https://courseoutline.auckland.ac.nz/dco/course/COMPSCI/210/1213

COMPSCI 210 : Computer Organisation

Science

2021 Semester One (1213) (15 POINTS)

Course Prescription

The low level representation of data and algorithms in the computer. An introduction to computer organisation. The instruction execution model. Assembly and disassembly of instructions. Assembly language programming. How a high-level language is implemented at the machine level. The memory subsystem. Hardware support necessary to implement a secure multi-user operating system.

Course Overview

This course aims to give students an understanding of how computer systems work, at the lowest level seen by the programmer, namely the interface between the computer hardware and software. Topics include: data representation, the development of computer architectures and Instruction Set Architecture (ISA), assembly language, assembly language programming, an introduction to elementary C syntax, the mapping of C programming language to an ISA and the mechanism of memory organization.

This course is our core Stage 2 computer systems course and is a pre-requisite for all of the computer systems courses offered in Stage 3:

- COMPSCI 313: Computer Architecture
- COMPSCI 315: Data Communications Technologies
- COMPSCI 316: Cyber Security
- COMPSCI 340: Operating Systems

Given that it introduces C programming, this course is also a pre-requisite for COMPSCI 373: Computer Graphics and Image Processing where C and C++ are used.

Course Requirements

Prerequisite: COMPSCI 110, and 15 points from COMPSCI 105, 107, 130

Capabilities Developed in this Course

Capability 1: Disciplinary Knowledge and Practice

Capability 2: Critical Thinking

Capability 3: Solution Seeking

Graduate Profile: Bachelor of Science

Learning Outcomes

By the end of this course, students will be able to:

1. Describe elemental data structures, including characters, strings, signed and unsigned integers (various sizes), floating point numbers, and pointers (Capability 1, 2 and 3)
2. Convert between various representations of a number (Capability 1, 2 and 3)
3. Describe the range and limitations of representations of numbers (Capability 1, 2 and 3)
4. Make the connection between simple combinational circuits and their corresponding truth tables (Capability 1, 2 and 3)
5. Describe the execution of basic instructions at the instruction set architecture level (Capability 1, 2 and 3)
6. Write simple assembly language programs and simple programs in C (Capability 1, 2 and 3)
7. Describe the assembly process, and the information that is contained in assembly language instructions (Capability 1, 2 and 3)
8. Explain the concept of a pointer and distinguish between the value of a pointer and the entity pointed to (Capability 1, 2 and 3)
9. Explain the abstractions built into high-level languages and operating systems that simplify the programming of complex computer systems (Capability 1, 2 and 3)
10. Describe how to use cache memory to bridge the speed gap between CPU and memory (Capability 1, 2 and 3)

Assessments

Assessment Type	Percentage	Classification
Tutorials	6%	Individual Coursework
Quizzes	8%	Individual Coursework
Assignments	12%	Individual Coursework
Laboratories	4%	Individual Coursework
Test	20%	Individual Coursework
Final Exam	50%	Individual Coursework
6 types	100%	

Assessment Type	Learning Outcome Addressed									
	1	2	3	4	5	6	7	8	9	10

Tutorials	✓	✓	✓	✓			✓	✓	✓	✓
Quizzes	✓	✓	✓	✓			✓	✓	✓	✓
Assignments					✓	✓				
Laboratories						✓				
Test	✓	✓	✓	✓	✓		✓	✓	✓	✓
Final Exam	✓	✓	✓	✓	✓		✓	✓	✓	✓

Tuākana

For more information and to find contact details for the Computer Science Tuākana coordinator, please see https://www.auckland.ac.nz/en/science/study-with-us/maori-and-pacific-at-the-faculty/tuakana-programme.html.

Key Topics

- An Instruction Set Architecture (ISA)
- Assembly language (LC3)
- Input and Output including interrupts
- Traps
- Subroutines
- Memory stack
- Introduction to programming in C
- Mapping C an ISA (LC3)
- Handling C's dynamic memory allocation
- User/kernel mode
- Hardware support for context switching and synchronization
- Exceptions
- MMU and virtual memory
- Caching

Special Requirements

None.

Workload Expectations

This course is a standard **15 point** course and students are expected to spend **10 hours** per week involved in each **15 point** course that they are enrolled in.

