COMP3350B, Winter 2022
Computer Organization
Syllabus

Course Information

Overview

The course is designed to give students an appreciation of hardware, its design, its implementation, and the impact of all of this on how software runs on the hardware. We will look at the general topics:

- Hardware Abstractions
- Qualitative Measures and Performance Metrics
- Memory Hierarchies and Organization
- Logical Circuits
- Instruction Set Architectures (MIPS)
- CPU data path and Pipelining
- Multi-core architectures, parallelism

Calendar Description

Topics include: semiconductor technologies, gates and circuits, buses, semiconductor memories, peripheral interfaces, I/O techniques, A/D conversion, standards, RISC.

Prerequisite Requirements

COMP 2208, COMP 2210, COMP 2211, and either COMP 2209 or COMP 2101
Antirequisite: ECE 3375

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

Teaching Staff + Office Hours

Alex Brandt
abrandt5@uwo.ca
MC 365, Mondays 12:30 - 13:30 (after January 31)

Teaching Assistants

Amreen Anbar	Andrew Bloch-Hansen	Runze Li	Anthony Wong
aanbar@uwo.ca	ablochha@uwo.ca	rli667@uwo.ca	awong655@uwo.ca
Tues. 10:00-11:00	Thur. 11:30-12:30	Fri. 10:00-11:00	Wed. 15:00-16:00

Class Schedule and Delivery (*All times are local time in London: Eastern Standard Time*)

During in-person delivery (after January 31)
Mondays, 10:30 - 12:30, MC 110
Wednesdays, 10:30 - 11:30, MC 110

During online delivery (before January 31)
There will be both synchronous and asynchronous content. Lectures will be ***asynchronous***. Video recordings of lectures will be posted to OWL. Each recording has a date which the recording should be viewed by, as if lectures were synchronous. Students should stay up to date with reviewing the recordings so that they are well-prepared for assignments, quizzes, and tutorials.

During our scheduled class time, there are three possible ***synchronous*** events:

1. **Tutorials** will be held Mondays 10:30-11:30 and Wednesdays 10:30-11:30. These will provide a short summary of the week's material, work through example problems, and give an opportunity for live questions and answers. Watch a week's lecture *before* the tutorials.

2. **Quizzes** will be held on Wednesdays 10:30-11:30 on select dates throughout the semester. When a quiz is scheduled for a particular Wednesday there will be no tutorial on that Wednesday. These quizzes will be given on OWL and will be synchronous.

3. **Office hours** for the instructor will be Mondays 11:30-12:30.

Special Dates

Classes begin: January 10
Reading Week: February 19–27, inclusive
Classes end: April 8

Online Delivery & COVID-19

Although the intent is for this course to be delivered in-person to the extent possible, the changing COVID-19 landscape may necessitate some or all of the course to be delivered online, either synchronously or asynchronously. The grading scheme will not change.

Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom and Proctortrack. Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please discuss this with your instructor in advance.

If online, the final exam in this course will be conducted using Proctortrack. By taking this course, you are consenting to the use of this software and acknowledging that you will be required to provide personal information (including some biometric data) and that the session will be recorded. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website.

Course Materials

Students are required to have access to a commputer with reliable internet connection. For proctoring, this include also having a working microphone and webcam.

All course materials will be posted to OWL: http://owl.uwo.ca. This includes course notes, supplementary materials, and recorded lectures (if online).

Students should check OWL (http://owl.uwo.ca) on a regular basis for news, announcements, and forum posts. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis.

There is no required textbook for this course. However, a suggested reading material is *Computer Architecture: A Quantitative Approach*, by Hennessy and Patterson. Another fine textbook is *Computer Organization and Design*, by Patterson and Hennessy. At least 4th edition of each.

If students need assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk at 519-661-3800.

Forums and Email Contact

Students should post all questions about course content on the OWL site's forums. This includes any question about lectures, assignments, or quizzes. Please check existing questions and answers on the forums first before submitting a new question. Emails (from your uwo.ca account) should be used only for personal and private matters only. If your forum question goes unanswered for a day or two, a friendly email reminder to the TAs or the instructor is okay.

Course Topics + Schedule

- Introductions, Hardware Abstractions (0.5 week)

- CPU and Memory (3 weeks)
  - CPU performance metrics
  - Memory hierarchy
  - Cache memories
  - Impact of cache on CPU performance

- Stateless Circuits (1 week)
  - Simple gates, switches, truth tables
  - Functional completeness
  - Boolean algebra, simplification, canonical forms
  - Combinational logic blocks: multiplexer, ALU, n-bit arithmetic

- Synchronous Circuits/State Circuits (1 weeks)
  - Clocks, signals, and waveforms
  - Flip-flops: D, T, SR, JK; Registers
  - Finite state machines

- CPU datapath, Instruction Set Architecture (2 weeks)
  - Typical 5-stage datapath
  - Single cycle vs Multi-cycle
  - MIPS

- Instruction-level Parallelism (3 weeks)
  - Single-cycle vs Multi-cycle
  - Pipelining
  - Performance metrics
  - Multi-issue processors: VLIW, superscalar
  - Hazards: data, control, structural

- Multi-core Processors (1 week)
  - Parallelism for performance
  - Cache coherency, MESI protocol
  - Thread-level parallelism and synchronization

Evaluation and Tentative Schedule

Assignments		**40%**
	February 4	10%
	February 18*	10%
	March 18	10%
	April 1	10%
In-Class Quizzes		**28%**
	February 2	7%
	February 16	7%
	March 16	7%
	March 30	7%
Final Exam	TBD	**32%**

*Due at 18:00, for reading week policies.

