CS 154: Formal Languages and Computability, Spring 2014

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[Dept. of Computer Science](#)
[San Jose State University](#)

Office Hours:
Monday & Wednesday
1615 - 1630 DH450
1920 - 1930 DH450
2045 - 2120 DH450

Course Goal and Description

Goal: To introduce students to the basic concepts of theoretical computer science, and to show them that many of the origins of these questions came from some very practical considerations.
Topics covered will include regular and context-free grammars, finite automata, minimization, regular expressions, pumping lemmas, closure properties, nonequivalence of deterministic and non-deterministic PDA's, Turing machines, and recursive, recursively enumerable and undecidable languages.

Prerequisite Courses

You must show me that your prerequisite courses have been satisfied**.** Further, I will not give out any add codes without first seeing prerequisite proof. You should show me grades for CS46B, and Math42, or their equivalents on a departmental course equivalence form. You must have a C- or better in each course. Students hoping for an exception **must** discuss their situation with me. CS46A is implicitly required, because it is a prerequisite for CS46B. Prerequisite courses and relevant topics covered:
CS46B: Recursion, Big-O notation.
Math42: Sets, logic, proofs, induction, combinatorics, and equivalence classes.

Textbooks

Required:
An Introduction to Formal Languages and Automata, Peter Linz
Publication Date: February 14, 2011 | ISBN-10: 144961552X | ISBN-13: 978-1449615529 | Edition: 5

Other Recommended Reference:
Introduction to Automata Theory, Languages, and Computation, Hopcroft, Motwani and Ullman.
Publication Date: **July 9, 2006** | ISBN-10: **0321455363** | ISBN-13: **978-0321455369** |
Edition: **3**

Introduction to the Theory of Computation, Michael Sipser
Publication Date: June 27, 2012 | **ISBN-10:** 113318779X | **ISBN-13:** 978-1133187790 |
Edition: 3

Introduction to Languages and the Theory of Computation, John Martin
Publication Date: February 2, 2010 | **ISBN-10:** 0073191469 | **ISBN-13:** 978-0073191461 |
Edition: 4

Course Objectives

- To teach students how to construct and use regular expressions and finite automata.
- To teach students how to construct and use context-free grammars and pushdown automata.
- To teach students how to construct and use simple Turing machines.
- To introduce students to the properties of various automata and languages.
- To teach students how to use pumping lemmas to show non-membership in a language category.
- To teach students how to turn a non-deterministic finite automaton into a deterministic one.
- To teach students how to minimize a deterministic finite automaton.
- To acquaint students with closure properties of languages, and state minimization of automata.

Student Learning Outcomes

Upon successful completion of this course, students should be able to:

- Write a grammar for a language described otherwise. Construct deterministic and non-deterministic machines for various languages.
- Describe a language in terms of a regular expression.
- Find a regular expression for a language described by a finite automaton and conversely. Construct a deterministic finite automaton from a non-deterministic one.
- Minimize a deterministic automaton.
- Be able to use a pumping lemma to show that some languages are not regular and/or not context-free
- Use closure properties to simplify proofs of non-regularity of languages.
- Be able to construct a pushdown automaton accepting a given language.
- Construct a Turing machine accepting some simple languages.

- State in precise mathematical terms what is meant by undecidablity of the Halting Problem, and be able to show the undecidability of simple extensions of the Halting Problem, using the reduction technique.

Course Requirements

Participations, Quizzes   5%
Homework's   5%
Mini-Exam   45%
Final Exam   45%

The separate web pages entitled Class Administration, Schedule, Assignments, are part of the official greensheet for this course, and you are responsible for knowing their contents.

Quizzes: Unannounced quizzes may be given during class. These will generally be problems from the homework, or very similar to something assigned on the homework, or something which was very plainly covered in the assigned reading.

Laptops
You will be required to bring a wireless laptop to all (!) classes and exams.

CS154 Mini-Exams Schedule – Spring 2014

Mini-Exam #	Mini Examination Day	Mini Examination Time
1	Monday, February 10	23 minutes
2	Monday, February 24	23 minutes
3	Monday, March 10	23 minutes
4	Monday, April 7	23 minutes
5	Monday, April 21	23 minutes
6	Monday, May 5	23 minutes

CS154 Final Exam Schedule – Spring 2014

Regular Class Start Time	Final Examination Day	Final Examination Time
1500	Tuesday, May 20	1215 – 1430
1630	Monday, May 19	1445 – 1700
1800	Monday, May 19	1715 - 1930
1930	Monday, May 19	1945 - 2200

http://info.sjsu.edu/web-dbgen/narr/static/catalog/final-exam-schedule-spring.html