For this course, you can expect **3 hours** of lectures, a **1 hour** tutorial, **3 hours** of reading and thinking about the content and **3 hours** of work on assignments and/or test preparation.

Delivery Mode

Campus Experience

Attendance is required at scheduled activities including tutorials/labs to receive credit for components of the course.
Lectures will be available as recordings. Other learning activities including tutorials will not necessarily be available as recordings.
Attendance on campus is required for the test and exam.
The activities for the course are scheduled as a standard weekly timetable.

Learning Resources

Introduction to Computing Systems: From Bits and Gates to C/C++ and Beyond, 3/e
Yale N. Patt, the University of Texas at Austin
Sanjay J. Patel, the University of Illinois at Urbana/Champaign

Student Feedback

During the course Class Representatives in each class can take feedback to the staff responsible for the course and staff-student consultative committees.

At the end of the course students will be invited to give feedback on the course and teaching through a tool called SET or Qualtrics. The lecturers and course co-ordinators will consider all feedback.

Your feedback helps to improve the course and its delivery for all students.

Digital Resources

Course materials are made available in a learning and collaboration tool called Canvas which also includes reading lists and lecture recordings (where available).

Please remember that the recording of any class on a personal device requires the permission of the instructor.

Academic Integrity

The University of Auckland will not tolerate cheating, or assisting others to cheat, and views cheating in coursework as a serious academic offence. The work that a student submits for grading must be the student's own work, reflecting their learning. Where work from other sources is used, it must be properly acknowledged and referenced. This requirement also applies to sources on the internet. A student's assessed work may be reviewed against online source material using computerised detection mechanisms.

Copyright

The content and delivery of content in this course are protected by copyright. Material belonging to others may have been used in this course and copied by and solely for the educational purposes of the University under

Inclusive Learning

All students are asked to discuss any impairment related requirements privately, face to face and/or in written form with the course coordinator, lecturer or tutor.

Student Disability Services also provides support for students with a wide range of impairments, both visible and invisible, to succeed and excel at the University. For more information and contact details, please visit the Student Disability Services' website http://disability.auckland.ac.nz

Special Circumstances

If your ability to complete assessed coursework is affected by illness or other personal circumstances outside of your control, contact a member of teaching staff as soon as possible before the assessment is due.

If your personal circumstances significantly affect your performance, or preparation, for an exam or eligible written test, refer to the University's aegrotat or compassionate consideration page https://www.auckland.ac.nz/en/students/academic-information/exams-and-final-results/during-exams/aegrotat-and-compassionate-consideration.html.

This should be done as soon as possible and no later than seven days after the affected test or exam date.

Learning Continuity

In the event of an unexpected disruption we undertake to maintain the continuity and standard of teaching and learning in all your courses throughout the year. If there are unexpected disruptions the University has contingency plans to ensure that access to your course continues and your assessment is fair, and not compromised. Some adjustments may need to be made in emergencies. You will be kept fully informed by your course co-ordinator, and if disruption occurs you should refer to the University Website for information about how to proceed.

Level 1: Delivered normally as specified in delivery mode
Level 2: You will not be required to attend in person. All teaching and assessment will have a remote option. The following activities will also have an on campus / in person option: [Lectures, tutorials, labs, office hours]
Level 3 / 4: All teaching activities and assessments are delivered remotely

Student Charter and Responsibilities

The Student Charter assumes and acknowledges that students are active participants in the learning process and that they have responsibilities to the institution and the international community of scholars. The University expects that students will act at all times in a way that demonstrates respect for the rights of other students and staff so that the learning environment is both safe and productive. For further information visit Student Charter https://www.auckland.ac.nz/en/students/forms-policies-and-guidelines/student-policies-and-guidelines/student-charter.html.

Disclaimer

Elements of this outline may be subject to change. The latest information about the course will be available for enrolled students in Canvas.

In this course you may be asked to submit your coursework assessments digitally. The University reserves the right to conduct scheduled tests and examinations for this course online or through the use of computers or other electronic devices. Where tests or examinations are conducted online remote invigilation arrangements may be used. The final decision on the completion mode for a test or examination, and remote invigilation arrangements where applicable, will be advised to students at least 10 days prior to the scheduled date of the assessment, or in the case of an examination when the examination timetable is published.