**The University of Western Ontario**
**London, Ontario, Canada**
**Department of Computer Science**

## CS 2208a - Introduction to Computer Organization and Architecture
## Course Outline - Summer (May--August) 2024

**This course uses the *Online Western's Learning (OWL)* system (https://westernu.brightspace.com)**

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Welcome to the CS2208A course outline (a.k.a. syllabus). It is a legally binding document that communicates essential information and subject matter about the course, such as instructor's information, course description and topics, course material and a full schedule, as well as the course expectations and grading structures.

## Table of Contents:

## A: Instructor

- Professor Mahmoud El-Sakka
  Middlesex College, Room 419
  Phone: 661-2111 x86996

Email: elsakka <at> csd.uwo.ca (*preferred communication method*)
Students must use their Western (@uwo.ca) email addresses when contacting the instructor.

Office hours: Tuesday from 8:00 pm to 8:45 pm (in-person)
Office hours: Thursday from 8:00 pm to 8:45 pm (in-person)

## B: Teaching Assistant(s)

- Haoze Yuan
  Email: hyuan46 <at> uwo.ca

- Lianghong Chen
  Email: lchen776 <at> uwo.ca

Teaching Assistant(s)' Office hours: *By appointment after marking the programing assignments (assignments 5 and 6)*

## C: Lectures and Tutorials Schedule/Location

- Lectures Time & Place
  Tuesday 6:00 pm - 8:00 pm at MC-110
  Thursday 6:00 pm - 7:00 pm at MC-110

- Tutorials Time & Place
  Thursday 7:00 pm - 8:00 pm at MC-110

- See [Section R: Course Delivery and Assessment in Case of Any University-Declared Emergency](#)

## D: Course Description and Learning Outcomes

The course covers the internal representation of various data types, including characters, integers, and floating-points. It also covers the addition and subtraction operations and how they are internally performed.

The course focuses on the architectural components of digital computers, how these components are interconnected, and the nature of the information flow between them. Assembly language is used to reinforce these issues.

The main purpose of this course is to give students an understanding of *how a computer works (organization)* and *what a computer does (architecture)*.

On successful completion of this course, students will be able to:

- Perform arithmetic operations on binary and two's complement numbers,
- Perform conversions between decimal, binary, hexadecimal, octal and IEEE floating-point numbers without a calculator,
- Understand the limits of the binary representations, including rounding error and overflow conditions,
- Analyze simple combinational circuits at the logic gate level,

- Understand how instructions get executed in a sequential processor system and the concept of pipelined processor architecture,
- Analyze how machine language is executed by a hardware,

- Perform conversions between ARM assembly and machine language instructions,
- Compose and analyze small ARM assembly language programs,

- Implement various stack types using ARM assembly,
- Understand how ARM block-move instructions work,
- Understand how Subroutine call/return mechanization works at the assembly level, and
- Understand the stack frame concept and how parameters pass to subroutines.

## E: Course Topics

The course will address the following topics:

- Introduction to Computer Systems Architecture and Organization
- Computer Arithmetic
- Floating Point Numbers
- Computer Digital Logic

- ARM Instruction Set Architecture
- ARM Assembly Language
- ARM Data Processing
- ARM Flow Control and Branching
- ARM Addressing Modes

- Subroutine Call and Return
- Data Storage and the Stack
- Data Processing and Data Movement

## F: Prerequisites

- Computer Science 1027a/b or 1037a/b with a grade of at least 65%
  OR
- Integrated Science 1001X with a grade of at least 60%.

Unless you have either the stated 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.

Students are assumed to be familiar with a high-level programming language and data structures such as stacks and queues.

## G: Textbook

- Alan Clements, *Computer Organization & Architecture: Themes and Variations*, Cengage Learning, 2014, ISBN: 978-1-111-98704-6. [https://bookstore.uwo.ca/textbook-search?campus=UWO&term=N2024&courses%5B0%5D=001_UW/CSC2208A](https://bookstore.uwo.ca/textbook-search?campus=UWO&term=N2024&courses%5B0%5D=001_UW/CSC2208A)

## H: Course Website

The CS 2208A course uses the Online Western's Learning (OWL) system ([https://westernu.brightspace.com](https://westernu.brightspace.com))

Class information and course material will be posted on this website, including lecture notes, tutorial notes, quizzes, assignments, and labs. Students should check OWL (https://westernu.brightspace.com) on a regular

basis for news and updates. 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.

Forums for the CS2208A will be maintained at the course OWL site, where the instructor will reply to these forum posts.

