Course Syllabus: CS 150: The Theory of Automata and Formal Languages
Spring, 2019

Course Description: The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, *e.g.* compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.

Course format: The course consists of three 50-minute lectures and a one-hour discussion session per week. The discussion session starts in the first full week of the quarter (*i.e.*, April 1). Each discussion session will be lead by a TA and will be used primarily to enforce concepts and techniques learned in class.

Prerequisite: CS 14 and CS/MATH 111. The students are expected to have a strong background in the fundamentals of discrete mathematics (symbolic logic, set, induction, number theory, summation, series, combinatorics, graph, recursion, basic proof techniques, etc.), algorithms and data structures. Some knowledge of programming languages, programming, and computer architecture will be helpful.

Instructor: Tao Jiang, WCH 336, phone: 827-2991, email: `jiangATcs.ucr.edu`. Office Hours: MW 4-5pm.

Teaching Assistants: All office hours are held in WCH 110.

Dis 021	Tu. 6:10 - 7pm	CHASS INTS 1134	Hao Chen	hao.chen001ATucr.edu	TBA
Dis 022	Th. 11:10 - 12pm	Skye 170	Hao Chen	hao.chen001ATucr.edu	TBA
Reader:			TBA	tbaATucr.edu	TBA

UCR Academic Resources Center (ARC): 156 Surge. See `www.arc.ucr.edu`.

Textbook: J. Hopcroft, R. Motwani, and J. Ullman. *Introduction to Automata Theory, Languages, and Computation*, 3rd edition, 2007, Pearson/Addison-Wesley.

Lecture Notes: Copies of slides used in lectures are available on the class homepage `www.cs.ucr.edu/~jiang/150-homepage.html` in the PDF format.

Reference Books (on reserve at the science library):
(1) P. Linz. *Introduction to Formal Languages and Automata*, 6th edition, 2017 (or 5th or 4th edition), Jones and Barlett; and
(2) Michael Sipser, *Introduction to the Theory of Computation*, 3rd edition (or 1st edition), 2013, Cengage Learning.

Grading:

5 homework assignments (all paper and pencil) — 25%
Midterm test I (in class, 50 minutes, May 3) — 15%
Midterm test II (in class, 50 minutes, May 24) — 15%
Final examination (June 13, 7:10-10:00pm) — 45%

Reading assignment: You are expected to review, before and after each class, the material to be covered in the class. A reference to the chapters of the text and major reference books that will be covered in lectures can be found in the *tentative timetable* below.

Assignment Policy:

1. All assignments will be handed out in class and/or posted on the class homepage `www.cs.ucr.edu/~jiang/150-homepage.html`

2. You have roughly one and half weeks for each homework assignment.

3. Submit your homework assignments to Prof. Jiang at least 5 minutes before the lecture on the due date begins. Make sure to put the assignment in the pile assigned to your discussion section, and always include your full name, ID, *discussion section number*, and the assignment number.

4. Write legibly. What cannot be read will not be graded.

5. No late assignments will be accepted.

Academic dishonesty: Many students find it helpful to consult their peers while doing assignments. This practice is legitimate and to be expected. However, it is not acceptable practice to pool thoughts and produce common answers. To avoid this situation, it is suggested that students not write anything down during such talks, but keep mental notes for later development of their own. Major occurrences of academic dishonesty, such as the submission of work that is not the student's own, will be dealt with according to the UCR'policies on academic dishonesty that can be found at webpage `http://conduct.ucr.edu/policies/academicintegrity.html`. Students who allow their files or assignments to be copied are as guilty of academic dishonesty as those who copy and will be treated accordingly. Each student is responsible for taking reasonable precautions to ensure that his/her work is not available for unauthorized use.

Copying solutions from the Internet or books or any other public sources without explicit citations is prohibited!

Table 1: Tentative Timetable

Week of	Topic	Chapters of	
		[HMU]	[Linz]
Apr. 1	basic concepts of finite automata and languages	1,2	1,2
	deterministic finite automaton, nondeterminism		
Apr. 8$*$	equivalence between DFA, NFA and ϵ-NFA	2,3	2,3
	regular expression and equivalence to FA		
Apr. 15$*$	algebraic laws for regular expressions	3	3
	pumping lemma and applications	4	4
Apr. 22	properties of regular languages	4	4
	minimization of automata and applications	4	2
Apr. 29$*$	context-free grammars and languages	5	5
	parsing (or derivation) and parse trees	5	5
	midterm I on May 3		
May 6	ambiguity of grammar and language	5	5
	pushdown automaton (PDA)	6	7
May 13 $*$	various forms of PDA	6	7
	equivalence between CFG and PDA	6	7
May 20 $*$	Chmosky normal form of CFG	7	6
	midterm II on May 24		
May 27	pumping lemma, properties of CFLs	7	8
June 3	Turing machines and (un)decidability	8	9,12

Legend: $*$ denotes the handing out of homeworks.

Class Mailing List: Please subscribe to the class mailing through the class homepage ASAP and remember to confirm the subscription.