Operating Systems Design – Course Outline

NWEN 301: 2015 Trimester 1

This document sets out the workload and assessment requirements for NWEN 301. 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.

Objectives

Operating Systems Design is part of the Engineering program at Victoria University of Wellington. BE graduates are expected to exhbit a number of graduate attributes at the completion of the program. This course contributes to the graduate attributes (GA) as indicated below. A full table of these attributes is available at Graduate Attributes.

By the end of the course, students should be able to explain (GA 3(a) & 3(b)) (objectives 1-5) and experience (objectives 6-9):

1. *What an operating system is, what it does, and how it is designed and constructed,*
2. *the process concept, lifecycle and concurrency models central to OS design,*
3. *process scheduling, interprocess communication, process synchronization and deadlock handling,*
4. *memory management schemes, such as segmentation, paging and virtual memory, and*
5. *basic mechanisms for protection and system security.*
6. *experience in writing operating system code (GA 3(d) & 3(f)),*
7. *an appreciation of impact upon performance of design choices such as the selection of algorithms with an operating system kernel (GA 3(b)),*
8. *a practical understanding of a large body of production quality code (GA 3(f)), and,*
9. *familiarity with UNIX/Linux; C programming, APIs and System Calls (GA 3(f)).*

Textbook

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Modern Operating Systems: Global Edition (4e)

Andrew S Tanenbaum Herbert Bos

Edition 4
ISBN 9781292061429
ISBN 10 1292061421
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Published by Pearson Higher Ed USA

Available at Vicbooks or online at: Publisher

Lectures, Tutorials, Laboratories, and Practical work

A schedule of lecture topics, readings, and assignment due dates is available online

Lectures for NWEN 301are:

| Mon*, Tue, Thu | 1510 - 1600 | Hugh Mackenzie LT001 |

*only in week 1.

Ad-hoc Tutorials for NWEN 301(only when scheduled) are:

| Mon | 1510 - 1600 | Hugh Mackenzie LT001 |

Labs (all in co246):

Tuesday 12pm
Wednesday 3pm
Friday 1pm

Lecture topics:

- OS components
- Processes and threads
- Concurrency
- Synchronization primitives
- Higher-level synchronization structures
- Deadlock
- Virtualisation
- CPU scheduling
- Multilevel CPU scheduling
- Security
- Memory management
- Memory management (Paging)
- Demand paging (VM)
- OS and machine Virtualisation
- File systems introduction
- File structures and space management
- Access scheduling and storage
- IO subsystems

Homework

Four homework assignments will be set from the text book. These will help focus your learning and exam preparation and contribute 2.5% ea to your final mark.

Projects

There are three projects for NWEN 301. All projects use Pintos, which is a simple operating system framework for the 80 x 86 architecture. It supports kernel threads, loading and running user programs, and a file system, but it implements all of these in a very simple way. In the Pintos projects, you will extend the core Pintos implementation to make the OS much more functional (and useable). These projects are challenging, and require you to brush up on your C skills as well as your understanding of operating systems - the best advice is to start them early and attend your labs.

- In project 1 you will familiarize yourself with the Pintos development environment, permitting you to compile, build, execute and debug your kernel. You will also implement a more efficient thread wait (alarm).
- In project 2 you will implement a better thread scheduler.
- In project 3 you will implement a range of system calls, which will then allow you to write your own simple user programs which will execute on Pintos. Congratulations, your OS is limited, but operational!

The programming projects have been selected to emphasise and cement important operating systems concepts through practice, in particular fulfil learning objects 6-9.

Workload

In order to maintain satisfactory progress in NWEN 301, 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:
- Two lectures per week (1 hour each),
- Project work (approximately 3 hrs per week averaged over the course),
- Homework assignment - <u>even weeks</u> (1-2 hours each, 5 in total), and
- Independent study each week (4-5 hours)

Assessment

Your grade for NWEN 301 will be determined based on the following assessment weightings:

Item	Weight	Due
Homework (x4)	10% (2.5% ea)	30 March, 27 April, 11 May, 25 May
Project 1	5%	23 March
Project 2	15%	4 May
Project 3	15%	1 June
Final Examination	55%	12 June - 1 July

Homework

All work will be submitted via the electronic submission system.**All homework must be submitted online i**n PDF - work submitted in any other format will **NOT** be marked. Hand written and/or annotated work can be scanned to PDF for submission. Our goal is to return homework to you within 3 weeks of submission.

Please note: copies of student work may be kept for IPENZ accreditation.

Policies and penalties for late submission of internally accessed work

Project work will be penalised at a rate of 10% per day late, up to a limit of 5 days late, after which the work will not be accepted for marking.

Homework, will not be accepted after the tutorial at which the solutions are distributed. Work submitted late, but prior to the tutorial will be penalised at 10% per day.

The Exam

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, electronic calculators or similar device will be allowed in the final examination. Paper non-English to English dictionaries will be permitted. The examination period for trimester 1 is 12 June - 1 July.

The exam will focus on learning objectives 1-5, in particular your ability to demonstrate you understanding of the broader operating systems concepts and related theory.

Mandatory Requirements

Students must achieve a minimum D grade in the examination.

Passing NWEN 301

To pass NWEN 301, a student must satisfy the mandatory requirements and gain at least a **C-** grade overall.

Withdrawal

The last date for withdrawal from NWEN 301 with entitlement to a refund of tuition fees is Fri 13 March. The last date for withdrawal without being regarded as having failed the course is Fri 15 May -- though later withdrawals may be approved by the Associate Dean in special circumstances.

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 301 is located on the second floor of the Cotton Building.

Staff

The course organiser and lecturer for (1st half) of NWEN 301 is Kris Bubendorfer:
- *Kris Bubendorfer*
- AM415
- +64 4 463 6484
- kris@ecs.vuw.ac.nz
- Office Hours: No set hours.

The lecturer for the course (2nd half) is Aaron Chen:

- *Aaron Chen*
- AM405, Alan MacDiarmid Building
- aaron.chen@ecs.vuw.ac.nz
- Phone: +64 4 463 5114
- Office Hours: No set hours.

The tutor for this course is: Jarrod Bakker email: jarrod.bakker@ecs.vuw.ac.nz

A class representative will be elected during the first week of teaching.

Announcements and Communication

The main means of communication outside of lectures will be the NWEN 301 web area at http://ecs.victoria.ac.nz/Courses/NWEN301_2015T1/. There you will find, among other things, this document, the lecture schedule and homework assignments, and the NWEN 301 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.

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.