

# COMP3350B, Winter 2020

## 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

Tuesdays, 12:30 - 13:30, or by appointment.

## Teaching Assistants

Davood Mohajerani

dmohajer@uwo.ca

Thursdays 16:30-18:30, MC4A

Caroline Strickland

cstrick4@uwo.ca

Mondays 12:00-13:00, MC23

Peter Valovcik

pvalovc@uwo.ca

Tuesdays 14:30-16:30, MC4

## Course Materials

There is no required textbook for this course. Course notes, and supplementary materials 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.

## Class Schedule

**Mondays**, 9:30 - 11:30, NCB-113

**Tuesdays**, 11:30 - 12:30, AHB-1R40

## Evaluation + Tentative Schedule

Assignments		<b>36%</b>
	January 31	9%
	February 14	9%
	March 13	9%
	March 27	9%
In-Class Quizzes		<b>24%</b>
	January 21	6%
	February 11	6%
	March 10	6%
	March 31	6%
Final Exam	TBD	<b>40%</b>

## 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: -15%,
  - 24-48 hours late: -30%,
  - >48 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.

## Course Topics + Schedule

- Introductions, Hardware Abstractions
- CPU and Memory
  - CPU performance metrics
  - Memory hierarchy
  - Cache memories
  - Impact of cache on CPU performance
- Stateless Circuits
  - Simple gates, switches, truth tables
  - Functional completeness
  - Boolean algebra, simplification, canonical forms
  - Combinational logic blocks: multiplexer, ALU, n-bit arithmetic
- Synchronous Circuits (State Circuits)
  - Clocks, signals, and waveforms
  - Flip-flops: D, T, SR, JK; Registers
  - Finite state machines
- CPU datapath, Instruction Set Architecture
  - Typical 5-stage datapath
  - Single cycle vs Multi-cycle
  - MIPS
- Instruction-level Parallelism
  - Single-cycle vs Multi-cycle
  - Pipelining
  - Performance metrics
  - Multi-issue processors: VLIW, superscalar
  - Hazards: data, control, structural
- Multi-core Processors
  - 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 documentation as soon as possible to the Dean's Office of the student's Faculty of registration 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 scibm-sac@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.