Assignment and Quiz regulations

- If the schedule cannot be adhered to, the evaluation scheme will be prorated.
- Assignments are due at 23:55 on the due date. Late assignments will be handled as follows.
    0-48 hours late: you make the instructor sad,
    48-72 hours late: -40%,
    >72 hours late: submissions are no longer accepted, you will receive 0.
- **Self-Reported Absences**.
    - To cover an assignment, an SRA's covered time period *must include the due date*. The resolution of an SRA will be to remove all late penalties, but your assignment must still be submitted **within 72 hours of the original due date**.
    - To cover a quiz, a SRA's covered time period *must include the date of the quiz*. The resolution of the SRA will be to re-weight the quiz onto the remaining quizzes.
- Assignments will be released at least two weeks before the due date. Extensions may be made on due dates depending on progression through course material.
- Assignments are to be submitted on OWL as **a single PDF file**. They should be typeset or **legible, scanned** copies of hand-written work. If the TA cannot read your handwriting, it will be marked as incorrect.
- Plagiarism is unacceptable. It is reasonable to assume that students discuss assignments and possible solutions, however all assignments shall be independent.
- Quizzes and exams are closed book. Any required information, numerical constants, formulas, etc. will be given in the quiz/exam/question.
- No electronic devices other than a simple scientific calculator may be in the possession of students during quizzes and the Final Exam.
- Any concerns with quiz or assignment marking must be addressed *within one week* of the assessment being returned. No adjustments will be made after this time. Concerns about quizzes may be addressed to the instructor. Concerns about the assignment should be addressed to the TA who marked the assessment; if no resolution is possible between student and TA, the instructor will re-mark the *entire assignment*.

Policies, Accommodation, Accessibility

Missed Assignments, Quizzes, and Exams

Illness and other extenuating circumstances are an inevitable fact of life. In all cases there will be no make-up quizzes or assignments. See the [University's absense policy](#).

Self-Reported Absences.
- To cover an assignment, an SRA's covered time period *must include the due date*. The resolution will be to remove all late penalties, but your assignment must still be submitted **within 72 hours of the original due date**.
- To cover a quiz, a SRA's covered time period *must include the date of the quiz*. The resolution will be to re-weight the quiz onto the remaining quizzes or final exam, see below.

Academic Considerations.
- For absences outside that covered by an SRA, you must request consideration from Academic Counselling of your home faculty. For the faculty of science, see [this site](#).

Resolution of missed quizzes.
- If one or two missed quizzes, either by SRA or Academic Consideration, the resolution will be to re-weight the remaining quizzes to total 28% of your overall mark (i.e. 9.33% each if 1 quiz missed, 14% each if 2 quizzes missed).
- If three quizzes are missed, the remaining quiz will be worth 14% and the exam will be worth 46%.
- If four quizzes are missed, the exam will be worth 60%.

Resolution of missed assignments.
- An SRA submitted for an assignment must cover the original due date of the assignment. The resolution will be that there is no late penalty, but the assignment must still be submitted within 72 hours of the original due date. (e.g. if due Friday at 23:55, the SRA must cover Friday and the assignment will be accepted until Monday at 23:55.)
- An academic consideration whose covered time period includes the assignment due date and no more than 2 days after the due date will be handled as the case of an SRA.
- An academic consideration whose covered time period includes the assignment due date and 3 or more days after the due date will have the remaining assignments re-weighted (i.e. 3 assignments worth 13.33% each).
- If, following several academic considerations, more than one assignment is missed, the weight of the remaining assignments will be 13.33% each with the remaining weight moved to the final exam. (e.g. two missed assignments results in two assignments worth 13.3% each and a final exam worth 45.33%).

Missing the final exam is a special case. One should contact their Academic Counselling Office as soon as possible. If their accommodation request is approved, the student may write the Special Exam. Students with exam conflicts or multiple exam situations may also be eligible to write the Special Exam.

If you require accommodation for a [religious holiday](#) please contact the instructor directly and *before* the holiday to obtain an accommodation on a case-by-case basis.

Mental Health

Mental and emotional well-being is highly important and should not be treated lightly. Students who are in emotional/mental distress should refer to Health and Wellness at Western for a complete list of options about how to obtain help. Students in immediate distress should contact Student Health Services, Campus Police, or Psychological Services whose contact information can be found here.

Accessibility

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Student Accessibility Services via their website or at (519)-661-2147 if you have any questions regarding accommodations.

Ethical Conduct

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at this web site.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Student Support

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being.

Learning-skills counsellors at the Student Development Centre are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exams, textbook reading, and more. Support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round via individual counselling.

Other services are also provided by the University Students' Council

Registration Services

Students should refer to the Registrar's website for registration information and services.