

# CS 466/666 – Algorithm Design and Analysis

Spring 2022 course outline

Last updated: 6 May 2022

Course website: <https://cs.uwaterloo.ca/~lapchi/cs466>

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

Name: Lap Chi Lau

Email: [lapchi@uwaterloo.ca](mailto:lapchi@uwaterloo.ca)

Office: DC 3120

Office hours: Mondays and Wednesdays 11:30-12:30.

## Lectures

Mondays and Wednesdays 10:00-11:20, MC 4042.

## Tutors

Surname	Given name	Userid	Office hours
Tung	Kam Chuen (Alex)	kctung	Fridays 10-11am, DC 3139
Wang	Robert	robert.wang2	Thursdays 5-6pm, DC 3139

## Course Description

We will study probabilistic and linear algebraic techniques in algorithmic design. Particular examples will be chosen from different areas of active research and application.

The lectures will be delivered on the blackboard. All other communications for the course will be made on the course website (for assignment postings) and on the Piazza page for the course (for all other notices and for discussions and questions about the assignments and all other aspects of the course).

## Course Text

Course notes will be provided. The following are some reference books.

- Probability and Computing, by Mitzenmacher and Upfal
- [Spectral and Algebraic Graph Theory, by Dan Spielman.](#)

## Posting Lecture Slides and Course Information

The lectures notes, syllabus, and assignments will be posted in the course homepage at <https://cs.uwaterloo.ca/~lapchi/cs466>.

Announcements and discussions about the course material or assignments will take place on Piazza ([piazza.com/uwaterloo.ca/spring2022/cs466](https://piazza.com/uwaterloo.ca/spring2022/cs466)).

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

## Course requirements

Prerequisites: CS 341

Taken a first course in probability and a first course in linear algebra.

## Evaluation

Assignments	40%
Midterm Exam	20%
Final Exam	40%
Course Project	20% (only for graduate students in CS 666)

## Schedule of Exams and Assignment Tentative Due Dates

- Assignment 1: due May 23, 11pm.
- Assignment 2: due June 6, 11pm
- Assignment 3: due June 20, 11pm
- Midterm, June 30, 2022, 7:00-8:50 PM
- Assignment 4: due July 11, 11pm
- Assignment 5: due July 25, 11pm
- Final Exam: to be scheduled by the Registrars' Office

## Submitting Assignments

Assignments are due at 11PM and are to be submitted electronically on the school's system ([linux.student.cs.uwaterloo.ca](https://linux.student.cs.uwaterloo.ca)).

Students are strongly encourage to typeset their solutions. *Clearly legible* handwritten solutions sets 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 10% 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/health-services/sites/ca.health-services/files/uploads/files/VIFonline.pdf>.

### **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 14 days after students having the opportunity to pick up their assignments or midterm. Details of how to request a regrade will be posted in Piazza after the first assignment is due.

### **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.

### **Topics to be Covered (Tentative)**

- Chernoff bounds, graph sparsification, dimension reduction (3 lectures).
- balls and bins, hashing, data streaming (5 lectures).
- polynomial identity testing, network coding (3 lectures).
- probabilistic methods, local lemma (3 lectures).
- spectral graph theory, random walks, mixing time (4 lectures).
- Cheeger's inequality, local graph partitioning (2 lectures).
- electrical networks, random walks (1 lecture).
- multiplicative update methods, maximum flow (2 lectures).

## **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.

## **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](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](mailto: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](mailto: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](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.