Course Overview

Monday, January 4th, 2016

Course info.

Website: [https://cseweb.ucsd.edu/classes/wi16/cse105-a](https://cseweb.ucsd.edu/classes/wi16/cse105-a)
Lectures: Mondays and Wednesdays, 5:00–6:20 PM, in CENTR 115
& Thursdays, 7:00–7:50 PM, in CENTR 101
Sections: Mondays, 2:00–2:50 PM, in CENTR 212
& Thursdays, 7:00–7:50 PM, in CENTR 101
Midterms: Monday, January 25th, 8:00–8:50 PM, in CENTR 101
& Wednesday, February 17th, 8:00–8:50 PM, in CENTR 101
Final: Tuesday, March 14th, 7:00–9:59 PM, room TBA.

All course material will be posted to the course Website — check it regularly! We will also use Piazza for discussion and Gradescope for homework submission and grading and for exam grading.

Staff.

Instructor: Hovav Shacham
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See the course Website for instructor offices and office hours.

Prerequisites. The formal prerequisites for CSE 105 are CSE 12 and CSE 21. One of Math 15B, Math 100A, or Math 103A may substitute for CSE 21.

We expect you to be comfortable with mathematical concepts such as sets, tuples, relations, and functions. You should in particular be familiar with the notion that a set is (or isn’t) closed under some operation. We expect you to be comfortable with manipulating formal mathematical definitions reading and writing formal proofs.

We further expect you to be comfortable with basic data structures, such as trees and graphs; with basic algorithms on those data structures, such as depth-first search and graph reachability; and with basic tools of algorithm analysis, such as big-$O$ notation.

Objectives. Our objectives in CSE 105 are: (1) to define computation formally; (2) to show that there are limits to what is computable; (3) to reason precisely about computation and its limits. Along the way, we will pick up some useful tools (finite automata, regular expressions, context-free grammars) and lay the foundation for the study (in CSE 200) of complexity theory.

Learning outcomes. A successful student will learn the following in CSE 105:

- Recall, understand and manipulate formal tuple definitions for DFAs, NFAs, CFGs, and TMs, and understand implications of these definitions and variants thereof.
• Understand and manipulate language definitions written in “set-builder” notation.

• Understand and generate closure-property proofs for claims of the form “if \( L \) is a regular language, then so is \( f(L) \)” for \( L \) transforming a language into another, and also for other classes of languages than regular languages.

• Understand the meaning and implications of closure properties, especially for the standard language operations; e.g., if two languages are not regular, can/must their concatenation be regular?

• Understand and use reductions for decidability and undecidability, and mapping reductions for recognizability.

• Given a language, determine whether it is decidable or undecidable and prove that claim formally and convincingly.

Computer use. Using computers in class can be distracting to you and to other students around you. Accordingly, computers (including laptops, tablets, phones, and smartwatches) may not be used in lecture except with staff permission.

Textbooks. There is one required text: Michael Sipser’s Introduction to the Theory of Computation. You may use either the second or third edition. New “international edition” copies of the second edition can be obtained for under $20; see the course Website for details.

The course Website includes a calendar that lists assigned sections from Sipser for each lecture. You should carefully read and make sure you understand these assigned sections. You may test your understanding by solving the “exercises” and “problems” at the end of each Sipser chapter. You should be able to solve every “exercise” without referring back to the material in the chapter. You should be able to solve most “problems” with some thought. The midterms and final will more resemble “problems” than “exercises”; the homework will be a mix of both.

Homework. There will be weekly homework. The homework and due dates will be posted to the course Website. You must typeset your solutions to the homework. See the “Homework preparation and submission” section, below, for more details.

You may discuss the homework with other students, but you must write up your solutions entirely by yourself. See the “Collaboration policy” section, below, for more details.

Exams. There will be two closed-book, in-person midterms, each 50 minutes long, scheduled outside of the usual lecture time. The dates and times for these midterms are posted on the course Website. There will also be a closed-book, comprehensive final exam in the course’s registrar-assigned final exam slot.

For the final only — not for the midterms — you may bring a single letter-size (8.5″ × 11″), handwritten\(^1\) summary sheet. If you choose to bring a summary sheet with you to the final exam, you will turn it in together with the final.

There will be no makeups for the midterm exams. If you miss a midterm because of a documented medical emergency (and only for this reason), we will substitute the lower of your other midterm score and your final exam score for the missed midterm. If you miss a midterm exam for any other reason, you will receive a zero for that exam. If you miss the final exam because of a documented medical emergency, contact the instructor immediately to arrange a makeup exam. If you miss the final exam for any other reason, you will receive a failing grade in the class.

\(^1\)By you, of course.
Grading. The homework will count for 20% of your class score, each midterm for 20%, and the final exam for 40%. We expect to apply the following cutoffs in translating scores to letter grades: 85% and above, A; 76% and above, B; 67% and above, C; 56% and above, D. Participation—in lecture, in section, at office hours, and on Piazza—may affect your final grade at the margin.

You may request a regrade of a homework or midterm no later than two weeks after that homework or midterm is handed back. You must request regrades using Gradescope.

