

Compiler Engineering - Course Outline

SWEN 430: 2015 Trimester 1

This document sets out the workload and assessment requirements for SWEN 430. 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.

Introduction

SWEN 430 looks at a range of issues relating to the modern compiler engineering. In particular, the course will focus on techniques and algorithms for code generation, code optimisation and type checking. During the course projects, students will develop a fully-fledged compiler for a small imperative language. Students should expect to learn a great deal about how compilers work and, in particular, about the Java Bytecode and x86 instruction sets.

The aim of this course is to introduce the ideas, techniques and algorithms which form the foundation of modern compilers. The course has a practical focus and students will develop their compiler in the Java language. If you have concerns about whether your Java skills are sufficient, you should speak to the course coordinator as soon as possible.

Objectives

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

1. understand basic principles of a compiler ([3\(a\)](#), [3\(c\)](#), [3\(f\)](#));
2. understand scanning and parsing stages of the compiler ([3\(a\)](#), [3\(b\)](#), [3\(c\)](#), [3\(d\)](#), [3\(f\)](#));
3. understand type checking stages of the compiler, including the basics of type systems ([3\(a\)](#), [3\(c\)](#), [3\(d\)](#));
4. understand what dataflow analysis is and how it is used within a compiler ([3\(a\)](#), [3\(b\)](#), [3\(c\)](#), [3\(d\)](#));
5. understand the code generation stage of the compiler, including knowledge of Java Bytecode ([3\(a\)](#), [3\(b\)](#), [3\(d\)](#));
6. have a good background for continued research in these areas ([3\(d\)](#)).

Note: SWEN 430 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](#).

Textbook

There is no set text for SWEN 430, but the following book contains most of the material presented in this course and is on closed reserve in VUW Library:

- *Modern Compiler Implementation in Java*, Andrew Appel. (closed reserve)

Other books of interest include:

- *Engineering a Compiler*, Keith D. Cooper and Linda Toczon. See Chapter 8. [1 copy in library]
- *Compilers: Principles, Techniques and Tools*, Alfred V. Aho, Ravi Sethi and Jeffrey D. Ullman. See Chapter 10. [1 copy in library]
- *Advanced Compiler Design and Implementation*, Steve S. Muchnick. See Chapter 9.
- *Optimizing Compilers for Modern Architectures*, Randy Allen and Ken Kennedy. See Chapter 4.4 and 11.

Lectures, Tutorials, Laboratories, and Practical work

A [schedule](#) of lecture topics, readings, and assignment due dates is available online. Major topics will include various compiler stages, grammars with ANTLR, type systems and type checking, bytecode generation, dataflow analysis, code optimisation, and register allocation.

Lectures for SWEN 430 are on Tuesdays and Thursdays between 11:00am and 12pm in Easterfield LT206

Assignments and Projects

Your grade for SWEN 430 will be determined through four programming assignments and a final examination. The exam will assess your understanding of the material presented in lectures, while the projects will assess your ability to apply the techniques in practice. The projects will mostly be assessed based on the implementation submitted.

Workload

In order to maintain satisfactory progress in SWEN 430, 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: 2 hours,
- Readings: 3 hours,
- Projects: 5 hours.

Note: A 15 point course maps to 150 hours over 15 weeks, where this includes the 12 weeks of lectures, 2 weeks of mid-trimester break, and 1 week of study period - all 15 weeks are expected to be full working (study) weeks for VUW students. As 400-level students, you are expected to work independently on developing solutions for your projects and undertaking the required research to fulfill the projects objectives to the best of your ability on your own. Please refer to [ECS Expectations of Students](#) for more information.

School of Engineering and Computer Science

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

Staff

The course coordinator for SWEN 430 is [David Pearce](#)

- *Dr David J. Pearce*
- [Cotton 231](#)
- +64 4 463 5833
- David.Pearce@ecs.vuw.ac.nz

The lecturer for the second half of SWEN 430 and the person responsible for assignments is [Roman Klapaukh](#):

- *Roman Klapaukh*
- [Cotton 230](#)
- roma@ecs.vuw.ac.nz

Our class representative is: *Adrian Cochrane* (cochraadri@ecs.vuw.ac.nz)

Announcements and Communication

The main means of communication outside of lectures will be the SWEN 430 web area at http://ecs.victoria.ac.nz/Courses/SWEN430_2015T1/. There you will find, among other things, this document, the [lecture schedule](#) and [assignment handouts](#), and the [SWEN 430 Forum](#). The forum is a web-based bulletin board system. Questions and comments can be posted to the forum, and staff and students can read these posts and respond to them.

Assessment

Your grade for SWEN 430 will be determined based on the following assessment weightings:

Item	Weight	Notes
Assignment 1	10%	Contributes to objectives 1+2
Assignment 2	10%	Contributes to objectives 3+4
Assignment 3	10%	Contributes to objective 5
Assignment 4	10%	Contribute to objective 5
Final Examination	60%	Contributes to all objectives

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

Deadlines and Submission

Work for marking should be submitted electronically using the [ECS Submission System](#). Marked projects will be available at lectures, or from the School Office ([Cotton 358](#)).

Hand-in dates for the four assignments are:

<u>Item</u>	<u>Due Date</u>
Assignment 1	Due Monday, 23rd of March, 2015 @ 11:59 p.m.
Assignment 2	Due Monday, 27th of April, 2015 @ 11:59 p.m.
Assignment 3	Due Monday, 11th of May, 2015 @ 11:59 p.m.
Assignment 4	Due Wednesday, 25th of May, 2015 @ 11:59 p.m.

Late work will be penalised 10% per weekday after the deadline. The work submitted between midnight Friday and midnight Monday is penalised as for one working day. Work which is more than five days late will not be marked. If you anticipate difficulty in meeting a deadline, please approach the course coordinator as soon as possible so an extension can be agreed upon.

Exam

The final examination will be three hours long. No computers, electronic calculators or similar devices will be allowed (or needed).

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 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 examination period for trimester 1 is 12 June - 1 July.

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 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

1. *Achieve at least 40% average across all of the assignments.*
2. *Achieve at least 40% in exam.*

Passing SWEN 430

To pass SWEN 430, a student must satisfy mandatory requirements and gain at least a **C-** grade overall. Please be aware that all grade boundaries were updated in 2014, and are now as follows:

<u>Grade</u>	<u>Range</u>
A+	90% -- 100%
A	85% -- 89%
A-	80% -- 84%
B+	75% -- 79%
B	70% -- 74%
B-	65% -- 69%
C+	60% -- 64%
C	55% -- 59%
C-	50% -- 54%
D	40% -- 49%

E	0 -- 39%
K	Failed Mandatory Requirements

Withdrawal

The last date for withdrawal from SWEN 430 with entitlement to a refund of tuition fees is Friday 13 March 2015. The last date for withdrawal without being regarded as having failed the course is Friday 15 May 2015 -- though later withdrawals may be approved by the Dean in special circumstances.

Student Evaluation

Students will be given the opportunity towards the end of SWEN 430 to provide feedback on both the course and lecturers. Course feedback from previous years is available and can be [viewed online](#).

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](#)