Formal Languages and Computability Section 61

CS 154

Summer 2024   3 Unit(s)   06/03/2024 to 08/09/2024   Modified 06/06/2024

🕐 Course Information

Course Canvas Page

https://sjsu.instructure.com/courses/1587653 (https://sjsu.instructure.com/courses/1587653)

Lecture Format

- In Person on Mondays
  - **Time**: 13:00 - 15:00
  - **Room**: MacQuarrie Hall 422
  - **Format**: In-class exercises, Q&A, NOT recorded (except for the first class on June 3 and the last class on August 5)
- Online on Wednesdays
  - **Time**: 13:00 - 15:00
  - **Zoom**: https://sjsu.zoom.us/j/84572153298 (https://sjsu.zoom.us/j/84572153298)
  - **Format**: Course materials will be pre-recorded and posted before Wednesday. Zoom session is optional for Q&A.

Instructor

- Yan Chen (yan.chen01@sjsu.edu (mailto:yan.chen01@sjsu.edu))
- Office Hour online via Appointment (https://calendly.com/yan-chen-sjsu/15min)

Graders

- Kyaw Soe Han (kyawsoe.han@sjsu.edu (mailto:kyawsoe.han@sjsu.edu))
- Tam Ly (tam.ly@sjsu.edu (mailto:tam.ly@sjsu.edu))

🖥 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

- 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 (https://www.sjsu.edu/senate/docs/F15-7.pdf), 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, or use AI-generated text, etc.) will result in **a reduction in final course grade** (for assignments, 2/3 letter grade off every time except the first time; for the final, one letter grade off) and administrative sanctions by the University.

▤ 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:

- 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

Textbook

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.

Equipment & software

- A laptop that can access the Internet (Canvas & Zoom) and run the required software.
- An app called JFlap, which is downloadable from the course Canvas page. More details will be given in class.

Further Readings (optional)

- 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

The course will include class participation, weekly assignments, and a final exam. No high-level programming is required.

University Policy S16-9 (http://www.sjsu.edu/senate/docs/S16-9.pdf (http://www.sjsu.edu/senate/docs/S16-9.pdf) 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."*

In-class Participation

- Monday in-person lectures include in-class exercises that are due before the end of the lecture (i.e., 15:00). These exercises will remain accessible on Canvas until 15:00 on Tuesday, but late submissions will result in a 20% penalty. **No submission will be accepted after the available time.**
- Recordings include multiple-choice, T/F, and fill-in-blank questions. Solutions will be displayed after the questions are answered. The questions can be retaken an unlimited number of times. The last submission will be graded. The recordings are posted on Canvas before Wednesdays and the questions are due on the following Mondays before the lecture starts (i.e. 13:00). **Late submissions will NOT be accepted.**
- (Extra Credits) Optional reading assignments and extra exercises will be posted as Canvas discussions, and graded based on participation.

Weekly Assignments

Assignments will be posted as untimed Canvas Quizzes every week, **locked by passwords that are ONLY given in the lectures** (both in-person & recorded). Each assignment is cumulative with more focus on the material learned during that week. The question types include multiple choices (will be graded as all-or-nothing), T/F, short answers, and automaton design problems. These assignments are due on Tuesdays. **A 20% late penalty per day will apply to late submissions.**

Final Examination

The final exam will be online as a 2-hour Canvas Quiz and cumulative. It can be taken anywhere with a stable Internet connection but the date and time are fixed: Wednesday**, August 7, 13:00 - 15:00 Pacific Time**. Exceptions may ONLY be given in cases of a verifiable emergency.

The final exam is closed-all-materials. Cheating (copying from each other, from the Internet, including AI, etc.) will result in 1 letter grade off. However, do NOT use the lockdown browser as some questions require external software (JFlap).

The final Exam is mandatory as University policy S17-1 (http://www.sjsu.edu/senate/docs/S17-1.pdf) 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

Criteria

Note that the "weight" is not a percentage - they are "points". There will be more than 108 points available.

Type	Weight	Topic	Notes
Participation	15	Weekly	1.5 pts every week
Assignments	35	Weekly	10 assignments total, 3.5 pts each
Final Exam	50	Cumulative	Online on August 7, 13:00 - 15:00
Extra Credits	8+	Others	Other class activities, such as reading assignments, discussions, etc.

Breakdown

The range also refers to "points", not percentages.

- A+ will be given to the top 1% of students (evaluated based on the assessment scores and class participation).
- Grades near the borderlines will be rounded up depending on your level and quality of class participation (in class and in the Discussions on Canvas).
- The grade might be curved ONLY if the final grades of the class at the end of the semester are not normal.

Grade	Range	Notes
A	Above 93	
A-	90 to 92.99	
B+	86 to 89.99	
B	83 to 85.99	
B-	80 to 82.99	
C+	76 to 79.99	
C	73 to 75.99	
C-	70 to 72.99	Passing grade
D+	66 to 69.99	
D	63 to 65.99	
D-	60 to 62.99	
F	Below 60	Contact instructor if want a WU instead

🏛 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

Visit [https://www.sjsu.edu/current/summer/calendar.php?#session1-10 (https://www.sjsu.edu/current/summer/calendar.php#session1-10)](https://www.sjsu.edu/current/summer/calendar.php#session1-10) for the Academic Calendar.

When	Topic	Notes
Mon, Jun. 3	Intro & Math Preliminaries	First class. In-person, recorded.
Wed, Jun. 5		Last day to Drop without "W" grade, 75% refund
Week 1	Formal Languages	Jun. 5 - Jun. 11
Week 2	DFA	Jun. 12 - Jun. 18
Week 3	NFA	Jun. 19 - Jun. 25
Week 4	Regular Languages	Jun. 26 - Jul. 2
Week 5	PDA	Jul. 3 - Jul. 9
Week 6	TM	Jul. 10 - Jul. 16
Week 7	REGEX	Jul. 17 - Jul. 23
Week 8	Grammar	Jul. 24 - Jul. 30
Week 9	Computability & Complexity	Jul. 31 - Aug. 6
Mon, Aug. 5	Final Review	Last class. In-person, recorded.
Wed, Aug. 7	Final Exam	13:00 - 15:00. Online via Canvas.
Fri, Aug. 9		Last day to submit Petition for Course Drop or Withdrawal