CS 341 – Algorithms

Spring 2025 course outline

Last updated: 7 May 2025
Course website: https://cs.uwaterloo.ca/~lapchi/cs341-2025

Please note that any term-specific content of this document is decided tentatively at the beginning of the term, and is subject to change. See the course website for current, up-to-date information.

Instructor
(Section 1 and 2)

Name: Lap Chi Lau
Email: lapchi@uwaterloo.ca
Office: DC 1309

Office hours: Tuesdays and Thursdays 2:30-3:30, DC 1309.

Lectures
Section 1: Tuesdays and Thursdays 1:00-2:20, MC 2054.
Section 2: Tuesdays and Thursdays 10:00-11:20, MC 2034.

Instructional support coordinator

Name: Sylvie Davies
Email: sldavies@uwaterloo.ca

Tutors

Surname	Given name	Userid	Office hours
El Sabeh	Remy	relsabeh	TBA
Liu	Raymond	r354liu	TBA
Wang	Robert	r585wang	TBA
Agarwal	Avantika	a243agar	
Baraskar	Omkar	obaraska	
Do	Brian	bdo	
Ibrahim	Anas	a23ibrah	
Lin	Junhao	j354lin	

Tutorials
TUT101: Fridays 9:30-10:20.
TUT102: Fridays 10:30-11:20.

Course Description
The main focus is to learn basic techniques to the design and analysis of efficient algorithms through the study of various classical algorithms. Towards the end, we will also study the notion of NP-completeness and prove that many natural problems are "hard" using polynomial time reductions. The course will give students some experience in program design and emphasize both pragmatic and mathematical aspects of program efficiency.

Course Text
Course notes will be provided. We will mostly use the problems discussed in the following three books.

- Algorithms, by Dasgupta, Papadimitriou, and Vazirani, McGraw-Hill.
- Algorithm Design, by Kleinberg and Tardos, Perason.
- Introduction to Algorithms, by Cormen, Leiserson, Rivest and Stein, MIT Press.

Posting Lecture Slides and Course Information
The lectures notes, course outline, and assignments will be posted in the course homepage at https://cs.uwaterloo.ca/~lapchi/cs341-2025.

Announcements and discussions about the course material or assignments will take place on Piazza (piazza.com/uwaterloo.ca/spring2025/cs341).

The current marks will be available to the students throughout the term online via the course's LEARN course site.

Course requirements
Prerequisites: CS 240 and MATH 239/249
Anti-requisites: SE 240, SYDE 423

Evaluation

Assignments	30%
Midterm Exam	25%
Final Exam	45%

Schedule of Exams and Assignment Tentative Due Dates
- Assignment 1: due May 23, 11pm.
- Assignment 2: due June 6, 11pm.
- Midterm, June 16, 2025, 7-9:20pm.
- Assignment 3: due June 27, 11pm
- Assignment 4: due Jul 11, 11pm
- Assignment 5: due Jul 25, 11pm
- Final Exam: to be scheduled

Submitting Assignments
Assignments are due at 11PM EST and are to be submitted electronically using Crowdmark. Programming problems will be submitted using Marmoset. Detailed instructions for submitting the assignments will be posted on the course Piazza page.

Students are encouraged to typeset their solutions. *Clearly legible* handwritten solutions will also be accepted. Marks can be deducted for unclear handwriting.

Late Assignments
- Late submissions will be accepted up to 24 hours after due date.
- There will be a penalty of 25% for accepted late submissions.

You must notify your instructor of any severe, long-lasting problem that prevents you from doing an assignment and submit the current version of the Verification of Illness form, https://uwaterloo.ca/students/sites/default/files/uploads/documents/uw-verification-of-illness-form.pdf.

Students using short-term absence will be granted an extension to submit their assignments. Unless special circumstances, there will be no weight shifting for assignments.

Assignment policy
Students are allowed to collaborate with other students about the assignments. If you collaborate with others, you must clearly indicate the collaboration for each problem. Marks will be deducted if you failed to do so.

You are not allowed to use any references other than the course notes and the three main references listed in the course page. Searching for solutions is considered plagiarism. If you happen to find the solution of a problem while reading from some external sources, you must give a proper citation of the source, failing to cite the source properly is considered plagiarism.

In any case, you must write your own solutions, without the help of others and without the use of any references other than the course notes and the three main references.

No Makeup for Midterm
There will be no deferred/makeup midterm exam. Under extenuating circumstances that are pre-approved, where a student is unable to write the mid-term, the instructor will assign a higher weight to student's final exam.

Regrading Request
Requests for regrading will be accepted up to 7 days after the assignment or midterm is returned to students. Details of how to request a regrade will be posted in Piazza when the first assignment is returned.

Retention of Assignments and Midterms
Unclaimed midterms assignments will be retained for one month after the term grades become official in Quest. After that time, they will be destroyed in compliance with UW's confidential shredding procedures.

