesdays from 1510-1600 in CO219.

Trimester Dates and Examination Period Dates

NWEN 303 is a trimester 2 course. The trimester starts on Monday 4th March. The examination period at the end of the course is 24 October - 15 November,

Objectives and Content

The Course

This course examines a range of techniques for programming multi-threaded and distributed applications. Topics include synchronisation mechanisms used for programs that communicate via shared memory and message passing techniques for programs that communicate across a network. Practical work involves implementing programs using these techniques in a modern concurrent language, such as Java.

Learning Objectives

By the end of the course, students should be able to:
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 assignments, labs and lectures will contribute to all learning objectives.

Note: NWEN 303 is part of the Engineering program at Victoria University of Wellington. BE students are expected to exhibit a number of graduate attributes upon graduation. These course objectives contribute to the graduate attributes as indicated above. A full table of these attributes is available at Graduate Attributes.

Course Content, Delivery and Workload

A schedule of lecture topics, readings, and assignment due dates is available online. A summary of the topics is:

1. Threads, threadpools and tasks
2. Semaphores and monitors
3. Futures, fork-join, threadpools and tasks.
4. Deadlock and starvation
5. Critical sections and the difficulty of implementing them correctly
6. Applying concurrency concepts to develop concurrent programs
7. Differences between concurrent, distributed and parallel programs
8. Shared memory parallelism
9. Message passing systems
10. Cloud computing systems
11. Synchronisation and agreement in distributed systems

We will be using the Java concurrency library and tools such as OpenMPI to provide practical examples of concepts introduced throughout the course and some time will be spent introducing these during lectures.

Attendance at lectures and tutorials are an essential part of the learning process. Lectures will be used to introduce basic ideas and techniques. Tutorials will provide you an opportunity to explore lecture topics in more detail and to apply concepts by carrying out small programming problems.

In addition to attending lectures and tutorials, we expect you to spend at least one hour a week preparing for them by doing assigned readings. These can be found in the Schedule.

Help desks will be run to support the projects and we will schedule these as required during the trimester.

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

- Lectures and tutorials: 3 hours
- Readings: 1 hour
- Assignment and project work: 6 hours

Readings

There is no official course textbook. However, in previous years, we have used the textbook "Principles of Concurrent and Distributed Programming (Second edition) by M. Ben-Ari and this may be useful for a deeper view on some of the topics covered in this course. The book is available online through the VUW Safari book subscription.

We will also use a range of online resources including opensource textbooks, white papers and will even recommend that you read some blogs.

Materials and Equipment

We will usually hand out copies of the lecture slides, though we cannot guarantee to always have them ready for the lecture. All the course handouts will be available on the course web site. Notice that the slides may be incomplete and we expect students to attend lectures and complete them.

Some assignments and both the projects will require the use of the School's lab computers. If you have access to a computer outside the labs, you may use it to work on the assignments/projects, but you will need to acquire your own software for writing Java programs and potentially tools such as OpenMPI. Please note that we do not have the resources to provide assistance if you have difficulties with a computer at home -- the tutors can only answer questions about the assignments/projects and the workstations in the laboratories. Note also that we cannot offer you any help with choosing, setting up, or fixing your own computer system, other than the general advice that we provide on the website.

Assessment

Method of Assessment

There will be four assignments, a mid-term test, two projects and a final examination.

Assignments

Each will consist of written questions and may include some practical programming problems that explore different aspects of the material presented in the lectures. Doing the assignments is an crucial part of the learning process and is essential for a proper understanding of the material. Marking will be based upon the correctness of your answers against a marking guide.

Projects

Each will require you to design, implement and evaluate a system from scratch that solves a given problem. We will set the goals for the project and assist with methodology without directly specifying how work should be completed. **A crucial part of the project is the writing up of what you have done in a laboratory report** that will be submitted as well as the program code and test results.

The first project will focus on concurrent programming and the second project will focus on parallel programming.. that explore the design, implementation and evaluation of concurrent programs and p

The projects will be marked using a marking guide that will focus on the achievement of goals, the application of methodologies appropriate to the course and the problem and your evaluation of what you have produced. The report will also be used to evaluate your ability to write in a professional manner. Our expectation is that **the majority of the assessment will be based upon what you communicate within the report**.

Mid-term Test

This will be a two hour closed book written test covering the first five weeks of the course. The date and time of the test is *Thursday 21st August*(TO BE CONFIRMED) from 5-7pm. The test itself will be run by the lecturers with help from the tutors. Should you miss the test you must contact the course coordinator as soon as possible via email or via his work phone number.

You should contact the course coordinator as soon as practical if your personal circumstances make attendance particularly difficult.

Final Examination

The final examination will be three hours long. No computers, electronic calculators or similar device will be allowed in the final examination. Paper non-English to English dictionaries will be permitted. The final examination is run by the University rather than the School or course lecturers. If you are late for, or miss an exam, go to the Science Faculty Student and Academic Services Office immediately. There are special procedures in this case.

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 examination period for trimester 2 is 24 October - 15 November

Weightings of Each Assessment Task

Your grade for NWEN 303 will be determined based on the following assessment weightings:

Item	Weight
Four assignments	10%
Two projects	30%
Terms test	10%
Final examination	50%

Note: Bachelor of Engineering students should be aware that copies of their assessed work may be retained for inspection by accreditation panel.

Due Dates

The hand-in dates for the assignments and projects are:

Item	Due date
Assignment 1	Friday 1 August at midnight
Assignment 2	Friday 15 August at midnight
Project 1	Sunday 24 August at midnight
Assignment 3	Sunday 28 September at midnight
Assignment 4	Sunday 12th October at midnight
Project 2	Friday 17th October at midnight

Assignments and projects should be submitted via the online submission system. In general, you should submit your assignments as a PDF document and the projects will require you to submit the program code, any test data and results and the project report (PDF as well).

Penalties

Unless prior agreement with the course coordinator has been made at least 24 hours in advance, late submissions will be penalised 20% of their mark for every day overdue. This means after 5 days zero marks will be awarded. In this case, the work should still be submitted in order to pass the mandatory requirements. However, submissions will not be accepted once any model answers have been given out. Approval for late submission will only be given in exceptional circumstances.

Duration of Examination

The final examination will be three hours long.

Special Requirements

This course has no special requirements.

Mandatory Requirements

The work you do outside of lectures is where you will do the majority of your learning. Attempting the assignments will help you learn the material and prepare you for the examination while the projects help you learn the practical skills required to write concurrent and parallel programs. In addition, the coverage of material in the exam will be biased towards the second half of the course.

Therefore, it the mandatory requirements are that you:

- make a reasonable attempt at all assignments.
- make a reasonable attempt at both projects
- sit the terms test
- achieve at least a 'D' grade in the final exam.

We acknowledge that medical or other circumstances can lead to you to missing an assignment, project or the terms test, in this case please contact the course coordinator as soon as possible.

Passing NWEN 303

To pass NWEN 303, a student must satisfy mandatory requirements and gain at least a **C-** grade overall.

Additional Information

Announcements and Communication

The main means of communication outside of lectures will be the NWEN 303 web area at
http://ecs.victoria.ac.nz/Courses/NWEN303_2014T2/. 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.

University Requirements and Plagarism Statement

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.

Withdrawal

The last date for withdrawal from NWEN 303 with entitlement to a refund of tuition fees is Friday 25 July 2014. The last
date for withdrawal without being regarded as having failed the course is Friday 26 September 2014 -- 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