

CSE103: Computational Models

(syllabus revised 2020-03-31)

Basic Information

- **Instructor:** Prof. Daniel Fremont
Office Hours: Thursdays 10:00-11:00 am
- **Class Time & Location:** MWF 4:00-5:05 pm, on Zoom.
Links for all Zoom meetings are on [Canvas](#); click “Join” and log in using your CruzID.

Please keep your camera and microphone turned off in Zoom to avoid distracting other students. To ask a question in lecture, use the “raise hand” feature (see [here](#)) and send your question to the TAs through the chat. We will unmute you to ask your question, or the TA can ask it for you if you prefer not to be recorded.
- **Teaching Assistants:** (see the [Canvas page](#) for Zoom links for sections and office hours)
 - Chuan-An Lin
Section A: Mondays 12:00-1:05 pm
Section B: Mondays 1:20-2:25 pm
Office Hours: Fridays 1:50-3:50 pm
 - Kostas Zampetakis
Section C: Tuesdays 1:30-2:35 pm
Section D: Wednesdays 2:40-3:45 pm
Office Hours: Wednesdays 6:10-7:15 pm and Thursdays 2:40-3:45 pm
 - Omkar Patil
Section E: Fridays 10:40-11:45 am
Section F: Fridays 9:20-10:25 am
Office Hours: Mondays 10:30-11:30 am and 3:00-4:00 pm
- **Workload:** 5 credits = 15 hours/week (including 3.25 in class)
- **Websites:**
 - Main Canvas page: <https://canvas.ucsc.edu/courses/32038>
 - Piazza, for questions: <https://piazza.com/ucsc/spring2020/cse103>
 - Gradescope, for homework: <https://www.gradescope.com/courses/105225>
- **Exam Dates:** Midterm: May 4th, 4:00-5:05 pm; Final: June 11th, 4:00-7:00 pm
- **Textbooks:** None is required, but we will largely follow *Introduction to the Theory of Computation* by Michael Sipser. Additional resources will be posted on the website.

Course Description

This course covers mathematical models of computation. These models provide the foundation for the theory of computer science, allowing us to ask and answer questions like “are there problems that computers can’t solve?” The concepts and algorithms we will study also underlie many areas of computer science practice, e.g. textual search, compilers, and constraint solvers. We start with finite automata and regular languages, studying their expressiveness as well as algorithms for manipulating them. We do the same for the more powerful models of pushdown automata and context-free languages. In the second half of the course, we study Turing machines, a model of general computation. We will explore computability theory, which examines which problems can be solved by algorithms, as well as complexity theory, which examines what resources are needed to solve computational problems.

Main Topics by Week

1. Deterministic Finite Automata
2. Nondeterministic Finite Automata; closure properties of regular languages
3. Regular expressions; pumping lemma for regular languages
4. Context-free grammars; parsing of context-free languages
5. Pushdown automata; pumping lemma for context-free languages
6. Turing machines; universal computation and the halting problem
7. Recursive enumerability; reductions between computational problems
8. More on undecidable problems; Rice’s Theorem; computation histories
9. P, NP, and NP-completeness; SAT and the Cook-Levin Theorem
10. More NP-complete problems; overview of computational complexity theory

Communication

- If you have questions about the content of the course, please ask them in section or office hours, or post them on Piazza (feel free to do so anonymously). When possible, please post your question publicly so that the resulting discussion can benefit everyone in the class. We will try to respond promptly to all questions, but responses in the evening or on weekends may be sparse; do not expect us to respond to homework questions asked a few hours before the deadline. Piazza will be the central location for discussion about course content: we will not respond to content questions asked by email.
- For questions about the course itself (e.g. accommodations or other logistics), please email the instructor, or post to Piazza if the answer would be useful to everyone.

Assessments

- *Homework:* There will be ~6 homework assignments, weighted equally and totaling 55% of the course grade. Homework will be released on the Canvas page at least one week

prior to the due date, and completed assignments will be uploaded to Gradescope (instructions forthcoming). You are welcome to discuss ideas about the homework with your fellow students, but you must 1) give due credit by listing your collaborators at the top of your submissions, and 2) write up your own solutions; copying someone else's solution is academic dishonesty and hurts everyone in the class.

Homework is due on Tuesdays at 11:59 pm. Late submissions will not be accepted, so please make sure to leave adequate time to upload your assignments. To give you some flexibility, we will automatically drop your lowest homework score, i.e., your homework grade will be the average of all your homework scores except the lowest. We will not otherwise give homework extensions, except in truly exceptional circumstances such as a medical or family emergency (in which case you should email the instructor as early as possible).

