Compiler Engineering - Course Outline
SWEN 430: 2016 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)).

Your understanding will be assessed through four implementation assignments, and one three hour examination.

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 cover the various stages of a compiler, including parsing, type checking, code generation, dataflow analysis, code optimisation, and register allocation.

Lectures for SWEN 430 are on Tuesdays and Fridays between 10:00am and 11am. Tuesday lectures are in CO228.

whilst on Thursday they are in ZT77 (**NOTE:** this is changed from the original schedule with lectures in Murphy 1208).

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 Lindsay Groves:

- *Lindsay Groves*
- Cotton 257
- lindsay@ecs.vuw.ac.nz

Our class representative is: *To Be Confirmed*

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_2016T1/. 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%	Extend existing parser and interpreter with small language feature. Contributes to objectives 1, 2+3
Assignment 2	10%	Extend existing Type Checker with small language feature. Contributes to objectives 1, 2+3
Assignment 3	10%	Complete given JVM Bytecode code generator. Contributes to objectives 1+5
Assignment 4	10%	Complete given x86 Machine code generator. Contributes to objectives 1+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:

Item	Due Date
Assignment 1	Due Monday, 21st of March, 2016 @ 11:59 p.m.
Assignment 2	Due Monday, 11th of April, 2016 @ 11:59 p.m.
Assignment 3	Due Monday, 9th of May, 2016 @ 11:59 p.m.
Assignment 4	Due Monday, 30th of May, 2016 @ 11:59 p.m.

Unless prior agreement with the course coordinator has been made at least 24 hours in advance, the policy on late submissions is as follows:

- **Late work will be penalised 20% per day after the deadline**. 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.

- **Each student has three "late days"**. You may choose to use these for any assignment(s) during the course. No penalty will be applied for these late days. You do not need to apply for them - any late days you have left will be automatically applied to assignments that you submit late.

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 10 June - 29 June.

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:

Grade	Range
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 11 March 2016. The last date for withdrawal without being regarded as having failed the course is Friday 13 May 2016 -- 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