Instructor Information and Office hours

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MC6015  
Office Hours: Monday 2:30-3:30pm and Tuesday 10:30-11:30am

TA Information and Office hours

TBD

Calendar Description

SYSC 4507 - Computer Systems Architecture

Evolution of computer systems architecture, influences of changing technology, techniques to improve performance, memory hierarchy, hardware accelerators. Instruction level parallelism, pipelining, vector processing, superscalar, out of order execution, speculative execution. Thread level parallelism, multi-core, many-core, heterogeneous systems. Evolution of architectures for specific application domains.

http://calendar.carleton.ca/undergrad/courses/SYSC/

Prerequisites

ELEC 2607 and (SYSC 2001 or SYSC 3006)

Students who have not satisfied the prerequisites for this course must either withdraw from the course or obtain a prerequisite waiver by visiting the Engineering Undergraduate Academic Support Office.

Precludes additional credit for

SYSC 4310

Assumed Knowledge

Upon entry into this course, students are expected to have knowledge of:  
Computer organization: processor, memory, input/output, system bus.  
Assembly language programming: representation of data, instruction encoding, execution  
Number systems: binary, decimal, hexadecimal.  
Programming techniques (e.g. Matlab, C and or Python)
Course Objectives
To develop an in-depth understanding of computer systems performance
To be able to analyze and evaluate memory hierarchy performance
To understand instruction-level parallelism including pipelining and superscalar execution
To develop a comprehensive knowledge of thread-level parallelism, multi-core and multi-core architectures
To understand the main trade-offs and challenges of large-scale computers systems

Learning Outcomes
By the end of this course students should be able to:

1. Know the history and evolution of computer systems
2. Develop a comprehensive understanding of computer performance
3. Understand memory hierarchies in computer systems
4. Demonstrate an ability to analyze and evaluate CPU and memory hierarchy performance
5. Learn instruction-level parallelism techniques including pipelining and superscalar execution
6. Know thread-level parallelism, multi-core and many-core architectures
7. Understand computer trade-offs and challenges in complicated systems such as heterogeneous networks and Internet of Things

Graduate Attributes (GA’s)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes at the time of graduation. For more information, please visit: https://engineerscanada.ca/.

Textbooks (or other resources)

Authors: J. Hennessy and D. Patterson
Publisher: Morgan Kaufmann

(5th edition will also be acceptable)

Evaluation and Grading Scheme

Assignments: 10% (up to 5 assignments max)
Quizzes: 10% (Will be held during tutorial sessions)
Midterm Examination: 30% (In class)
Final Examination: 50% (Scheduled by University)
**Breakdown of course requirements**

Lectures three hours a week, laboratory three hours alternate weeks.

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.

CU Learn will be used for the course web page, which is accessible at [http://culearn.carleton.ca](http://culearn.carleton.ca)

- The web page will list your official midterm, assignment and quiz grades throughout the semester.
- Under cases where reevaluation of midterm exams need to be done, it would be performed without student’s presence.
- It is your responsibility to double check that the grades are recorded correctly for your work.
- Check the course web page regularly for announcements and postings.

Use of cell phones is strictly prohibited during lectures/exams/quizzes/tests/labs.

To obtain a final grade higher than F,

- students must obtain a passing grade on the final exam 
  AND
- have attended and completed all laboratory requirements

Please make a note of the following:

If a midterm is missed, procedure laid out by Carleton must be followed when you seek re-administration (please check Carleton’s Exam policies)

If no valid documentation as per Carleton University guideline is provided for not taking midterms due to unavoidable circumstances, a zero grade will be given.

If valid documentation is provided, then re-administration of midterm will be done. Date and time for re-administration of midterms will be announced either in the class or through an email.

Assignments submitted late will not be graded. Students may consult with each other to understand assignments but each student must submit their own assignment that is 100% their own work.

Problems will be provided for practice. Solutions may be given only for selected problems.

Any bonus point obtained by a student will be included in grade calculation only if the student obtains a passing grade on the final exam is obtained.

Final Exam, Midterm Exams and Quizzes will be closed book. Duration of final exam will be 3 hours. Only non-programmable calculating devices will be allowed.
Crib sheets are not allowed unless provided with the exam. If there are changes to the policy during the course of the semester, it will be announced in the class before the test/exam.

### Tentative Week-by-Week breakdown

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<th>Topic</th>
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<td>Computer Performance</td>
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<td>5</td>
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<td>Instruction Level Parallelism (ILP): Pipeline</td>
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<td>Instruction Level Parallelism (ILP): Pipeline</td>
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<tr>
<td>11</td>
<td>Multicore and computer networks</td>
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<td>12</td>
<td>System on Chip (SoC) and Embedded Microcontrollers</td>
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### General Regulations

**Attendance**: Students are expected to attend all lectures and lab periods. The University requires students to have a conflict-free timetable. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 2.1.3, Course Selection and Registration and Section 2.1.7, Deregistration.*

**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)

**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 *Undergraduate Calendar, Academic Regulations of the University, Section 4.4, Deferred Term Work.*

**Appeal of Grades**: The processes for dealing with questions or concerns regarding grades assigned during the term and final grades is described in the *Undergraduate Calendar, Academic Regulations of the University, Section 3.3.4, Informal Appeal of Grade and Section 3.3.5 Formal Appeal of Grade.*

**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.

**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 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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