California State University Stanislaus
Department of Computer Science
Syllabus

Instructor: Dr. Xuejun Liang

My Office: DBH 282
Office Hours: MWF 1:00 p.m. - 2:00 p.m.
Phone: (209) 667-3169, Email: xliang@cs.csustan.edu

Class Information:

Class Room: DBH 103
Class Date & Time: TR 9:30 a.m. - 10:45 a.m.
Class Website: https://www.cs.csustan.edu/~xliang/Courses2/CS4410-22F

Catalog Description:

CS4410 Automata, Computability, and Formal Language. (3 units) Pre-requisites: CS 3100 and MATH 2300. Finite state concepts; sequential machines and state minimization; Chomsky grammar; algorithms on grammars; computability and Turing machines; non-computable functions.

Textbook:

An Introduction to Formal Languages and Automata, Sixth Edition, by Peter Linz, Jones & Bartlett Learning, 2017, ISBN: 978-1-284-07724-7.

JFLAP:

JFLAP is a package of graphical tools which can be used as an aid in learning the basic concepts of Formal Languages and Automata Theory.

Course Goals/Objectives

- To familiarize students the theoretical foundations and principles of Computer Science.
- To strengthen students' ability to carry out formal and rigorous mathematical arguments.

Course Outcomes

Students who successfully complete the course should be able to

1. Define the three basic concepts in the theory of computation: automaton, formal language, and grammar and perform related operations.
2. Construct a finite state machine (DFA and NFA) and the equivalent regular expression and regular grammar, transform an arbitrary NFA to an equivalent DFA, and apply the pumping lemma to show that a language is not regular.
3. Construct pushdown automata and the equivalent context-free grammars, construct derivation trees for strings generated by a context-free grammar, show that a context-free grammar is ambiguous, rewrite a grammar to remove ambiguity, simplify context-free grammars, transform a context-free grammar into an equivalent grammar in Chomsky normal form, and apply the pumping lemma to show that a language is not context-free.
4. Construct a Turing machine to accept a specific language or to compute a simple function, and state Turing's thesis and discuss the circumstantial evidence supporting it.

5. Describe the structure and components of the Chomsky hierarchy.
6. Understand limits of algorithmic computations, and have a basic understanding of the complexity classes P and NP, and concepts of intractability and NP-completeness.

Course Outline* (Major Topics and Weekly Schedule)

Date	Topics Covered
Week 1 8/23, 8/25	Class introduction and syllabus
Week 2 9/30, 9/1	Introduction to the theory of computation: Mathematical preliminaries and notations. Three Basic Concepts: Languages, Grammars, Automata. Some applications.
Week 3 9/6, 9/8	Deterministic Finite Accepters (DFA): Deterministic Accepters and Transition Graphs, Languages and DFAs, and Regular Language.
Week 4 9/13, 9/15	Nondeterministic Finite Accepters, Equivalence of Deterministic and Nondeterministic Finite Accepters
Week 5 9/20, 9/22	Regular expressions, Connection Between Regular Expressions and Regular Languages
Week 6 9/27, 9/29	Regular Grammars. Closure Properties of Regular Languages, Elementary Questions about Regular Languages
Week 7 10/4, 10/4	Identifying Nonregular Languages using pumping Lemma
Week 8: 10/11, 10/13	Context-free languages and Context-free grammars. Grammar simplification methods: Substitution Rule, Remove λ-productions, unit-productions, and useless productions Midterm Exam
Week 9 10/18, 10/20	Two Normal forms: Chomsky and Greibach. Nondeterministic Pushdown Automata and Context-Free Languages
Week 10 10/25, 10/27	Deterministic Pushdown Automata
Week 11 11/1, 11/3	Properties of Context-Free Languages: Two Pumping Lemmas and Closure of Context-Free Languages
Week 12 11/8, 11/10	Standard Turing machines, Linear Bounded Automata, universal Turing Machine.
Week 13 11/15, 11/17	Other Models of Turing machines
	Thanksgiving Break
Week 14 11/29, 12/1	A hierarchy of formal languages and automata. Introduction to computability: The limits of algorithms

Week 15 12/6, 12/8	Introduction to complexity theory. Review for the final
Week 16 12/15	Final Examination Scheduled Time: 8:30 a.m.-10:30 a.m. Fall 2022 Finals Schedule https://www.csustan.edu/class-schedule/finals-schedule

*It is subject to change.

Grading Scale

Grading scale will be assigned on a standard scale as below.

A	B	C	D	F
90-100	75-89	60-74	45-59	<45

Clustering of grades may cause the grading scale to be lowered (to your benefit), but it will not be raised.

Evaluation:

The overall course grade will be the weighted sum of the points earned in the following categories:

Participation	Homework	Midterm Test	Final Exam
10%	25%	30%	35%

Other Polices:

1. I will accept the late homework assignments for maximum three days (including holidays) with the point deduction 20% per day.
2. There will be no makeup tests except in a verified emergency with immediate notification.

Academic Honesty:

The work you do for this course will be your own, unless otherwise specified. You are not to submit other people's work and represent it as your own. I consider academic honesty to be at the core of the University's activities in education and research. Academic honesty is expected at all times in this course.

Accommodations for Students with Disabilities

Students with disabilities seeking academic accommodations must first register with the Disability Resource Services (DRS) program, located in MSR 210, ph. (209) 667-3159. Students are encouraged to talk with the instructor regarding their accommodation needs after registering with DRS.