Course: SYSC 5704 Elements of Computer Systems  
Location: Online course (Real-time and Recording)  
Term/Year: Summer/2020 (May 4th-June 16th 2020)  
Instructor: Dr. Nasser Mustafa  
E-mail: nassermustafa@cmail.carleton.ca

Calendar Information  
This is an early summer course which starts on May 4th, 2020 and ends on June 16th, 2020. Students must refer to the following link: [http://calendar.carleton.ca/grad](http://calendar.carleton.ca/grad) for full details about the course calendar.

Prerequisites: Programming experience with at least one high-level language and permission of the professor.

Course Objectives  
This course aims to provide 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,
I'st complement, 2nd 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 differences 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)


Some other recommended books are:

- Andrew S. Tanenbaum and Alfred Woodhull, Operating systems: design and implementation, 3rd edition, Prentice Hall.

Students also are encouraged to check the following link on the net for further readings.
Evaluation and Grading Scheme

To pass the course, all course components must be completed
- Assignment 1 (25%), the due date will be 12:00 PM, 20/5/2020 (Online submission)
- Assignment 2 (25%), the due date will be 12:00 PM, 15/6/2020 (Online submission)
- Term paper (35%) a students will write a paper about a single or a family of modern processors. The topic must be approved by the professor.
- Presentation (10%) via video conference (The presentations date and time will be assigned during the semester)
- Peer evaluation (5%)

Week-by-Week breakdown

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<th>Topic</th>
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<td>The Instruction Set Architecture (RISC, CISC Computers)</td>
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<td>DATAPATH AND CONTROL</td>
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<td>5</td>
<td>Memory Systems. Buses and I/O Systems and Networking</td>
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<td>6</td>
<td>Operating Systems and Concurrency Alternative Architectures and Parallel processing</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/](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 in all cases this must occur no later than three (3.0) working days after the term work was due. 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/](http://www.carleton.ca/equity/) For an accommodation request, the processes are as follows:

- **Pregnancy or Religious obligation**: 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/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](mailto: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). Requests made within two weeks will be reviewed on a case-by-case basis. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website ([www.carleton.ca/pmc](http://www.carleton.ca/pmc)) 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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**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/)