CS 154-03: Formal Languages and Computability Syllabus

San José State University, Fall 2020

Instructor Information

Instructor	Email	Zoom Office Hours
Yan Chen	yan.chen01@sjsu.edu	TR 14:45 – 15:45 or By Appointment

General Information

TR 13:30 – 14:45 @ https://sjsu.zoom.us/j/99334087426

Catalog Description

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. (Permission codes will be provided to the requesters who fulfill the prerequisites based on the priorities stated in University Policy F17-4. More information will be given on the first day of the class.)

Course Format

Hybrid-CS mode: live lectures will be conducted at the set times/days via Zoom. Also, those lecture sessions will be recorded and posted on Canvas. Office hours will also be held via Zoom (same link as lecture). Further details regarding office hours will be given on the first day of the class.

Canvas will be used for class activities including posting and submitting assignments as well as exams that require lockdown browser (built-in on Canvas).

Course Learning Outcomes (CLO)

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

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

Course Materials

There is no required text for this course other than all the materials (lecture notes, homework, etc.) on Canvas. You are responsible for regularly checking the Canvas course page for any updates, including its messaging system.

Further Readings

- Peter Linz, "An Introduction to Formal Languages and Automata," 5th edition, Jones & Bartlett Learning, ISBN-13: 978-1449615529
- The references at the end of each lecture note.

Course Requirements and Assignments

There will be weekly assignments (optional), a midterm (optional) and a final (mandatory). No high-level programming is required in this course.

Weekly Assignments

Assignments will be posted on Canvas every week, locked by passwords that are ONLY given in the lectures. They are optional, but points earned in those assignments will be extra points adding to the final score. See "Grading Information" for more details.

There will be two types of assignments (either one of below each week):

- Timed quizzes that are closed-all-materials and have 2 parts. The first part (multiple choice and short answer questions) requires a lockdown browser; the second part will be timed design problem(s) that require a file submission. You can start the quizzes any time before due, but each part must be finished in one sitting, within the time limit. They are cumulative with more focus on the material learned during that week.
- Design problems that are open notes with no time limit before due but more complex than those appear in timed quiz.

Midterm

The midterm will be held in class (see tentative schedule on page 5). It will be posted on Canvas as a timed quiz, with more questions but less time per problem than normal assignments. No Zoom meeting on the midterm day, but you need to finish each part during the required time frame. Exceptions may ONLY be given in cases of a verifiable emergency or for those who live in a different time zone where the exam time would be in the midnight or early morning. You can view the midterm as a checkpoint and a practice for the final.

Although weekly assignments and midterm are optional, they are highly recommended to practice what you learned in class and to enhance your score. University Policy S16-9 states that:

> *"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practice. Other course structures will have equivalent workload expectations as described in the syllabus."*

Final Examination

The final will be in the same format as the midterm and is cumulative. The date and time are fixed (Wednesday, December 9, 12:15-14:30 Pacific Time). Exceptions may ONLY be given in cases of a verifiable emergency or for those who live in a different time zone where the exam time would be in the midnight or early morning.

Final exam is mandatory as University policy S17-1 states:

> *"Faculty members are required to have a culminating activity for their courses, which can include a final examination, a final research paper or project, a final creative work or performance, a final portfolio of work, or other appropriate assignment."*

Grading Information

Final Points = Points from assignments + Participation point of the midterm + Score of the final exam

Points from assignments

For each assignment, points earned = percentage of assignment score * 2 + 0.2 with a maximum of 2 point.

For example, if you get 17/20 on one assignment, the points earned would be 0.85 * 2 + 0.2 = 1.9; if you get 19/20 on one assignment, it would be 2 points (maximum).

• Late homework: a penalty of 10% per day (on the assignment score).

Participation point of the midterm

1 point would be given if you finish the midterm with a score that is over 50%.

Final Exam

The total score of the final exam would be 100.

Grading scale

Grade	Points	Grade	Points	Grade	Points
A	Above 93.00	**B minus**	80.00 to 82.99	**D plus**	66.00 to 69.99
A minus	90.00 to 92.99	**C plus**	76.00 to 79.99	**D**	63.00 to 65.99
B plus	86.00 to 89.99	**C**	73.00 to 75.99	**D minus**	60.00 to 62.99
B	83.00 to 85,99	**C minus**	70.00 to 72.09	**F**	Below 59.99

• A+ will be given for those who receive over 95% for assignments, midterm, AND the final exam. If more than 1% of students meet these criteria, the top 1% of students will be given an A+.

