CS/SE 154 Section 1
Formal Languages and Computability

GREEN SHEET
Spring Semester 2016

Department of Computer Science
San José State University
Instructor: Ron Mak

CS/SE 154-01 TuTh 1:30 – 2:45 PM DH 250

Office hours: TuTh: 4:30 – 5:30 PM
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Course catalog descriptions

"Finite automata, context-free languages, Turing machines, computability." *3 units*

Goals

Understand the fundamental capabilities and ultimate limitations of computation.
Appreciate the rich antecedents and fundamental theories of modern computing.

Learning outcomes

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

- LO1: Write a grammar for a language described otherwise.
- LO2: Construct deterministic and non-deterministic machines for various languages.
- LO3: Describe a language in terms of a regular expression.
- LO4: Find a regular expression for a language described by a finite automaton and conversely.
- LO5: Construct a deterministic finite automaton from a non-deterministic one.
- LO6: Minimize a deterministic automaton.
- LO7: Be able to use a pumping lemma to show that some languages are not regular and/or not context-free
- LO8: Use closure properties to simplify proofs of non-regularity of languages.
- LO9: Be able to construct a pushdown automaton accepting a given language.
- LO10: Construct a Turing machine accepting some simple languages.

Course learning outcomes

- CLO1: Construct and use regular expressions and finite automata.
- CLO2: Construct and use context-free grammars and pushdown automata.
- CLO3: Construct and use simple Turing machines.
- CLO4: Describe the properties of various automata and languages.
- CLO5: Use pumping lemmas to show non-membership in a language category.
- CLO6: Turn a non-deterministic finite automaton into a deterministic one.
- CLO7: Minimize a deterministic finite automaton.
- CLO8: Describe closure properties of languages, and state minimization of automata.
- CLO9: Describe decidability and classify basic problems as decidable or not.

Prerequisites

CS 46B	Introduction to data structures	*grade C- or better*
Math 42	Discrete mathematics	*grade C- or better*

The Department of Computer Science strictly enforces prerequisites. A student not meeting any prerequisites must fill out an Add Form provided by the instructor at the beginning of the semester to explain his or her justifications to take the course, and it will be the instructor's and the department's decision whether or not to allow the student to enroll.

Required text

Title:	**An Introduction to Formal Languages and Automata, 5th edition**
Author:	Peter Linz
Publisher:	Jones & Bartlett Learning, 2012
ISBN-13:	978-1-4496-1552-9

Software to install

Download and install the following software packages:

- JFLAP (Java Formal Language and Automata Package): http://www.jflap.org
- JavaCC (Java Compiler Compiler): https://javacc.java.net

There may be other software packages announced during the semester.

Schedule

Subject to change with fair notice. Chapter readings are from the textbook.

Week	Dates	Topics and activities	Chapters
1	Jan 28	Introduction	1
2	Feb 2, 4	Finite automata (FA) Deterministic FA Nondeterministic FA	2
3	Feb 9, 11	Regular languages Regular grammars	3
4	Feb 16, 18	Properties of regular grammars Pumping lemma for regular languages ***Midterm exam #1 Thursday, February 18***	4
5	Feb 23, 25	Context-free languages	5
6	Mar 1, 3	Simplification of context-free grammars Normal forms	6
7	Mar 8, 10	Pushdown automata (PDA) Pushdown automata and context-free languages Deterministic and nondeterministic PDA	7
8	Mar 15, 17	Pumping lemma for context-free languages Pumping lemma for linear languages	8
9	Mar 22, 24	Closure properties and decision algorithms Decidability properties of context-free languages ***Midterm exam #2 Thursday, May 24***	8
	Mar 28 Apr 1	Spring break	
10	Apr 5, 7	Alan Turing The standard Turing machine	9
11	Apr 12, 14	Other Turing machine models Nondeterministic Turing machines A universal Turing machine	10
12	Apr 19, 21	Hierarchy of formal languages and automata Context-sensitive grammars and languages The Chomsky hierarchy	11
13	Apr 26, 28	Problems not solvable by Turing machines Computability and decidability The halting problem The Post correspondence problem	12
14	May 3, 5	Recursive functions Post systems Rewriting systems	13
15	May 10, 12	Computational complexity Complexity classes P and NP Some NP problems NP-completeness	14
	May 19	***Final exam Thursday, May 19*** 12:15 – 2:30 PM, DH 250	

Course requirements and assignments

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at http://www.sjsu.edu/senate/docs/S12-3.pdf.

NOTE that University policy F69-24 at http://www.sjsu.edu/senate/docs/F69-24.pdf states that "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. Attendance per se shall not be used as a criterion for grading."

Class grade

Your individual class grade will be weighted as follows:

50%	Assignments
30%	Midterm exams (2)
20%	Final exam

Assignments will be problem sets and written Java programs. Problem sets will be individual work. Some collaboration might be allowed for programming assignments.

Each assignment and exam will be scored (given points) but not assigned a letter grade. The mean score and standard deviation will be announced after each assignment and exam. Final individual class grades will be assigned based on the class curve.

Note that "All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades." See University Policy F13-1 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

There can be no make-up midterm examination unless there is a documented medical emergency. Make-up final examinations are available only under conditions dictated by University regulations.

Classroom protocol

It is very important for each student to attend classes and to participate. Cell phones in silent mode, please.

University policies

General expectations, rights and responsibilities of the student

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU's policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. See University Policy S90–5 at http://www.sjsu.edu/senate/docs/S90-5.pdf. More detailed information on a variety of related topics is available in the SJSU catalog, at http://info.sjsu.edu/web-dbgen/narr/catalog/rec-12234.12506.html. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

Dropping and adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at http://info.sjsu.edu/static/catalog/policies.html. Add/drop deadlines can be found on the current academic year calendars document on the Academic Calendars webpage at http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop Policy is available at http://www.sjsu.edu/aars/policies/latedrops/policy/**.** Students should be aware of the current deadlines and penalties for dropping classes.

Information about the latest changes and news is available at the Advising Hub at http://www.sjsu.edu/advising/.

Consent for recording of class and public sharing of instructor material

University Policy S12-7, http://www.sjsu.edu/senate/docs/S12-7.pdf, requires students to obtain instructor's permission to record the course and the following items to be included in the syllabus:

- "Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material."
    - It is suggested that the greensheet include the instructor's process for granting permission, whether in writing or orally and whether for the whole semester or on a class by class basis.
    - In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- "Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without instructor consent."

Academic integrity

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy S07-2 at http://www.sjsu.edu/senate/docs/S07-2.pdf 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 Student Conduct and Ethical Development website is available at http://www.sjsu.edu/studentconduct/.

Campus policy in compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make 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 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the Accessible Education Center (AEC) at http://www.sjsu.edu/aec to establish a record of their disability.