- *Exams:* There will be one midterm exam, covering all material through week 5, and a final exam, covering the entire course. The exams will be conducted online (probably using Canvas). Exams cannot be made up: missing an exam will be equivalent to scoring zero on it, unless there is an excuse approved by the Dean or an equivalent authority and submitted to the instructor at least one week prior to the exam date. In such a case, the course grade will be determined by rescaling the other course assessments to total 100% of the grade.
 - Midterm (20% of grade): Monday, May 4th, 4:00-5:05 pm (i.e., normal class time)
 - Final (25% of grade): Thursday, June 11th, 4:00-7:00 pm

Grading

- Grade weighting:
 - 55% homework
 - 20% midterm
 - 25% final
- Grade scale: 100-90 A, 89-80 B, 79-70 C, 69-60 D, 59-0 F. The numerical grades of homework and exams may be individually curved to correct errors in calibrating their difficulty.
- Grades will be posted to Gradescope and/or Canvas.
- To obtain an incomplete, students must complete at least 80% of the homework, take the midterm, and provide a valid reason for requesting an incomplete. To resolve the incomplete, students must take a final exam.

Additional Resources and Support

- **Tutoring:** Unfortunately, due to the coronavirus situation, we will not have tutors for this offering of the course.
- **Support for students with disabilities:** UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately by email, preferably within the first two weeks of the quarter. We can then discuss ways we can ensure your full participation in the course. I encourage all students who may benefit from learning more about DRC services to contact DRC by email at drc@ucsc.edu.
- **Support for students with other difficulties:** All of us are dealing with heightened stress and worry during this uncertain time. You should always feel free and comfortable to bring up any problem with the instructor, but if this is not sufficient, or if you prefer professional help, here are several campus resources that you may want to consider contacting (and that are still operating, although mostly remotely):
 - [UCSC Care](#), a confidential space to discuss issues of dating violence, sexual assault and stalking.
 - [Slug Support](#) where you can ask for help on many practical issues, including dealing with a financial crisis, problems with your living situation, computers, books, etc.
 - [CAPS](#), which provides counseling and psychological services to students.
- **Title IX reporting disclosure:** Title IX prohibits gender discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking. If you have experienced sexual harassment or sexual violence, you can receive confidential support and advocacy at the Campus Advocacy Resources and Education (CARE) Office by calling (831) 502-2273. In addition, Counseling and Psychological Services (CAPS) can provide confidential, counseling support, (831) 459-2628. You can also report gender discrimination directly to the University's Title IX Office, (831) 459-2462. Reports to law enforcement can be made to UCPD, (831) 459-2231 ext. 1. For emergencies call 911. Faculty and Teaching Assistants are required under the UC Policy on Sexual Violence and Sexual Harassment to inform the Title IX Office should they become aware that you or any other student has experienced sexual violence or sexual harassment. If you prefer to speak to someone confidentially, please contact UCSC Care (see above).

Academic Integrity

Academic integrity is the cornerstone of a university education. Academic dishonesty diminishes the university as an institution and all members of the university community. It tarnishes the value of a UCSC degree. All members of the UCSC community have an explicit responsibility to foster an environment of trust, honesty, fairness, respect, and responsibility. All members of the university community are expected to present as their original work only that which is truly their own. Plagiarism of any kind is unacceptable. All members of the community are expected to

report observed instances of cheating, plagiarism, and other forms of academic dishonesty in order to ensure that the integrity of scholarship is valued and preserved at UCSC. Any student found in violation of the UCSC Academic Integrity policy may face both academic sanctions imposed by the instructor of record and disciplinary sanctions imposed by the graduate division. Violations of the Academic Integrity policy can result in dismissal from the university and a permanent notation on a student's transcript. For the full policy and disciplinary procedures on academic dishonesty, students and instructors should refer to the [Academic Integrity page](#) at the [Division of Undergraduate Education](#) or [Graduate Division](#).

Missing Class or Adding the Class Late

- We strongly recommend you attend all the lectures: there will be interactive elements, and you will not learn as much if you do not actively participate. However, in case you are unable to attend some of the lectures, they will be recorded and posted to [Google Drive](#). If you prefer the UCSC Webcast interface, the lectures will also be available [there](#): use the username “cse-103-1” and password “CSE103”.
- If you add the class before April 17th (the add/drop date), please watch the lectures you missed using the link above. You will have one week to complete any homework assigned before you added the class. We will not grant permission to add the class after April 17th, since by that time we will have covered too much material to make up.