

CSC367H1 S

Parallel Programming

Winter 2024 Syllabus

Course Meetings

CSC367H1 S

Section	Day & Time	Delivery Mode & Location
LEC0101	Monday, 3:00 PM - 4:00 PM	In Person: BA 1160
	Wednesday, 3:00 PM - 4:00 PM	In Person: BA 1160
	Friday, 3:00 PM - 4:00 PM	In Person: BA 1160

Refer to ACORN for the most up-to-date information about the location of the course meetings.

- Tutorials are on Mondays instead of lecture
- Tutorials start the second week
- Check Quercus for Updates
- Other Q&A is on Piazza

Course Contacts

Course Website: <https://q.utoronto.ca/courses/337403>

Instructor: Avery Laird

Email: avery.laird@mail.utoronto.ca

Office Hours and Location: Wednesdays, 16:10 - 17:10 pm, BA3070

Course Overview

Introduction to aspects of parallel programming. Topics include computer instruction execution, instruction-level parallelism, memory system performance, task and data parallelism, parallel models (shared memory, message passing), synchronization, scalability and Amdahl's law, Flynn taxonomy, vector processing and parallel computing architectures.

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Course Learning Outcomes

Prerequisites: CSC258H1/ CSC258H5/ CSCB58H3; CSC209H1/ CSC209H5/ CSCB09H3

Corequisites: None

Exclusions: CSC367H5. NOTE: Students not enrolled in the Computer Science Major or Specialist program at A&S, UTM, or UTSC, or the Data Science Specialist at A&S, are limited to a maximum of 1.5 credits in 300-/400-level CSC/ECE courses.

Recommended Preparation: None

Credit Value: 0.5

Recommended to take CSC369 previously or concurrently.

Course Materials

All required course materials are provided to students.

Marking Scheme

Assessment	Percent	Details	Due Date
Assignments	40%		2024-01-31,2024-02-14,2024-02-28,2024-04-04
Project	30%		2024-03-15,2024-03-22
Labs	10%		2024-01-15,2024-01-22,2024-01-29,2024-02-05,2024-02-12,2024-02-26,2024-03-11,2024-03-18
In-tutorial Test	20%		2024-03-04

The final grade is based on one in-tutorial test, the course project, the assignments, and labs. There will be 4 programming assignments along with a programming project. There are approximately 8 labs.

Late Assessment Submissions Policy

All labs are due at 10:00 PM on the due date. Late lab submissions get 0 marks. Assignments and the project are due at 10:00 PM on the due date. Check the handouts for final due dates. For assignments and the project each student will have 10 “grace” tokens. Each grace token is worth a 2-hour extension without any penalty. The 10 tokens are for the entire term, not per assignment/project. After you use all 10 tokens, any late submissions will get a mark 0. For each 2-hours of being late, a token gets deducted from *both* partners. Since a token gets deducted from both partners, if you repartner with someone else for a later assignment, you should be aware that you can only use up to the minimum between the tokens they each if you have left.

Course Schedule

Date	Topics
	Lec1: Moores law, speedup
Week1 (J8-J14)	Lec 2: Compilers and Single processors (locality, pipelining, false sharing)
	Lec3: performance, single processor machines
Week 2 (J15-J21)	Lec 4: performance
	Lec 5: Theory of CC
Week 3 (J22-J28)	J26 change to BA 1180
	Lec 6: Parallelism, decomposition Granularity and concurrency
	Lec 7: Static/Dynamic mapping
Week 4 (J29-F4)	Lec 8: Work pool and speedup
	Lec 9: PThread
Week 5 (F5-F11)	Lec 10: OMP
	Lec 11: OMP and false sharing
Week 6 (F12-F18)	Lec 12: Distributed, network
Week 7 (F19-F25)	Reading week
	Lec 13: DMA, non blocking, MPI
Week 8 (F26-M3)	Lec 14: MPI
	Lec 15: Ghost zones
Week 9 (M4-M10)	Lec 16: GPU PCI CUT
Week 10 (M11-M17)	Lec 17&18: Thread blocks, warps, etc.
	Lec 19: shared memory, allocation, atomic,
Week 11 (M18-M24)	Lec 20: Parallel reduction
Week 12 (M25-M31)	Lec 21: Parallel reduction
M29 - Good Friday	
Week 13 (A1-A7)	Automatically Generating High-Performance Codes

Policies & Statements

Late/Missed Assignments

This item is listed here to remind you to include your late/missed assignment policy; if you have late penalties, you are required to publish them in your syllabus. Please see the [A&S Academic Handbook](https://www.artsci.utoronto.ca/faculty-staff/teaching/academic-handbook) (<https://www.artsci.utoronto.ca/faculty-staff/teaching/academic-handbook>) sections on missed term work (Section 4.7), late term work and extensions (section 4.8), and missed term tests (Section 5.3) for more information.

Quercus Info (if using)

This Course uses the University's learning management system, Quercus, to post information about the course. This includes posting readings and other materials required to complete class activities and course assignments, as well as sharing important announcements and updates. New information and resources will be posted regularly as we move through the term. To access the course website, go to the U of T Quercus log-in page at <https://q.utoronto.ca>. SPECIAL NOTE ABOUT GRADES POSTED ONLINE: Please also note that any grades posted are for your information only, so you can view and track your progress through the course. No grades are considered official, including any posted in Quercus at any point in the term, until they have been formally approved and posted on ACORN at the end of the course. Please contact me as soon as possible if you think there is an error in any grade posted on Quercus.

