Course Outline

Instructor Information and Office hours

Course:

Location: Mackenzie Building Room: 4236

Instructor: Dr. Nasser Mustafa
Office hours: 15-16 Mon, Wed
E-mail: nassermustafa@cmail.carleton.ca

Course Number and Calendar Description

Course Objectives

This course provides students with the necessary knowledge about the architecture and organization of computer systems. It provides a historical overview of computer systems and the different methods of data representation and manipulation. Additionally, the course describes Microarchitecture, I/O buses, Memory Systems and RISC and CISC architectures. Additional topics will be discussed in this course, such as Assembly language and the assembly process, operating systems and concurrency, and simple program optimization techniques.

Learning Outcomes

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

1. Understand some basic concepts related to computer systems
   - Distinguish between computer architecture and computer organization.
   - Understand how computer systems evolved over history.
   - Know how to represent numbers in different formats such as Binary, Octal, Hexadecimal, 1'st complement, 2'nd complement, sign magnitude, and floating point representations.

2. Understand the relationship between the Assembly language and computer instruction
   - Know how Assembly code is encoded to machine instructions.
   - Know the typical CPU registers used during encoding instructions.
   - Know the different formats of machine instructions (Zero, one, two and three address machines) and the design tradeoffs.
   - Identify the difference between RISC and CISC computers in terms of their Instruction Set Architecture (ISA).
3. Understand computer Microarchitecture
   - Differentiate between Instruction and Micro-Instruction.
   - Describe how the Control Unit and CPU execute a program (Fetch-Execute Cycle).
   - Explain the control and data paths used during the fetch-execute cycle.
   - Differentiate between Microprogramming and Hardwired techniques in Fetch-Execute.

4. Understand how the design of memory and bus systems affect computer performance
   - Discuss the different memories for data storage of data processing.
   - Describe the effect of using each memory type on computer performance.

5. Analyze how programs manipulated by the operating system
   - Know the utilities provided by an operating system to execute a program.
   - Know the pipelining technique and the scheduling process.
   - Understand concurrency and multithreaded execution.
   - Know how programs are assembled, linked, loaded, and executed inside computers.

Textbooks (or other resources) if applicable

Miles Murdocca and Vincent Heuring, Computer Architecture and Organization: An Integrated Approach, Wiley

Some other recommended books are:
   - Andrew S. Tanenbaum and Alfred Woodhull, Operating systems: design and implementation, 3rd edition, Prentice Hall.

Evaluation and Grading Scheme

To pass the course, all course components must be completed, regular attendance is required, the final exam must be passed, and an appropriate overall mark must be earned:
   - Assignment (20%) due at the beginning of class on the assigned due date. There will be no credit given for late homework assignments.
   - Term paper (20%) Students will pick a topic in the field of computer systems and write a paper. The topic must be approved by the professor.
   - In-class paper presentation (10%).
Final exam (50%), scheduled. An open book, no calculators, final exam will be held during the University's formal examination period. The final exam is for the evaluation purposes only and will not be returned to the student. Students who miss the final exam may be granted permission to write a deferred examination (See the Graduate Calendar for regulations on deferred exams).

The final examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

**Week-by-Week breakdown**

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<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>2</td>
<td>Languages and the Machine: Assembly and High-Level Languages. Assembly Process and Compilers</td>
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<tr>
<td>3</td>
<td>Memory Systems. Buses and I/O Systems and Networking</td>
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<tr>
<td>4</td>
<td>Operating Systems and Concurrency Alternative Architectures and Parallel processing</td>
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<tr>
<td>5</td>
<td>Final Exam</td>
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**General Regulations**

**Student Responsibility:** It is the student's responsibility to remain informed of all rules, regulations and procedures required by their program and by the Faculty of Graduate and Postdoctoral Affairs. Ignorance of regulations will not be accepted as a justification for waiving such regulations and procedures.

**Academic Integrity:** Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: https://carleton.ca/registrar/academic-integrity/. This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

**Plagiarism:** Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

**Deferred Term Work:** Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and
The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the current Graduate Calendar, Academic Regulations of the University, Section 9.3.

**Academic Accommodation:** You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www.carleton.ca/equity/ For an accommodation request, the processes are as follows:

- **Pregnancy obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see [https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)
- **Religious obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see [https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)
- **Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or **pmc@carleton.ca** for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult [https://carleton.ca/pmc/students/dates-and-deadlines/](https://carleton.ca/pmc/students/dates-and-deadlines/) for the deadline to request accommodations for the formally-scheduled exam (if applicable).
- **Survivors of Sexual Violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: [https://carleton.ca/sexual-violence-support/](https://carleton.ca/sexual-violence-support/).
- **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see [https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf](https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf)
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Health and Safety: Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: [http://sce.carleton.ca/courses/health-and-safety.pdf](http://sce.carleton.ca/courses/health-and-safety.pdf)

Students from the University of Ottawa: You can request to have access to cuLearn: please see [http://gradstudents.carleton.ca/forms-policies/](http://gradstudents.carleton.ca/forms-policies/)