Prescription

This course addresses the design and implementation of operating sytems and examines fundamental concepts such as resource management, concurrency, protection and security. Examples drawn from a range of modern operating systems illustrate these concepts and project work provides practical experience in the design and implementation of operating systems.

Course learning objectives

Students who pass this course should be able to:

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

Course content

There are two programming projects in NWEN 301 and use Pintos. Pinto is a simple operating system framework for the 80x86 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.

Withdrawal from Course

Withdrawal dates and process:
https://www.wgtn.ac.nz/students/study/course-additions-withdrawals

Lecturers

Dr Kris Bubendorfer (Coordinator)

kris.bubendorfer@vuw.ac.nz   04 463 6484

AM 403 Alan Macdiarmid Building, Gate 7, Kelburn Parade, Kelburn

Teaching Format

The course is primarily offered in-person lectures, labs, tutorials and an exam require in-person attendance. There will be remote alternatives for all the components of the course, but these are only available to students studying from outside the Wellington region. The remote option for the exam will use a Zoom-based system for online supervision.

Students taking this course remotely must have access to a computer with camera and microphone and a reliable high speed internet connection that will support real-time video plus audio connections and screen sharing. Students must be able to use Zoom; other communication applications may also be used. A mobile phone connection only is not considered sufficient. The computer must be adequate to support the programming required by the course: almost any modern windows, macintosh, or unix laptop or desktop computer will be sufficient, but an Android or IOS tablet will not.

Student feedback

Student feedback on University courses may be found at:
www.cad.vuw.ac.nz/feedback/feedback_display.php

Dates (trimester, teaching & break dates)

- Teaching: 11 July 2022 - 14 October 2022
- Break: 22 August 2022 - 04 September 2022
- Study period: 17 October 2022 - 20 October 2022
- Exam period: 21 October 2022 - 12 November 2022

Class Times and Room Numbers

11 July 2022 - 21 August 2022
- **Tuesday** 16:10 - 17:00 – LT102, Maclaurin, Kelburn
- **Thursday** 16:10 - 17:00 – LT102, Maclaurin, Kelburn

05 September 2022 - 16 October 2022
- **Tuesday** 16:10 - 17:00 – LT102, Maclaurin, Kelburn
- **Thursday** 16:10 - 17:00 – LT102, Maclaurin, Kelburn

Other Classes

All labs are 'drop in'.

Set Texts and Recommended Readings

Required

You will need access to the text book for background study, revision and for completing the assignments. The indicated readings from the text book (those from lectures and assignments) will be considered examinable material.

- Andrew S Tanenbaum Herbert Bos, *Modern Operating Systems: Global Edition* (4e), Pearson Higher Ed. (Copies are held in the library.)

Mandatory Course Requirements

In addition to achieving an overall pass mark of at least 50%, students must:

- achieve a minimum **D** grade in the final examination or test, to demonstrate achievement of all the CLOs of the course.

If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.

Assessment

Two homework assignments will be set from the text book. These will help focus your learning and exam preparation and contribute 5% ea to your final mark.

There are two projects for NWEN301. All projects use Pintos, which is a simple operating system framework for the 80x86 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. The programming projects have been selected to emphasise and cement important operating systems concepts through practice, in particular fulfil learning objects 6-9.

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

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Homework assignments (x 2) (3-6 hours each)	Week 6 and 12	CLO: 1,2,3,4,5	10%
Project 1 (12-24 hours)	Week 7	CLO: 6,7,8,9	20%
Project 2 (12-24 hours)	Week 11	CLO: 6,7,8,9	25%
Exam (2 hours duration)	During assessment period	CLO: 1,2,3,4,5	45%

Penalties

The basic late penalty is 10% per day - please see the section on extensions for more detail.

Extensions

Individual extensions should be negotiated with the course coordinator before the deadline whenever possible. Documentation (eg, medical certificate) may be required. You need to submit your requests via the submission system - follow the link in the item you are requesting an extension for. For the projects (only) you will have 4 days of free lateness spread over both projects. This means, for example, you can submit project 1 one day late, and project 2 three days late without penalty. As long as the lateness does not exceed 4 days overall. This does not apply for assignmnets, that is the usual penalty of 10% per day.

Submission & Return

All work is submitted through the ECS submission system, accessible through the course web pages. Marks and comments will be returned through the ECS marking system, also available through the course web pages.

Workload

In order to maintain satisfactory progress in NWEN 301, you should plan to spend an average of 10 hours per week on this paper. A plausible and approximate breakdown for these hours would be:

- Lectures: 2 hours
- Labs: 2 hours
- Project and assignment work: approx. 3 hours
- Independent study: approx. 3 hours

Teaching Plan

See https://ecs.wgtn.ac.nz/Courses/NWEN301_2022T2/LectureSchedule

Communication of Additional Information

All online material for this course can be accessed at https://ecs.wgtn.ac.nz/Courses/NWEN301_2022T2/

Links to General Course Information

- Academic Integrity and Plagiarism: https://www.wgtn.ac.nz/students/study/exams/integrity-plagiarism
- Academic Progress: https://www.wgtn.ac.nz/students/study/progress/academic-progess (including restrictions and non-engagement)
- Dates and deadlines: https://www.wgtn.ac.nz/students/study/dates
- Grades: https://www.wgtn.ac.nz/students/study/progress/grades
- Special passes: Refer to the Assessment Handbook, at https://www.wgtn.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf
- Statutes and policies, e.g. Student Conduct Statute: https://www.wgtn.ac.nz/about/governance/strategy
- Student support: https://www.wgtn.ac.nz/students/support
- Students with disabilities: https://www.wgtn.ac.nz/st_services/disability/
- Student Charter: https://www.wgtn.ac.nz/learning-teaching/learning-partnerships/student-charter
- Terms and Conditions: https://www.wgtn.ac.nz/study/apply-enrol/terms-conditions/student-contract
- Turnitin: http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin
- University structure: https://www.wgtn.ac.nz/about/governance/structure
- VUWSA: http://www.vuwsa.org.nz

Offering CRN: 17180

Points: 15
Prerequisites: NWEN 241
Duration: 11 July 2022 - 13 November 2022
Starts: Trimester 2
Campus: Kelburn