If students need OWL-related assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be reached by phone at 519-661-3800 or ext. 83800.

## I: Material Accessibility Statement

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 Accessible Education--formerly SSD--(http://academicsupport.uwo.ca/accessible_education/index.html) at 661-2111 x82147 for any specific question regarding an accommodation.

## J: Technical Requirements

During this course, students are required to download (from the course website on OWL) and install a Windows-based simulator software.

This software is also available on Western MyVLab (myvlab.uwo.ca) using VMware Horizon Client to run it on your computer (Windows, MAC, Linux).

## K: Email Contact

In accordance with policy, http://www.uwo.ca/its/identity/activatenonstudent.html, the centrally administered email account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that the email received from the University at their official university address is attended to in a timely manner.

Losing emails is not an acceptable excuse for not knowing about the information that was sent.

## L: Quiz Conduct

- There will be 9 equally weighted weekly online quizzes.

- Quizzes schedule

| Quiz no. | To be posted on | Due by date/time |
|----------|-----------------|------------------|
| 1 | Thursday, May 09 | Saturday, May 11 @ 11:55 pm |
| 2 | Thursday, May 16 | Saturday, May 18 @ 11:55 pm |
| 3 | Thursday, May 23 | Saturday, May 25 @ 11:55 pm |
| 4 | Thursday, June 06 | Saturday, June 08 @ 11:55 pm |
| 5 | Thursday, June 13 | Saturday, June 15 @ 11:55 pm |
| 6 | Thursday, June 20 | Saturday, June 22 @ 11:55 pm |
| 7 | Thursday, July 4 | Saturday, July 6 @ 11:55 pm |
| 8 | Thursday, July 11 | Saturday, July 13 @ 11:55 pm |

| 9 | Thursday, July 18 | Saturday, July 20 @ 11:55 pm |

- Quizzes will be posted on the course website by the dates listed above.

- Any changes, updates, and clarifications to quizzes will also be posted on the website. It is your responsibility to monitor these pages closely.

- All submissions will be submitted electronically. We reserve the right to use similarity detection software to detect possible cheating cases.

- Late quizzes are strongly discouraged.
  - 10% will be deducted from a late quiz (up to 24 hours after the due date/time)
  - After 24 hours from the due date/time, late quizzes will receive a zero grade.

- Quizzes will be marked automatically.

- You can send your related questions directly to the instructor.

- A request for an adjustment in a quiz mark must be made within two weeks following the quiz due date.

- All quiz marks are considered to be final after two weeks following the quiz week.

## M: Lab Conduct

- There will be 7 equally weighted labs.

- Labs schedule

| Lab no. | To be posted on | Section 3 on Wednesday 6:00--7:00 am NCB-105 | Section 4 on Wednesday 7:00--8:00 pm NCB-105 | Section 5 on Wednesday 8:00--9:00 pm NCB-105 |
|---|---|---|---|---|
| 1 | Thursday, June 6 | June 12 | June 12 | June 12 |
| 2 | Thursday, June 13 | June 19 | June 19 | June 19 |
| 3 | Thursday, June 20 | June 26 | June 26 | June 26 |
| 4 | Thursday, June 27 | July 03 | July 03 | July 03 |
| 5 | Thursday, July 04 | July 10 | July 10 | July 10 |
| 6 | Thursday, July 11 | July 17 | July 17 | July 17 |
| 7 | Thursday, July 18 | July 24 | July 24 | July 24 |

- Students will submit an online lab report for each lab session.

| Lab no. | Due by date/time |
|---|---|
| 1 | Thursday, June 13 @ 11:55 pm |
| 2 | Thursday, June 20 @ 11:55 pm |
| 3 | Thursday, June 27 @ 11:55 pm |
| 4 | Thursday, July 4 @ 11:55 pm |
| 5 | Thursday, July 11 @ 11:55 pm |

| 6 | Thursday, July 18 @ 11:55 pm |
| 7 | Thursday, July 25 @ 11:55 pm |

- Lab descriptions will be posted on the course website before the dates listed above.

- Any changes, updates, and clarifications to labs will also be posted on the website. It is your responsibility to monitor these pages closely.

- All submissions will be submitted electronically. We reserve the right to use similarity detection software to detect possible cheating cases.

- Late labs are strongly discouraged.
  - 10% will be deducted from a late lab (up to 24 hours after the due date/time)
  - After 24 hours from the due date/time, late labs will receive a zero grade.

- Labs will be marked automatically.

