SJSU SAN JOSÉ STATE UNIVERSITY

College of Science · Computer Science

Formal Languages and Computability Section 01

CS 154

Fall 2023 3 Unit(s) 08/21/2023 to 12/06/2023 Modified 08/20/2023

Course Description

Finite automata, context-free languages, Turing machines, computability.

Contact Information

Instructor(s):	Dr. Chung-Wen (Albert) Tsao
Email:	chung-wen.tsao@sjsu.edu
Class Days/Time:	M/W 10:30 – 11:45 am
Classroom:	Science Building 311 Live lectures will be recorded and available on the same day.
Office Hours:	• M/W 3 – 4 pm in office MH411 • M/T/W/Th/F 3 – 4 pm on ZOOM athttps://sjsu.zoom.us/j/86250414128 (https://sjsu.zoom.us/j/86250414128)
Office Location:	MH 411
Prerequisites:	Math 42 Discrete Mathematics Grade C- or better CS 46B Introduction to Data Structure Grade C- or better

Course Description and Requisites

Finite automata, context-free languages, Turing machines, computability.

Prerequisite(s): MATH 42 or MATH 42X and CS 46B (with a grade of "C-" or better in each); Allowed Declared Majors: Computer Science, Applied and Computational Mathematics, or Software Engineering. Or instructor consent.

Letter Graded

Classroom Protocols

- Students may be dropped from the class by the instructor for either one of the following reasons:
  - absence for 1st day of class without informing you before 2nd day of class

    - lack of prerequisites.
- Do not ask for special treatment. The rules for this course apply to everyone equally.
- Cheating will not be tolerable; a ZERO will be given to any cheated assignment/exams, and it will be reported to the Department and the University.
- Do NOT share/post online any course materials, PPT slides, or homework solutions.
- Use of electronic devices during exams is NOT allowed unless stated otherwise.
- You are required to check Canvas for reading/assignments.
- The information on this syllabus is subject to change; changes, if any, will be clearly explained in class, and it is your responsibility to become aware of them.
- Once the class starts, use Canvas Inbox to email me for a faster response. I check the Canvas Inbox emails much more often than my school emails.

Program Information

Diversity Statement - At SJSU, it is important to create a safe learning environment where we can explore, learn, and grow together. We strive to build a diverse, equitable, inclusive culture that values, encourages, and supports students from all backgrounds and experiences.

Course Learning Outcomes (CLOs)

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

1. Understand the high-level building blocks of computer science.
2. Analyze and design deterministic and non-deterministic machines for various formal languages.
3. Describe regular languages in terms of regular expressions and vice versa.
4. Analyze and design pushdown automata for some formal languages.
5. Analyze and design Turing machines for some formal languages.
6. Describe the properties of various automata and formal languages.
7. Construct different type of grammars (regular, context-free, etc.) for some formal languages.
8. Use the pumping lemma to prove that some formal languages are not regular.
9. Describe decidability and classify problems as decidable or undecidable.
10. Describe computability and complexity of problems.
11. Categorize languages based on their complexities.
12. Be familiar with some open-questions in computer science.

Course Materials

Introduction to the Theory of Computation

Author: Michael Sipser.
Publisher: Cengage Learning
Edition: 3rd Edition
ISBN: 113318779X

ISBN-13 978-1133187790

Limits of Computation: An Introduction to the Undecidable and the Intractable

Author: Edna E. Reiter, Clayton Matthew Johnson.
Publisher: Routledge
Edition: 1st Edition
ISBN: ISBN-10 1439882061 ISBN-13 978-1439882061
Optional

Course Requirements and Assignments

There will be about *eight* assignments in total.

- No late assignments will be accepted without advanced arrangement with the instructor.
- Students are allowed (and actively encouraged) to form study groups.
- You may discuss solutions but you MUST write up the answers independently.
- If you use a website or reference book, you must cite it.
- If there are multiple similar submissions not exhibiting independent thought, or with words obviously lifted from a book or website without citations, all such submissions will receive scores of 0.

Quizes

We will have pop quizzes to check your understanding of the current lecture material. The quizzes are usually explained in class and due on the end of the lecture day. The purpose of pop quizzes is to encourage you to study and review the concepts and materials we discussed in the lecture.

Exams

There will be two midterm examinations, and a cumulative final exam.

- Exams typically include an in-class closed-book quiz and a take-home open-book written test.
- Exams may NOT be taken before or after the scheduled time for any reason. All the students need to attend synchronously.
- No make-up exams for anyone except for the medical emergency with the official medical proof.
- Use of electronic devices during exams is NOT allowed unless stated otherwise.
- All exams will remain with the instructor.

Grading Information

Final grades will not be adjusted in any way - so an 89.99% is still a B+. No incomplete grades will be given. The grading scale is as follows.

Grading Scale					
A+	97%	A	93%	A-	90%
B+	87%	B	83%	B-	80%
C+	77%	C	73%	C-	70%
D+	67%	D	63%	D-	60%
F	below 60.0%				

Breakdown

- Pop Quizzes (10%)
- Midterm exam 1 (20%)
- Midterm exam 2 (20%)

- Homework (25%)
- Final exam (25%)

University Policies

Per University Policy S16-9 (PDF) (http://www.sjsu.edu/senate/docs/S16-9.pdf), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on the Syllabus Information (https://www.sjsu.edu/curriculum/courses/syllabus-info.php) web page. Make sure to visit this page to review and be aware of these university policies and resources.

Course Schedule

Week	Topics	Chapter	Assignments
1	Syllabus, Introduction, Math Preliminaries	0	
2	Finite Automata, DFA, NFA	1	HW #1 Assigned
3	Regular Expressions, Regular Languages	1	
4	Pumping Lemma	1	HW #2 Assigned
5	Context-free Grammars	0-1	
6	Push-down Automata, Pumping Lemma,	2	HW #3 Assigned
7	Midterm Exam I	2	
8	Turing machines	2	HW #4 Assigned
9	Other Models of Turing machines	3	
10	Nondeterministic Turing machines	3	HW #5 Assigned
11	Decidable Languages	0-3	
12	Review, Midterm II	3	HW #6 Assigned
13	Decidability, Undecidability	4	HW #7 Assigned
14	Reducibility	5	HW #8 Assigned
15	Review	*5*	
Final Exam	Tuesday, December 12 9:45 AM-12:00 PM)	0-5	