

COMP3350B, Winter 2021

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

Mondays, 11:30 - 12:30, or by appointment.

Teaching Assistants

Duff Jones

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Andrew Katoch

akatoch2@uwo.ca

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Class Schedule and Delivery

(All times are local time in London: Eastern Standard Time)

Mondays, 10:30 - 12:30

Wednesdays, 10:30 - 11:30

This course has both synchronous and asynchronous components.

The lectures in this course will be held *asynchronously*. Video recordings of lectures will be posted to OWL. Each recording will have an associated date for which the lecture would have been given 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 optional (and recorded) events will provide a short summary of the week's material, work through example problems, and give an opportunity for live questions and answers.
2. **Quizzes** will be held on Wednesdays 10:30-11:30 on select dates throughout the semester. See the Evaluation section below. 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 11

Reading Week: February 13–21, inclusive

Classes end: after April 12

Course Materials

All course material will be posted to OWL: <http://owl.uwo.ca>. This includes course notes, recorded lectures, and supplementary materials.

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. will be posted on OWL. 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. The 4th or greater of each is recommended.

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 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 is okay.

Online Etiquette

- “Arrive” to class on time.
- Use your computer and/or laptop if possible (as opposed to a cell phone or tablet).
- Ensure that you are in a private location to protect privacy and confidentiality.
- To minimize background noise, mute your microphone for the entire class until you are invited to speak, unless directed otherwise.
- In order to give us optimum bandwidth and web quality, turn off your video camera for the entire class unless you are invited to speak.
- Unless invited by your instructor, do not share your screen in the meeting.
- If you wish to speak, use the “raise hand” function and wait for the instructor to acknowledge you before beginning your comment or question.
- Please remember to unmute your microphone and turn on your video camera before speaking.
- Self-identify when speaking.
- Please remember to mute your mic and turn off your video camera after speaking.
- Keep in mind the different cultural and linguistic backgrounds of other students.
- Be courteous toward the instructor, your colleagues, and peers.

Evaluation and Tentative Schedule

Assignments		36%
	February 2	9%
	February 23	9%
	March 16	9%
	April 6	9%
In-Class Quizzes		36%
	January 27	9%
	February 10	9%
	March 10	9%
	March 31	9%
Final Exam	TBD	28%

Assignment and Quiz regulations

- If, for any reason, the schedule cannot be adhered to, the marks for quizzes and assignments will be prorated.
- Assignments are due at 23:55 on the due date. Late assignments will be handled as follows.
 - 0-24 hours late: -10%,
 - 24-48 hours late: -30%,
 - 48-72 hours late: -60%,
 - >72 late: you will receive 0 on the assignment.
- Assignments should be released 10-14 days 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.
- 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 said quiz or assignment being returned. No adjustments will be made after this time.

Remote Proctoring

I have determined that online proctoring represents the best solution for the assessment of the final exam in this course. This allows us to assess students in a way that preserves the integrity of the course without increasing the number of papers assigned, which would both add to student workload and divert limited teaching resources to marking, and away from supporting learning.

Examinations in this course will be conducted using Zoom. You will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session will not be recorded.

More information about the use of Zoom for exam invigilation is available in the Online Proctoring Guidelines at the following link: <https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf>.

Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom. Information about the system requirements are available at the following link: <https://support.zoom.us/hc/en-us>.

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 of the test or examination.

Course Topics + Schedule

- Introductions, Hardware Abstractions (1 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 (2 weeks)
 - Clocks, signals, and waveforms
 - Flip-flops: D, T, SR, JK; Registers
 - Finite state machines
- CPU datapath, Instruction Set Architecture (3 weeks)
 - Typical 5-stage datapath
 - Single cycle vs Multi-cycle
 - MIPS
- Instruction-level Parallelism (2 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

Policies, Accommodation, Accessibility

Missed Assignments, Quizzes, and Exams

Illness and other extenuating circumstances (e.g. religious holidays) are an inevitable fact of life. In accordance with the University's absense policy there are two different circumstances: (i) missed course work totalling less than 10% of the course mark, or (ii) missed course work totalling 10% or more of the course mark. There will be no make-up quizzes or assignments.

- (i) Missing a single assignment or quiz falls into this case. For quizzes a student must communicate with the instructor *before* the quiz that illness or other circumstance has impaired their ability to effectively study for or complete the quiz. The resolution will be that their overall quiz mark will be calculated by averaging the other 3 quizzes. If, in exceptional circumstances, communication with the instructor regarding missed quizzes cannot occur before the quiz, appropriate documentation will be required as in case (ii). For assignments, students must communicate their inability to complete the assignment with the instructor at least 48 hours prior to the due date of the assignment. Extensions on the due date or reallocation of the assignment weight to the other 3 assignments may be given. With less than 48 hours notice students should proceed as in case (ii).
- (ii) In accordance with the University's illness policy a student must submit either a Self-Reported Absence Form or submit documentation to the Dean's Office of the student's Faculty of registration as soon as possible to obtain accommodation. For Science students the Academic Counselling Office for the Faculty of Science is located in NCB 280 and can be contacted at (519)-661-3040 or scibmsac@uwo.ca. Upon approval of accommodation, the overall quiz or assignment mark will be calculated using the remaining quizzes or assignments. If more than one assignment or two quizzes is missed these cases will be handled on a case by case basis.

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.

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

The Student Development Centre provides learning skills services for students. Other services are also provided by the University Students' Council

Registration Services

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