CSE 355: Introduction to Theoretical Computer Science

Fall 2021 (MW 15:00 - 16:15 CAVC351)

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Course Overview and Objectives:

This course is about understanding the fundamental models of computation, not just specific technologies. We seek to determine what computers can and cannot do, how quickly, with how much memory, and on which type of computational model. To do that, we will discuss highly abstract models of computation such as finite automata, formal languages, grammar, notions of algorithm, computability, decidability, and complexity.

Textbook:

1. (Required) Michael Sipser; Introduction to the Theory of Computation Third Edition
2. (Optional) John E Hopcroft and Jeffrey D Ullman; Introduction to Automata Theory, Languages, and Computation
   `https://archive.org/details/HopcroftUllman_cinderellabook`
3. (Optional) Fleck and Har-Peled; Lecture notes;
   `http://sarielhp.org/teach/notes/373/book.pdf`

Tentative Course Itinerary: We will have 15 weeks (29 lecture times, excluding the holiday on Sept 06th) before the final week. Topics to be covered and the approximate time on each topic are given below (in the given order):

1. Sipser Chapter 0 (2 lectures): Course overview, introduction
2. Sipser Chapter 1 (8 lectures): Deterministic finite automata (DFAs), nondeterministic finite automata (NFAs), regular expressions, non-regular languages
3. Midterm Exam 1 (1 lecture, Sept 29th 2021)
4. Sipser Chapter 2 (6 lectures): Context-free grammars (CFGs), pushdown automata, non-context-free languages
5. Sipser Chapter 3 (4 lectures): Turing machines
6. Midterm Exam 2 (1 lecture, Nov 08th 2021)
7. Sipser Chapter 4&5 (4 lectures): Halting problem, decidable/undecidable problems
8. Sipser Chapter 7 (2 lectures): Time/Space complexity.
9. Final Exam (1 lecture, Dec 01st 2021)

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Grading:

1. **Homework** (50%, expect 5-6 assignments): The homework assignment model is based on self-assessment. Students finish and submit homework before the deadline. After the deadline, TAs provide the solution. Students assess their own homework. TAs and instructor (randomly) check 20% students' assessments and correct them if any. **All submissions must be typed (not handwritten) and submitted electronically.**

2. **Midterm** 1 (15%): Focus on Sipser Chapter 0&1

3. **Midterm** 2 (15%): Focus on Sipser Chapter 2&3

4. **Final** (20%): Covers all lectures

Late submission of homework will not be accepted. We use the traditional grading scale as below:

A+	A	A-	B+	B	B-	C+	C	D	E
$\geq 97\%$	$\geq 94\%$	$\geq 90\%$	$\geq 87\%$	$\geq 84\%$	$\geq 80\%$	$\geq 76\%$	$\geq 70\%$	$\geq 60\%$	$0 - 59\%$

Collaboration Policy: Collaborative work is held to the following requirements:

- Always make a good-faith effort to do the work by yourself first, before working together. Not only is this a more effective way to learn, it will also make your collaborative time more effective. Students must write up solutions on their own. Submissions from different students should never look similar.

- No collaboration on exams.

Email Policy: Often questions regarding a lecture topic or an assignment may be common for many, and thus it will be most beneficial to ask such questions on the Discussions forum on the Canvas, to avoid repetition. Accordingly, emails should be reserved for solving mostly non-technical matters like grade appeal, reporting excused absence, etc. When you have to send an email, please include in the subject line the prefix CSE 355: (For example, the subject line of your email may read CSE 355: Potential grading error for HW1). A good rule of thumb: if your question cannot be answered in a short paragraph, then it is not appropriate for email.

Other Policies

- Recording: *Note that class sessions may be recorded and recordings provided to enrolled students, instructors or instructional support personnel. If you have concerns about being recorded, please contact the course instructor.*

- Academic Integrity: Students in this class must adhere to ASU's academic integrity policy, which can be found at `https://provost.asu.edu/academic-integrity/policy`. Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In addition, all engineering students are expected to adhere to both the ASU Academic Integrity Honor Code and the Fulton Schools of Engineering Honor Code. All academic integrity violations will be reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). The AIO maintains record of all violations and has access to academic integrity violations committed in all other ASU college/schools.

- Copyright: All course content and materials, including lectures, are copyrighted materials and students may not share outside the class, upload to online websites not approved by the instructor, sell, or distribute course content or notes taken during the conduct of the course (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5-308 F.14 for more information).

  You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the students first comply with all applicable copyright laws; faculty members reserve the right to delete materials on the grounds of suspected copyright infringement.

- Disability Accommodations: Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with the ASU Disabilities Resource Center and provide documentation of that registration to the instructor. Students should communicate the need for an accommodation in sufficient time for it to be properly arranged. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities.

- Harassment and Sexual Discrimination: Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information. Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at `https://sexualviolenceprevention.asu.edu/faqs`. Mandated sexual harassment reporter: As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services,

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`https://eoss.asu.edu/counseling`, is available if you wish discuss any concerns confidentially and privately.

- Title IX Language: Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at `https://sexualviolenceprevention.asu.edu/faqs`.

  As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services, `https://eoss.asu.edu/`counseling is available if you wish to discuss any concerns confidentially and privately. ASU online students may access 360 Life Services, `https://goto.asuonline.asu.edu/success/online-resources.html`.

  Additional Notes: Any information in this syllabus may be subject to change with reasonable advance notice. If the instructor could not make it to a lecture 15 minutes after its start time and also did not make an advance notice about the absence, you are excused from the lecture (no exam/quiz/test/attendance-taking/importance course content can be given in this lecture, even if the instructor arrives later).

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