- A request for an adjustment in a lab mark must be made within two weeks following the lab due date.

- All lab marks are considered to be final after two weeks following the lab week.

## N: Assignment Conduct

- There will be 5 equally weighted assignments.

- Assignment schedule

| Assignment no. | To be posted on | Due in | Due by |
|----------------|-----------------|--------|--------|
| 1 | Thursday, May 09 | 5 days | Tuesday, May 14 @ 11:55 pm |
| 2 | Thursday, May 16 | 5 days | Tuesday, May 21 @ 11:55 pm |
| 3 | Thursday, May 23 | 5 days | Tuesday, May 28 @ 11:55 pm |
| 4 | Thursday, June 20 | 12 days | Tuesday, July 02 @ 11:55 pm |
| 5 | Thursday, July 11 | 12 days | Tuesday, July 23 @ 11:55 pm |

- Assignment descriptions will be posted on the course website by the dates listed above.

- Any changes, updates, and clarifications to assignments will also be posted on the website. It is your responsibility to monitor these pages closely.

- All submissions will be submitted electronically. We reserve the right to use similarity detection software to detect possible cheating cases.

- Late assignments are strongly discouraged.
  - 10% will be deducted from a late assignment (up to 24 hours after the due date/time)
  - After 24 hours from the due date/time, late assignments will receive a zero grade.

- Assignments may involve concept questions (non-programming) related to the course material and Assembly programming.

- A program that produces the correct output is not necessarily a *working* program; it must also satisfy the specifications given in the assignment description. Other criteria for which an assignment will be evaluated include coding style, comments, and efficiency.

- Your assignment solutions are expected to be your own individual work, not the products of a group effort.

- It is your responsibility to keep up-to-date backups of assignment disk files in case of system crashes or inadvertently erased files. Retain disk copies of all material handed in, as well as the actual graded assignment to guard against the possibility of lost assignments or errors in recording marks. You should keep these materials at least until you are satisfied that your final mark for the course has been appropriately computed.

- Assignments will be marked either automatically or by the Teaching Assistant(s), who follow marking schemes provided by the instructor.

- Every effort will be made to have assignments marked and handed back within three weeks after the hand-in date, preferably sooner.

- When marking an assignment is completed, you will be informed via the course website and/or email.

- For assignments that are marked by the Teaching Assistant(s), you should direct any questions about marking in the first instance to your Teaching Assistant. If your discussion with the Teaching Assistant is not satisfactory, you may want to further discuss the issue with the course instructor.

  For assignments that are automatically marked, you can send your related questions directly to the instructor.

- A request for an adjustment in an assignment mark must be made within two weeks following the first handed-back day.

- All assignment marks are considered to be final after two weeks following the first handed-back day.

## O: Ethical Conduct

Scholastic offences are taken seriously, and students are strongly encouraged to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence.

All assignments are individual. You may discuss approaches to problems; however, the actual details of the work (assignment coding, answers to concept questions, etc.) must be an individual effort.

Assignments that are judged to be the result of academic dishonesty will, for the student's first offence, be given a mark of zero with an additional penalty equal to the weight of the assignment also being applied.

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.

Students are responsible for reading and respecting the Computer Science Department's policy on Scholastic Offences and Rules of Ethical Conduct.

# P: Midterm Tests and Final Exam

- First midterm test **(in-person)**
  - Date: Friday,May 31, 2024
  - Time: from 6:00 pm to 7:30 pm

- Second midterm test **(in-person)**
  - Date: Friday, June 28, 2024
  - Time: from 6:00 pm to 7:30 pm

  Every effort will be made to have the marks of midterm tests available within two weeks of the test, preferably sooner.

  If a student misses a midterm test with an approved valid reason, the makeup test (in-person) will be held on *Friday June 7 (for the first midterm test)* and *Friday July 5 (for the 2nd midterm test).*

  *If a student misses a midterm makeup test with an approved valid reason, this student will be given the opportunity to write the test with the next offering of the course. In which case the student will receive a grade of Incomplete (INC) and their maximum course load may be reduced during the term in which they complete their course requirements.*

- Final exam **(in-person)**
  - Date: During the final exam period
  - Time: TBA (tentatively--three hours long)

- Calculators of any kind are *NOT* allowed during tests and examinations.