Academic Integrity

All suspected cases of academic dishonesty will be investigated following procedures outlined in the [Code of Behaviour on Academic Matters](https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019) (<https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019>). If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to me. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources. For example, to learn more about how to cite and use source material appropriately and for other writing support, see the U of T writing support website at <http://www.writing.utoronto.ca>. Consult the Code of Behaviour on Academic Matters for a complete outline of the University's policy and expectations. For more information, please see [A&S Student Academic Integrity](https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-integrity) (<https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-integrity>) and the [University of Toronto Website on Academic Integrity](https://www.academicintegrity.utoronto.ca) (<https://www.academicintegrity.utoronto.ca>).

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Course Materials, including lecture notes

Course materials are provided for the exclusive use of enrolled students. These materials should not be reposted, shared, put in the public domain, or otherwise distributed without the explicit permission of the instructor. These materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. Students violating these policies will be subject to disciplinary actions under the Code of Student Conduct.

Video Recording and Sharing (Download Permissible; Re-use Prohibited)

This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session.

Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. In this course, you are permitted to download session videos and materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor.

For questions about the recording and use of videos in which you appear, please contact your instructor.

Online Communication

Instructors are strongly advised to require students use their mail.utoronto.ca email addresses for all course-related communications, and to flag for students that they are expected to check this address regularly. University of Toronto email accounts are more secure, and are also governed by the institution's codes of conduct, meaning that the University has recourse to address any inappropriate communications (e.g., racist, aggressive, threatening, harassing, etc.) between students and other students as well as with the instructor. Also, if a student claims to have emailed you an assignment, this can be verified by IT staff if needed. For these reasons, instructors can state that they will only respond to emails received from a mail.utoronto.ca account. Note that Quercus has a built-in communication tool, called "Inbox". This is not the same as email. Instructors are advised to review its functions and limitations. If you prefer students to use email instead, you should clearly specify this expectation. You may also wish to remind students not to include attachments in replies to any Quercus system notifications they receive through email; messages with attachments included in replies to these system notification messages are not sent to the instructor.

Online Communication

Please do not send emails directly to the TAs. They will not be replied to. Emails to the instructor will be replied to within 48 hours or 72 hours if it's a weekend but these emails have to be limited to urgent and personal enquiries.

Additional Content

Use of ML/Generative AI

The use of generative artificial intelligence (AI) tools is strictly prohibited in all course assessments unless explicitly stated otherwise by the instructor. This includes, but is not limited to, ChatGPT, GitHub Copilot, and open-source models that you have trained and/or deployed yourself. You may not interact with, nor copy, paraphrase, or adapt any content from any generative AI for the purpose of completing assignments in this course. Use of generative AI will be considered use of an unauthorized aid, which is a form of cheating.

This course policy is designed to promote your learning and intellectual development and to ensure that our evaluations are a fair and accurate assessment of your learning. Though it may be tempting to use generative AI to assist you when completing your assignments, this will simply inhibit your learning. If the work you submit is essentially the output of generative AI, then what have you learned and what value are you adding? Think of it this way: if a potential employer or supervisor can get as much from an AI tool as what you're able to do yourself, then why should they hire you at all? You should aim to understand course content at a level that far exceeds what an automated tool can achieve. Our course—and in particular, each assignment—is designed to help you attain true mastery of the course content. If you have questions or are stuck, please come to office hours, where we'll be happy to help!

Important policies:

- You have to read the announcements posted in Quercus.
- Violation of Scinet policies will lead to failing the course. You are responsible to read the Introduction to Scinet documentation (released during the first week of class) and carefully follow all rules.
- Please do not send emails directly to the TAs. They will not be replied to. Emails to the instructor will be replied to within 48 hours or 72 hours if it's a weekend but these emails have to be limited to urgent and personal enquiries.
- Piazza should be used to answer and discuss questions about assignments, the project, and labs. The instructor and the TAs will reply to Piazza questions within 48 hours of the post time or 72 hours if it's a weekend.
- Except for the GPU related labs and assignments, all your code and solutions will be graded on the Scinet cluster. We will post announcements if Scinet experiences

downtimes. If needed we will ask you to use other computing resources for Scinet downtimes.

- Carefully follow all announcements!
- Your submissions and code should (1) follow submission instructions carefully to avoid penalties; (2) compile! If your code doesn't compile you will get 0 marks.

Academic Integrity Details

- Plagiarism is an extremely serious academic offence with severe penalties.
- Do not post your code publically! Your repositories have to be private! Even after the course is over.
- The recording of course lectures should not be distributed outside of the class. Doing so will violate the plagiarism policy.
- Read the licences in all lab, assignment, and project handouts carefully.
- Do not search for solutions (see “Use of ML/Generative AI” below)
- You should not use code fragments from public places, even if it is open source.
- You and your partner are both responsible for any detected plagiarism.
- Do not give your code to anyone!
- Code or answers to assignment questions should not be posted in Piazza.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please reach out to me. Note that you are expected to seek out additional information on academic integrity from me or from other institutional resources (for example, the [University of Toronto website on Academic Integrity](#)).