# Formal Languages and Computability
## CS 154

Spring 2026   Section 01   In Person   3 Unit(s)   01/22/2026 to 05/11/2026   Modified 01/19/2026

# 👤 Contact Information

## Instructor: Ahmad Yazdankhah

**Email:** [ahmad.yazdankhah@sjsu.edu](mailto:ahmad.yazdankhah@sjsu.edu)
**Office:** Online

Course materials, including handouts, notes, assignment instructions, and more, are available on the Canvas Learning Management System at [https://sjsu.instructure.com](https://sjsu.instructure.com).

Students are responsible for checking Canvas regularly—at least once per day—to stay informed about assignments and due dates.

## Office Hours

TR 14:15 - 15:45
Online, by appointment

Please email me **at least 12 hours in advance** if you'd like to request an office hour.

For most questions, the **best and fastest way** to get help is by posting in the course **Discord**, where others can benefit from the discussion as well.

You can find the Discord link in **Canvas → Discussions → Course Discord**.

# 🖥️ 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 Majors: Computer Science or Applied and Computational Mathematics; or instructor consent.

Letter Graded

# ✳️ Classroom Protocols

## Consent for Recording of Class and Public Sharing of Instructor's Material

- Common courtesy and professional behavior require notifying individuals when you are recording them.
- You must obtain the instructor's **written permission** before making any audio or video recordings in this class.
- Any granted permission is strictly for **your personal study purposes**.
- All recordings are the **intellectual property of the instructor** and may not be reproduced, shared, or distributed without explicit written consent.

## In-Person Class Protocol

- Please arrive on time.
- Cell phones must be set to silent mode and kept in your pocket or backpack; they should not be used during lectures.
- Laptops should remain closed unless they are needed for a specific in-class activity or for note-taking.
- Activities such as instant messaging, emailing, texting, tweeting, or other similar distractions are strictly prohibited during class.
- While attendance is highly recommended, it is not mandatory, **except during exams**.

## Online Class Protocol

- All microphones will be automatically muted upon joining the Zoom meeting.
- If you have a question, you may unmute yourself and speak, or type your question in the chat.
- The chat will be private; the instructor will read questions aloud and respond.
- Cameras are not required during lectures but **are required during exams**. Please dress appropriately, following a *business casual* dress code.
- Attendance is highly recommended but not mandatory, **except during exams**.

# ⊞ 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 will 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 systems.
- Construct different types 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

This course does **not** require a textbook. All required materials will be provided in the lecture notes.

## Further Readings

1. **Peter Linz,** *An Introduction to Formal Languages and Automata*, 5th edition, Jones & Bartlett Learning, ISBN-13: 978-1449615529
2. References listed at the end of each lecture note.

# 📋 Course Requirements and Assignments

## Requirements

- A computer equipped with a **microphone and camera** is required for online activities, including some lectures, office hours, and online exams.

## Workload

Success in this course is based on the expectation that students will spend approximately **6–10 hours per week** on course-related work, including:

- Completing programming assignments
- Preparing for exams (quizzes, midterms, and the final exam)
- Working on the term project

# ✔️ Grading Information

- To encourage the good habit of reviewing course materials regularly, there will be a **weekly short quiz**.
- There will be **two midterm exams** and a **final exam**.
- To practice the covered material in a realistic software development context, the course includes a **term project** and several **individual assignments**.
- All examinations will cover material **from the beginning of the semester**.
- All examinations will be **closed-book and closed-notes**.
- **No makeup exams** will be given.
- To promote effective time management, **late submissions will incur a penalty of 20% of the total assignment score**, plus an additional **20%** for each subsequent 24-hour period.

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|---|---|
| Assignments | 10% |
| Term Project | 15% |
| Quizzes | 30% |
| Midterm #1 | 10% |
| Midterm #2 | 15% |
| Final | 20% |
| **Total** | **100%** |

## Nominal Grading Scale

| From | To | Grade |
|---|---|---|
| 97 | 100 | A plus |
| 93 | 96.99 | A |
| 90 | 92.99 | A minus |
| 87 | 89.99 | B plus |
| 83 | 86.99 | B |
| 80 | 82.99 | B minus |
| 77 | 79.99 | C plus |
| 73 | 76.99 | C |
| **70** | **72.99** | **C minus** |
| 67 | 69.99 | D plus |
| 63 | 66.99 | D |
| 60 | 62.99 | D minus |
| 0 | 59.99 | F |

# 🏛 University Policies

Per [University Policy S16-9 (PDF) (http://www.sjsu.edu/senate/docs/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)](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

Note: This is a **tentative schedule** and is subject to change but with fair notice.

| Day | Date | Lec # | Topics | Exams (Fridays) |
|---|---|---|---|---|
| 1 | 01/26 | 0 | Greensheet; A big picture of the course; | |
| 2 | 01/28 | 1 | Mathematical preliminaries (part 1); | Quiz 0 (Preparation) |
| 3 | 02/02 | 2 | Mathematical preliminaries (part 2); | |
| 4 | 02/04 | 3 | Formal Languages | Quiz 1 |
| 5 | 02/09 | 4 | Deterministic finite automata (part 1); | |
| 6 | 02/11 | 5 | Deterministic finite automata (part 2); | Quiz 2 |
| 7 | 02/16 | 6 | Deterministic finite automata (part 3); | |
| 8 | 02/18 | 7 | Nondeterministic finite automata (part 1); | Quiz 3 |
| 9 | 02/23 | 8 | Nondeterministic finite automata (part 2); | |
| 10 | 02/25 | 9 | Regular languages | Quiz 4 |

| Day | Date | Lec # | Topics | Exams (Fridays) |
|---|---|---|---|---|
| 11 | 03/02 | | Review, Study Guide, Q & A | |
| 12 | 03/04 | | Exam: Mid 1 | Mid 1 (aka Quiz +) |
| 13 | 03/09 | 10 | Pushdown automata (part 1); | |
| 14 | 03/11 | 11 | Pushdown automata (part 2); | Quiz 5 |
| 15 | 03/16 | 12 | Turing machines (part 1); | |
| 16 | 03/18 | 13 | Turing machines (part 2); | Quiz 6 |
| 17 | 03/23 | 14 | Other mode and models of Turing machines | |
| 18 | 03/25 | 15 | Regular expressions (part 1); | Quiz 7 |
| 19 | 03/30 | | Spring Break | |
| 20 | 04/01 | | Spring Break | |
| 21 | 04/06 | 16 | Regular expressions (part 2); | |
| 22 | 04/08 | 17 | Grammars (part 1); | Quiz 8 |
| 23 | 04/13 | | Review, Study Guide, Q & A | |
| 24 | 04/15 | | Exam: Mid 2 | Mid 2 (aka Quiz ++) |
| 25 | 04/20 | 18 | Grammars (part 2); | |
| 26 | 04/22 | 19 | Grammars (part 3); | Quiz 9 |

| Day | Date | Lec # | Topics | Exams (Fridays) |
|---|---|---|---|---|
| 27 | 04/27 | 20 | Non-regular languages (part 1); | |
| 28 | 04/29 | 21 | Non-regular languages (part 2); | Quiz 10 |
| 29 | 05/04 | 22 | Introduction to computability | |
| 30 | 05/06 | 23 | Introduction to complexity | |
| 31 | 05/11 | | Study Guide, Q & A | |

## Final Exam

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| Start Date and Time | Wednesday, May 13 @ 3:15 PM |
| Duration | Will be announced in Study Guide |
| Venue | In-Person in the classroom or Online |