Major Topics covered in this course
- Divide-and-Conquer Algorithms
- Greedy Algorithms
- Graph Algorithms
- Dynamic Programming Algorithms
- Maximum Flows
- Intractability and Undecidability

Academic Integrity
In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. All members of the UW community are expected to hold to the highest standard of academic integrity in their studies, teaching, and research. The Office of Academic Integrity's website (https://www.uwaterloo.ca/academicintegrity) contains detailed information on UW policy for students and faculty. This site explains why academic integrity is important and how students can avoid academic misconduct. It also identifies resources available on campus for students and faculty to help achieve academic integrity in — and out — of the classroom.

Generative AI
This course includes the independent development and practice of specific skills, such as the design and analysis of efficient algorithms. Therefore, the use of Generative artificial intelligence (GenAI) trained using large language models (LLM) or other methods to produce text, images, music, or code, like Chat GPT, DALL-E, or GitHub CoPilot, **is not permitted** in this class. Unauthorized use in this course, such as running course materials through GenAI or using GenAI to complete a course assessment is considered a violation of Policy 71 (plagiarism or unauthorized aids or assistance). Work produced with the assistance of AI tools does not represent the author's original work and is therefore in violation of the fundamental values of academic integrity including honesty, trust, respect, fairness, responsibility and courage (ICAI, n.d.).
You should be prepared to show your work. To demonstrate your learning, you should keep your rough notes, including sources, research notes, brainstorming, drafting notes and prompts. You may be asked to submit these notes along with earlier drafts of your work, either through saved drafts or saved versions of a document. If the use of GenAI is suspected where not permitted, you may be asked to meet with your instructor or TA to provide explanations to support the submitted material as being your original work. If you cannot sufficiently support your work, academic misconduct allegations may be brought to the Associate Dean.

In addition, you should be aware that the legal/copyright status of generative AI inputs and outputs is unclear. More information is available from the Copyright Advisory Committee. Students are encouraged to reach out to campus supports if they need help with their coursework including:

- Student Success Office for help with skills like notetaking and time management
- Writing and Communication Centre for assignments with writing or presentations
- AccessAbility Services for documented accommodations
- Library for research-based assignments

Grievance

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, https://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm

Discipline

A student is expected to know what constitutes academic integrity, to avoid committing academic offences, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about 'rules' for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offences and types of penalties, students should refer to Policy 71 - Student Discipline, https://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm

Avoiding Academic Offences:

Most students are unaware of the line between acceptable and unacceptable academic behaviour, especially when discussing assignments with classmates and using the work of other students. For information on commonly misunderstood academic offences and how to avoid them, students should refer to the Faculty of Mathematics Cheating and Student Academic Discipline Policy, https://www.math.uwaterloo.ca/navigation/Current/cheating_policy.shtml

Appeals:

A student may appeal the finding or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals, https://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm

Note for students with disabilities:

The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.
See http://www.studentservices.uwaterloo.ca/disabilities for more information.

Turnitin.com
Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit alternate assignment.

Continuity Plan
If in-person classes are canceled, whether for the particular course or University-wide, we will have online Zoom lectures at the same time (Monday and Wednesday 10:00-11:20). If in-person exams are canceled (in response to decisions affecting the entire University), we will have remote exams at the same scheduled time via CrowdMark. Students who cannot attend in-person classes due to self-isolation will still be able to read lecture notes. If students cannot take the final due to COVID-19, it will be handled similarly to other illness-related issues.

Mental Health Support
The Faculty of Math encourages students to seek out mental health support if needed.

On-campus Resources:

- Campus Wellness https://uwaterloo.ca/campus-wellness/
- Counselling Services: counselling.services@uwaterloo.ca 519-888-4567 ext. 32655
- MATES: one-to-one peer support program offered by Waterloo Undergraduate Student Association (WUSA) and Counselling Services: mates@wusa.ca

- Health Services: located across the creek from the Student Life Centre, 519-888-4096.

Off-campus Resources:

- Good2Talk (24/7): Free confidential help line for post-secondary students. Phone: 1-866-925-5454 (Ontario and Nova Scotia only)

- Here 24/7: Mental Health and Crisis Service Team. Phone: 1-844-437-3247 (Waterloo Region only)

- OK2BME: set of support services for lesbian, gay, bisexual, transgender, or questioning teens. Phone: 519-884-0000 extension 213 (Waterloo Region only)

- EMPOWER ME 1-833-628-5589 for Cdn./USA other countries see: http://studentcare.ca/rte/en/IHaveAPlan_WUSA_EmpowerMe_EmpowerMe

- EMPOWER ME in China:
  China North 108007142831
  China South 108001402851

Diversity

It is our intent that students from all diverse backgrounds and perspectives be well served by this course, and that students' learning needs be addressed both in and out of class. We recognize the immense value of the diversity in identities, perspectives, and contributions that students bring, and the benefit it has on our educational environment. Your suggestions are encouraged and appreciated. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups. In particular:

- We will gladly honour your request to address you by an alternate/preferred name or gender pronoun. Please advise us of this preference early in the term so we may make appropriate changes to our records.

- We will honour your religious holidays and celebrations. Please inform of us these at the start of the course.

- We will follow AccessAbility Services guidelines and protocols on how to best support students with different learning needs.