

CS/Math 345

Theory of Computation

- Schedule & Location:** MWF 2:15 – 3:45 Room: Sharpless 430 (MW) / Hilles 11 (F)
- Contact information:** *Steven Lindell* Office: Link 308
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- Consultation hours:** MW 1:00-2:00, and by appointment.
- Textbook:** *Automata and Formal Languages: An Introduction*, by Dean Kelley © 1995.
- Prerequisites:** Discrete Mathematics 231 (or instructor permission).
- Course Description:** Formal languages and automata theory: finite-state automata, regular expressions, context-free grammars, pushdown automata, Turing machines, recursively enumerable languages, undecidability, models of computation, and elements of complexity theory.
- Homework:** Weekly exercises will be a combination of easier observations, moderate problems, and more difficult proofs. No unexcused late homework will be accepted, but your lowest assignment will be dropped. Aside from attending lecture, doing the homework exercises conscientiously is the most important factor for success in this course. You must show your work to receive credit, whether your answer is correct or not. Many hints and solutions will be provided, and extra credit may be awarded for harder problems (marked *).
- Problem section:** Attendance is required at the once weekly Friday discussion section where we will go over solutions and provide approaches for the homework problems.
- Midterms:** Two take-home examinations, the first covering through regular languages, and the second through context-free languages. Students who have not completed a sufficient amount of homework may not be ready to take the exams.
- Final:** A take-home comprehensive examination.
- Grading:**
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|----------------------|-----|---|
| <i>Participation</i> | 10% | (during lectures and and discussion sections) |
| <i>Homework</i> | 20% | (ten assignments) |
| <i>Midterms</i> | 40% | (two exams) |
| <i>Final</i> | 30% | (cumulative) |
- Rules and regulations:** Although everything turned in for a grade must be your own work, collaboration on problems is strongly encouraged (especially working in groups). *Ideas* on how to solve homework problems may be exchanged (orally, or at a board), but not specific detailed solutions (written on paper). Just acknowledge your collaborators on your assignment.
- Special Circumstances:** Students who think they may need accommodations in this course because of the impact of a disability are encouraged to meet with me privately early in the semester, and should also contact the Office of Disabilities Services to verify their eligibility for reasonable accommodations as soon as possible.

Syllabus

Date	Topic	Assignment
1/18	Review of Discrete Mathematics	Chapter 0
1/20	"	"
1/23	Alphabets & Languages	Chapter 1
1/25	"	Section 2.1
1/27	<i>Practice problems for #1</i>	<i>Homework #0</i>
1/30	Regular expressions	Section 2.2
2/1	Deterministic finite automata	2.3-2.4
2/3	<i>Solutions #0; Practice #2</i>	<i>Homework #1</i>
2/6	Nondeterminism, NFA \rightarrow DFA	Sections 2.5-2.6
2/8	ϵ -moves	Sections 2.6-2.7
2/10	<i>Solutions #1; Practice #3</i>	<i>Homework #2</i>
2/13	Arden's lemma	Section 2.8
2/15	Pumping lemma	Section 2.9
2/17	<i>Solutions #2; Practice #4</i>	<i>Homework #3</i>
2/20	Context-free grammars	Sections 3.3-3.4
2/22	Simplification	Section 3.5
2/24	<i>Solutions #3; Practice #5</i>	<i>Homework #4</i>
2/27	Normal forms	Sections 3.5, 3.9
3/1	Pushdown store automata, CFG \rightarrow PDA	Sections 3.7, 3.8
3/3	<i>Solutions #4; Review for midterm</i>	<i>Homework #5</i>
3/6-3/10	SPRING BREAK	
3/13	PDA \rightarrow CFG	Section 3.8
3/17	Properties and Pumping lemma	Section 3.6
3/19	<i>Solutions #5; Practice #6</i>	<i>First midterm</i>
3/20	Decision and CYK algorithms	Section 3.6
3/22	Turing machines	Sections 4.1-4.2
3/24	<i>Discuss midterm; Practice #7</i>	<i>Homework #6</i>
3/27	Nondeterminism	Section 4.4
3/29	Closure properties, Generators and Enumerators	Section 5.3
3/31	<i>Solutions #6; Practice #8</i>	<i>Homework #7</i>
4/3	Computable functions /Phrase structure grammars	Section 5.4
4/5	TM \leftrightarrow PSG	Section 5.4
4/7	<i>Solutions #7; Review for midterm</i>	<i>Homework #8</i>
4/10	Universality	Section 4.5
4/12	Unsolvability	Section 6.1
4/14	<i>Solutions #8; Practice #9</i>	<i>Second midterm</i>
4/17	Time and Space complexity	Sections 7.1, 7.2
4/19	Complexity classes	Section 7.3
4/20	<i>Discuss midterm; Practice #10</i>	<i>Homework #9</i>
4/23	Reductions, Completeness	
4/25	Open problems; Review	
4/27	<i>Solutions #9; Solutions #10; Review for final</i>	<i>Homework #10</i>
5/6	End of exam period for seniors	Final Exam
5/12	End of exam period for underclassmen	Final Exam