# Q: Methods of Evaluation

- The overall course grade will be calculated as listed below
  - Weekly quizzes worth a total of 12%
  - Assignments worth a total of 6%
  - Labs worth a total of 10.5%
  - First midterm test worth 15.5%
  - Second midterm test worth 20% **(or 10% if your performance in the final exam surpasses that of the second midterm)**
  - Final exam worth 36% **(or 46% if your performance in the final exam surpasses that of the second midterm)**

- When calculating a student assignments grade average, the best 4 assignments (out of 5) will only be considered.

- If an assignment has to be cancelled for any reason, the remaining assignment weights will be prorated (scaled) to add up to the total of assignments worth.

- When calculating a student quizzes grade average, the best 8 quizzes (out of 9) will only be considered.

- If a quiz has to be cancelled for any reason, the remaining quiz weights will be prorated (scaled) to add up to the total of quizzes worth.

- When calculating a student labs grade average, the best 6 labs (out of 7) will only be considered.

- If a lab has to be cancelled for any reason, the remaining lab weights will be prorated (scaled) to add up to the total of labs worth.

- **To be eligible to receive a passing grade in the course, your total marks on the two midterm tests and the final exam must be at least 50%, i.e., at least 35.75 out of 71.5.**

- **To be eligible to receive a grade of C (60%) or higher (i.e., to be eligible for Honors Programs), your total marks on the two midterm tests and the final exam must be at least 60%, i.e., at least 42.9 out of 71.5.**

## R: Course Delivery and Assessment in Case of Any University-Declared Emergency

- **Contingency plan for an in-person class pivoting to 100% online learning**
  Although the intent is for this course to be delivered in person, should any university-declared emergency that necessitates the course delivery moving away from face-to-face interaction,
    - All remaining course content will be delivered entirely online, either:
        - synchronously (i.e., at the times indicated in the timetable) or
        - asynchronously (e.g., posted on OWL for students to view at their convenience).
    - The grading scheme will not change.
    - Any remaining assessments will also be conducted online as determined by the course instructor.

  In the event that online learning is required, *a stable internet connection with working microphone and webcam will be required.*

  As has been the case in the past, the decision to pivot to online learning will be made by Western, and not individual instructors or departments (excepting temporary online instruction in the event of instructor illness).

## S: Accommodation Policies

Students with disabilities work with Accessible Education--formerly SSD-- (http://academicsupport.uwo.ca/accessible_education/index.html), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

In this course, both midterm tests and the final exam are timed, as shown in *Section P: Midterm Tests and Final Exam*. If you are a student with a disability and require extra time accommodation, please ensure your accommodations are active on the Accommodated Exams website
https://studentservices.uwo.ca/Accommodatedexamssignup/ for this course at least 10 days prior to the assessment for which you require accommodation. Recommended accommodations posted there **on time** will be applied to your assessment.

## T: Academic Accommodation for Student Absence

If you are unable to meet a course requirement due to illness, other serious circumstances, or compassionate grounds, you must provide valid medical or other supporting documentation to your Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's office immediately.

Students should also note that individual instructors are not permitted to receive documentation directly from a

student, whether in support of an application for consideration on medical grounds or for other reasons.

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's office) for visits to Student Health Services. The form can be found here:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

For further information, please consult the University's medical illness policy at
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf.

**Absences from Final Examinations**

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

**Note: missed work can only be excused through the mechanisms above. Being asked not to attend an in-person course requirement due to potential COVID-19 symptoms is not sufficient on its own.**

## U: Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration.

Please consult the Diversity Calendar for list of recognized holidays at https://www.edi.uwo.ca/img/3754-2024-Diversity-Calendar-PDF.pdf.

For further information, please consult the University's Accommodation for Religious Holidays policy at https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf.

## V: Tutoring

The role of tutoring is to help students understand the course material. Tutors should **not** write assignments or tests for the students who hire them. Submitting an assignment that contains material written by a tutor is an academic offense.

Having employed the same tutor as another student is not a legitimate defense against an accusation of collusion, should two students hand in assignments judged similar beyond the possibility of coincidence.

The Computer Science Department does not have or maintain any tutoring list.

## W: Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop courses, academic considerations for absences, appeals, exam conflicts, and many other academic-related matters: https://www.uwo.ca/sci/counselling/

Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

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: https://www.uwo.ca/se/digital/

Students who are in emotional/mental distress should refer to Mental Health at Western (http://www.uwo.ca/uwocom/mentalhealth) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at https://www.uwo.ca/health/student_support/survivor_support/get-help.html
To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Students may refer to http://westernusc.ca/your-services for services provided by the USC.

Students may refer to http://www.registrar.uwo.ca for the Registrarial Services.