

CS 360 - Intro to the Theory of Computing

Spring 2022 Course Outline

Last revised: May 2, 2022

Course website: <https://cs.uwaterloo.ca/~s4bendav/course/cs360s22>

Course message board: <https://piazza.com/uwaterloo.ca/spring2022/cs360>

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.

CS 360 Description

This course introduces the theoretical foundations of computer science. Topics covered include regular and context-free languages, automata, non-determinism, Turing machines, computability, and complexity classes such as P and NP.

This will be an in-person course. Live lectures will take place on Mondays and Wednesdays from 10:00-11:20am in room MC 4060. The lectures will not be recorded, but lecture notes will be posted on the course website.

There will be four websites associated with this class:

1. The [Piazza page](#) will be the class message board, but will also serve as the place for announcements and will be the most frequently updated page associated with the class. All students are required to join the Piazza board.
2. Crowdmark will be the primary place for assessments; all students must complete their assignments on Crowdmark. Students who are registered to the class will be invited via email to the Crowdmark platform.
3. The [course website](#) will contain documents such as lecture notes and assignments.
4. The [Learn webpage](#) will function as a secondary website for this course. Students will be able to check their grades on Learn. The quizzes will be available only through Learn.

CS 360 Course Objectives

At the end of the course, students should be able to

- Describe how a real computer can be modeled mathematically by a theoretical computer in many different ways
- Explain what a formal language is and how it corresponds to a computational decision problem
- Describe regular languages in two different ways (automata and regular expressions)
- Describe context-free languages in two different ways (grammars and pushdown automata)

- Prove languages regular and non-regular, context-free and non-context-free, recursive and non-recursive, recursively enumerable and non-r.e.
- Describe the Church-Turing thesis
- Explain what nondeterminism is and how it is used
- Explain what a Turing machine is and create simple Turing machines to solve problems
- Describe the fundamental limits to computation (computable versus uncomputable)
- Describe the meaning of computational complexity classes such as P, NP, and PSPACE

Textbooks and Readings

Course notes specific to this offering of CS 360 will be posted on the course website. Students who are looking for additional reading materials have a few options.

The textbook *Introduction to the Theory of Computation* by Sipser is recommended as a supplementary source of content. An alternative book covering the same material is *Automata Theory, Languages, and Computation* by Hopcroft, Motwani, and Ullman. Both books are currently in their third editions (though a previous edition should also be fine). Both books contain essentially all the material that will be covered in the course. Additionally, the course notes of John Watrous, available at <https://cs.uwaterloo.ca/~watrous/ToC-notes/>, are useful reading.

Contact Information

The following course staff will be answering questions on Piazza and will be available for contact over email. They will each hold 1 hour of office hours per week; check the course website for details.

- **Shalev Ben-David** (Instructor) shalev.b@uwaterloo.ca
- **Bandar Al-Dhalaan** (TA) bandar.al-dhalaan@uwaterloo.ca
- **Luke Rowe** (TA) l6rowe@uwaterloo.ca

Grade calculation

The tentative grade breakdown is as follows:

Final Exam	50%
Midterm	20%
5 Assignments	25%
10-11 Mobius “Quizzes”	5%

There will be 5 assignments, due roughly every other week, tentatively on Fridays before the midterm and Tuesdays after. The assignments will be worth 5% each, for a total of 25%.

Additionally, there will also be around 10 “quizzes”, which will be weekly multiple choice assessments. These quizzes will be posted on Learn through Mobius, and can be completed online at any time (with no time limit). The quizzes can be thought of as mini-assignments, since they have no time limit (the name “quiz” is a bit misleading). They are meant to encourage students to study the previous week’s material before each new week of classes. Together, they will be worth 5%.

There will be a midterm, likely in the form of an in-class exam. (We may go to a different room for the midterm.) It will be worth 20%.

There will also be a 150-minute final exam worth 50%. The exam date and location will be determined by the registrar’s office to minimize conflicts.

Course Work Policies

Missed or Late Work

Missed or late assignments will by default receive a grade of 0; however, if this happens, please contact the instructor to determine a lower lateness penalty based on your circumstances. Reasonable requests for extensions may be granted, but please contact the instructor in advance. If you submit the assignment a bit late (e.g. due to a technical problem), please contact the instructor as soon as possible.

When contacting the instructor, a private post on Piazza is strongly preferred to an email (but you can send an email if you need to, for example if you are sending an urgent email from your phone and do not have Piazza access).

Remarking Policy

Please contact a TA with any concerns about assignment grades. Contact the instructor with concerns about exam grades, or if an issue with assignment grades cannot be resolved after discussion with the TA.

Group Work

Group work on the assignments is allowed, so long as the discussion is at a high level and each student writes up his or her solutions separately. Assignments are the only assessment students are allowed to collaborate on. Please list all collaborators in the assignment solutions.

Please do not share quiz answers with other students in the class. Also, do not cheat on the exams. In the event that the midterm or final exam move to being online instead of in-person, no collaboration is allowed on those exams.

Students are allowed and encouraged to ask clarifying questions on Piazza (regarding any of the assessments). Please prefer public posts to private posts when asking clarifying questions.

Other Important Information

The remainder of this outline contains important information about University of Waterloo policies, but is not specific to CS 360.

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. [Check the [Office of Academic Integrity](#) for more information.]

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](#). When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the [Office of Academic Integrity](#) for more information.] 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 instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to [Policy 71, Student Discipline](#). For typical penalties, check [Guidelines for the Assessment of Penalties](#).

Appeals: A decision made or penalty imposed under [Policy 70, Student Petitions and Grievances](#) (other than a petition) or [Policy 71, Student Discipline](#) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to [Policy 72, Student Appeals](#).

Note for students with disabilities: [AccessAbility Services](#), located in Needles Hall, Room 1401, 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 AccessAbility Services at the beginning of each academic term.

MOSS: MOSS (Measure of Software Similarities) is used as a mean of comparing students' assignments in order to support academic integrity.

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 an alternate assignment.

Intellectual property: Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository). Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).