Class Schedule & Notes

Meeting #	Day	Date	Textbook (3e, 4e & 5e)	ppt #
1.	1/27	Introduction	1.2	class0.ppt
2.	1/29	Mathematical Preliminaries & Languages	1.1, 1.2	class1.ppt
3.	2/3	Finite Automata Finite Automata Minimization	2.1 2.3, 2.4	class2.ppt
4.	2/5	Nondeterministic Finite Automata	2.2	class3.ppt
5.	2/10	Continue Mini-Exam 1		
6.	2/12	Properties of Regular Languages Regular Expressions	4.1 3.1, 3.2	class4.ppt
7.	2/17	Regular Grammars	1.2, 3.3	class5.ppt
8.	2/19	Elementary Questions for Reg. Lang. Pumping Lemma for Regular Languages Pumping Lemma Examples	4.2 4.3	class6.ppt class7.ppt
9.	2/24	Continue Mini-Exam 2		
10.	2/26	Lex		
11.	2/29	Context-Free Languages	5	class8.ppt
12.	3/3	Simplifications of Context-Free Grammars & Normal Forms	6	class9.ppt
13.	3/5	Continue		
14.	3/10	Mini-Exam 3 Pushdown Automata	7.1	class10.ppt
15.	3/12	Pushdown Automata and Context-Free Lang.	7.2	class11.ppt
16.	3/17	Deterministic Pushdown Automata Properties of Context-Free Languages Yacc	7.3	class12.ppt
17.	3/19	Continue		
		Monday, March 24 - Friday, March 28 Spring Recess - no classes		
		Monday, March 31 Cesar Chavez Day - campus closed		
18.	4/2	Pumping Lemma for Context-Free Languages Pumping Lemma Examples	8.1, 8.2	class13.ppt class14.ppt
19.	4/7	Continue Mini-Exam 4		
20.	4/9	Turing Machines	9.1, 9.2	class15.ppt
21.	4/14	Turing Thesis Variations of Turing Machines	9.3 10.1-10.3	class16.ppt
22.	4/16	Universal Turing Machines	10.4	class17.ppt

23.	4/21	Recursive and Recursively Enumerable Languages Mini-Exam 5	11.1	class18.ppt
24.	4/23	Continue		
25.	4/28	Chomsky's Hierarchy Decidability	10.5, 1.4 12.1	class19.ppt
26.	4/30	Decidability	12.1-12.2	class20.ppt
27.	5/5	The Post-Correspondence Problem Mini-Exam 6	12.3 - 12.4	class21.ppt
28.	5/7	Time Complexity	14	class22.ppt
29.	5/12	NP-completeness Review	14 (continued)	class23.ppt

Calender – Spring 2014

http://www.sjsu.edu/registrar/calendar/2142

Day	Note
Thursday, January 23	First day of instruction for Spring semester
Tuesday, February 4	Last day to drop a class without a "W" grade for Spring
Tuesday, February 11	Last day to add for Spring
Monday, March 24 - Friday, March 28	Spring Recess - no classes
Monday, March 31	Cesar Chavez Day - campus closed
Tuesday, April 22	Last Day to withdraw for Spring
Tuesday, May 13	Last day of instruction for Spring
Wednesday, May 14	Faculty web access for Spring's grade posting opens at 8:00am
Thursday, May 15 - Wednesday, May 21	Spring's Final Exams (Exam Schedule)
Saturday, May 24	Commencement
Monday, May 26	Memorial Day - campus closed
Tuesday, May 27	Spring 2014 grades due from Faculty (Preliminary Deadline)
Wednesday, May 28	Initial Spring 2014 grades viewable on MySJSU
Friday, May 30	Deadline to clear Spring 2013 Incomplete grades Spring 2014 grades due from Faculty (Final Deadline) Faculty web access for grade posting closes at 11:59pm

Grading Policy

You will receive a letter grade for each of the exams, the finals, the total performance, and the total participation in labs/discussions/quizzes. Letter grades are obtained by adding and curving the numeric scores. When determining a curve, the cutoffs are guided by the university definitions for letter grades:

- A+, A, A- excellent
- B+, B, B- above average
- C+, C, C- average
- D+, D, D- below average
- F failure

Letter grades are converted into number grades, as specified, except that an A+ is counted as 4.3, and weighted with the percentages given in the Course Requirements section. The weighted average is rounded towards the nearest letter grade, which is your class grade.

Class Participation: Class participation and feedback are very important to keep the course interesting.

Homework: Homework will be regularly assigned, and will include reading assignments, written or electronically submitted problem assignments (which may involve programming for various automata models).

Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Furthermore, unannounced quizzes may be given during any class meeting (other than the ones with scheduled exams).

Reading assignments: Reading assignments will regularly be for the next class. Ideally, students will do the reading to get an idea of what the class will be about, then attend class, and then re-read the material with intuition gained from class. At the very least, assignments should be read before or after class. Due to possible unannounced quizzes on the reading, reading the material before class is preferred for cases when there is only time for one reading.

Class slides: Class slides will be posted after the class; this is to maximize your class participation and to keep the course interesting.

Dept. of Computer Science - Additional Green Sheet Information Required by the University

Academic Integrity:

Your own commitment to learning, as evidenced by your enrollment at SJSU, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development. The policy on academic integrity can be found at http://sa.sjsu.edu/judicial_affairs/.

Further Information:

- If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations register with the SJSU Disability Resource Center to establish a record of their disability.
- Please familiarize yourself with SJSU policies and procedures:
    - http://info.sjsu.edu/static/soc-spring/soc-spring.html
    - http://info.sjsu.edu/static/catalog/policies.html

    particularly the add/drop policy. It is your responsibility to know and observe these policies. However, if there is something about a policy that you don't understand, please feel free to ask! You can also find answers to many questions at the Academic Advising and Retention Services web site.

    For further greensheet information please see
    http://www.cs.sjsu.edu/greensheetinfo/index.html