Homework preparation and submission. All written homework must be typeset and submitted as a PDF. Scanning a handwritten copy is not acceptable. We recommend, but do not require, that you use the LaTeX typesetting system.

All homework must be submitted using Gradescope. Homework submitted by other means—on paper, by e-mail, etc.—will not be accepted.

Late policy. With homework due weekly, getting behind on the homework deadlines is strongly discouraged. Accordingly, homework due dates will be strictly enforced: No homework submitted after the due date will be accepted for any reason.

Policy on academic accommodations. Per UCSD policy on academic accommodations (see https://senate.ucsd.edu/Operating-Procedures/Senate-Manual/Appendices/3), any requests for accommodations must be presented to the instructor and to the CSE department student-affairs staff within the first two weeks of instruction (that is, by Monday, January 18th). Accommodations cannot be made retroactively. All requests must be accompanied by a letter of certification and accommodation recommendation from the Office for Students with Disabilities.

Collaboration policy. You may discuss the homework with anyone in the class. You must then write up the solutions entirely on your own. You must list the name of everyone in the class with whom you discussed the homework in your homework writeup.2

You must not discuss the homework with anyone outside of class. You must not discuss the course material more generally with anyone outside of class without first getting permission from the course staff.

If you received permission from the course staff to refer to any books or online resources beyond the ones assigned listed under “Book and Internet use policy,” below, you must cite these sources in your homework writeup.

No collaboration whatsoever is allowed on the midterms or the final exam.

If you are unsure about what constitutes allowed collaboration, ask the course staff!

Book and Internet use policy. You may consult any edition of Sipser’s Introduction to the Theory of Computation. You may also, if you wish, consult any edition of Hopcroft, Motwani, and Ullman’s Introduction to Automata Theory, Languages, and Computation, though note that their notation may differ from Sipser’s.

You must not consult the solutions manual for Sipser or for Hopcroft-Motwani-Ullman. You must not consult any other book on automata or computability theory without first getting permission from the course staff.

You can and should use our CSE 105 Piazza forum to ask for help on the homework. You must not post to any forum elsewhere, including Stack Exchange or Facebook groups.

You must not consult any book or Internet resource on automata or computability theory without first getting permission from the course staff. You must note any such resources you consulted on your homework submissions.

You must not seek out solutions to specific assigned questions on the Internet, from automata courses offered at other universities, or from automata courses offered in previous quarters at UCSD.

If you are unsure about what constitutes allowed use of outside resources, ask the course staff!

2Note that we expect that “discussed with” is a symmetric relation.
Posting of solutions. You must not post online or otherwise distribute to others your solutions to home-
work or the exams in this course. This prohibition applies both during and after the quarter. This prohibition
specifically covers posting any homework or programming assignments to GitHub or similar sites except in
a private repository.

Students violating this policy will be subjected to the academic integrity disciplinary process.

Academic integrity. Academic integrity at UCSD is governed by the Policy on Integrity of Scholarship,
https://senate.ucsd.edu/Operating-Procedures/Senate-Manual/appendices/2. Allegations of aca-
demic misconduct are handled by the Academic Integrity Office, https://academicintegrity.ucsd.edu/

Cheating will not be tolerated, and any student who engages in forbidden conduct will be subjected to
the disciplinary process. The course penalty assessed for any cheating in CSE 105 is a failing course grade.
Cheaters may additionally be subject to administrative sanctions.

How to do well in CSE 105. The following advice, reproduced (with slight adaptation) from Mihir
Bellare’s CSE 107 syllabus (https://cseweb.ucsd.edu/~mihir/cse107/outline.pdf) applies just as well
to CSE 105.

Some students operate in a mode I call random access. You look at the homework (perhaps
just before it is due), see that you don’t know how to do it, then scan through the slides to see if
you can spot some example that looks similar, and try to use that. If that fails, you might ask
for help, saying you do not know how to do the homework.

This random access mode of operation is not likely to work well. Here’s the alternative, which
I call sequential access. There is a homework due. Ignore it. Instead, read the slides for the
chapter in question, sequentially, beginning to end, and make sure you understand everything
there. If you don’t, ask for help. Once you have understood everything, do the homework. It
will feel a lot easier.

What’s the difference? If you look at the homework and try to map back to the material, your
mapping will be imperfect at best. The understanding needed may not be the obvious one. And
an example cannot be understood in isolation. In the sequential mode, you aim to understand
the material as a coherent whole. It pays off. […]

Do make use of instructor and TA office hours to ask questions. But here’s one lesson. The
students who do well are ones who ask questions about the slides and lecture material, not
about the homework. If you have trouble with homework, trace it back to something you don’t
understand in the slides, and ask about the latter.

If you feel that you understand lecture material and the slides but can’t do the homework,
you have created a contradiction. If you can’t do the homework, then, by definition, you do
not understand lecture and slide material. Adopting the attitude that you do understand but
cannot do the homework is unproductive. It makes it harder for you to help yourself, and makes
it harder for us to help you. Instead, if you can’t do a homework, draw the conclusion that you
actually don’t understand the material, even if you think you did. This is better because now
you know what you have to do and where you can get help.