• Grade near the borderlines may be rounded up depending upon your level and quality of participation in the discussions board on Canvas.

• The grade might be curved ONLY if the final grades of the class at the end of the semester are not normal.

Class Protocol

• Do NOT share any course material publicly (on Canvas, GitHub, etc.) without permission, including but not limited to lecture notes, lecture videos, passwords, homework/exam solutions, and class meeting links.

• No late homework questions (within 24 hours before due, excluding follow-ups) via email.

• For all homework and exams, only use the notations mentioned in the class. Wrong/different notation(s) will be considered as wrong answer(s).

• Instances of academic dishonesty will not be tolerated. Your own commitment to learning, as evidenced by your enrollment at San José State University and the University's Academic Integrity Policy, require you to be honest in all your academic course work. Cheating or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a reduction in final course grade (for assignments, 2/3 grade off every time except the first time; for the final, one grade off) and administrative sanctions by the University.

Important Dates

Date	Description
Aug. 20, Thursday	First day of instruction (for this class)
Aug. 31, Monday	Last day to drop without a W grade
Sep. 8, Tuesday	Last Day to Add Classes via MySJSU
Nov. 1, Sunday	Daylight saving time ends (at 2:00 AM Pacific Time)
Dec. 3, Thursday	Last day of instruction (for this class)
Dec. 9, Wednesday	Final Examination (for this class) 12:15 – 14:30 Pacific Time
Dec. 19, Saturday	Grades Viewable on MySJSU

Visit https://www.sjsu.edu/classes/calendar/2020-2021.php for the Academic Calendar.

University Policies

Per University Policy S16-9 available at 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 Syllabus Information web page available at http://www.sjsu.edu/gup/syllabusinfo. Viewing these policies and resources is highly recommended.

Course Schedule

This is a tentative schedule and is subject to change (except for the final exam) but with fair notice.

Lesson	Date	Topics
0	Thu, Aug 20	Syllabus
1	Tue, Aug 25	Mathematical preliminaries (part 1)
2	Thu, Aug 27	Mathematical preliminaries (part 2)
3	Tue, Sep 1	Formal Languages (part 1)
4	Thu, Sep 3	Formal Languages (part 2)
5	Tue, Sep 8	Deterministic finite automata (part 1); Finalizing enrollments;
6	Thu, Sep 10	Deterministic finite automata (part 2)
7	Tue, Sep 15	Deterministic finite automata (part 3)
8	Thu, Sep 17	Nondeterministic finite automata (part 1)
9	Tue, Sep 22	Nondeterministic finite automata (part 2)
10	Thu, Sep 24	Nondeterministic finite automata (part 3)
11	Tue, Sep 29	Regular languages (part 1)
12	Thu, Oct 1	Regular languages (part 2); Study guide for midterm
13	**Tue, Oct 6**	**Midterm**
14	Thu, Oct 8	Pushdown automata (part 1); Midterm solutions
15	Tue, Oct 13	Pushdown automata (part 2)
16	Thu, Oct 15	Turing machines (part 1)
17	Tue, Oct 20	Turing machines (part 2)
18	Thu, Oct 22	Other Models of Turing machines (part 1)
19	Tue, Oct 27	Other Models of Turing machines (part 2)
20	Thu, Oct 29	Regular expressions (part 1)
21	Tue, Nov 3	Regular expressions (part 2)
22	Thu, Nov 5	Grammars (part 1)
23	Tue, Nov 10	Grammars (part 2)
24	Thu, Nov 12	Grammars (part 3)
25	Tue, Nov 17	Non-regular languages (part 1)
26	Thu, Nov 19	Non-regular languages (part 2)
27	Tue, Nov 24	Introduction to computability (part 1)
28	Thu, Nov 26	Introduction to computability (part 2)
29	Tue, Dec 1	Introduction to complexity (part 1)
30	Thu, Dec 3	Introduction to complexity (part 2); Study guide for final
Final Exam	**Wed, Dec 9**	**12:15 – 14:30 Pacific Time**