

# CptS 317: Automata and Formal Languages

## Syllabus, Fall 2024

Last updated: August 25, 2024

### Course Information

**Credit Hours:** 3

**Semester:** Fall 2024

**Meeting Times:** MWF, 3:10–4:00 pm

**Meeting Location:** SPRK G0010

**Learning Management System:** Canvas will be used for the management of this course, including for posting of lecture materials, assignments, announcements, and messages. It will also be used for handling student submissions and instructor and Teaching Assistant feedbacks.

### Instructor Information

**Instructor:** Assefaw Gebremedhin

**Office:** EME B43

**Email:** assefaw.gebremedhin@wsu.edu

**Webpage:** <https://eecs.wsu.edu/~assefaw/>

**Instructor Office Hour:** Fridays 12:00–1:30pm

Office hour will be conducted in-person, but I will also make a zoom option available in case you can't make it in person. Zoom meeting information is posted on the Canvas site of the course.

**Teaching Assistant 1:** Bryan Frederickson

**Email:** bryan.frederickson@wsu.edu

**Office Hour:** Mondays 4:30–6pm

**Teaching Assistant 2:** Martin Hundrup

**Email:** martin.hundrup@wsu.edu

**Office Hour:** Wednesdays 4:30–6pm

**Teaching Assistant 3:** Haridhar (Harry) Pulivarthi

**Email:** haridhar.pullivarthi@wsu.edu

**Office Hour:** Fridays 5:30–7pm

**Teaching Assistant 4:** Angel Ramirez

**Email:** angel.ramirez1@wsu.edu

**Office Hour:** Tuesdays 10:30am–12pm

**Teaching Assistant 5:** Roy Zabetski

**Email:** roy.zabetski@wsu.edu

**Office Hour:** Thursdays 10:30am–12pm

**TA Office Hours Location:** Each TA Office Hour will take place in person in DANA 115. I will also make a zoom option available in case you can't make it in person. Zoom meeting information is posted on the Canvas site of the course.

## Course Objectives

- Introduce concepts in automata theory and theory of computation
- Identify different formal language classes and their relationships
- Design grammars and recognizers for different formal languages
- Prove theorems in automata theory and language properties
- Determine the decidability and intractability of computational problems

## Prerequisites

- CptS 122/132 Data Structures
- Math 216 Discrete Structures

## Text book

- Introduction to the Theory of Computation, Third Edition by Michael Sipser. 2013.

## Learning Outcomes

At the conclusion of this course students will:

- Have acquired a fundamental understanding of the core concepts in automata theory and formal languages
- Be able to design grammars and automata (recognizers) for different language classes
- Be able to identify formal language classes and prove language membership properties
- Be able to prove theorems establishing key properties of formal languages and automata
- Have acquired a fundamental understanding of core concepts relating to the theory of computation and computational models including decidability and intractability

## Coursework and Assessment

### Coursework:

- **7 homework assignments** (58%)
- **2 midterm exams** (20%)
- **1 final exam** (20%)
- **Class Participation** (2%)
  - Active class participation—in discussions during lectures, surveys, and other online discussions, including responding to Participation Question of The Day—is required. Class Participation will count towards 2% of the final grade.

### Homework policy:

- Submissions happen electronically via Canvas.
- Submissions are required to be in PDF format. You can hand-write your solution to an assignment or type it up using a computer. If you hand-write, make sure your writing is legible and clean.
- All homework assignments must be done individually.
- **Missing or Late Work:** Students are expected to submit assignments by the specified due date and time. Assignments turned in up to 48 hours late will be accepted with a 10% grade penalty per 24 hours late. Except by prior arrangement, missing or work late by more than 48 hours will be counted as a zero.

## Exam policy:

- The dates for the two midterm exams are tentatively set for September 25 and October 28. If changes are made to these tentative dates, the exact dates will be announced in class and also updated in the syllabus at least two weeks before the exam date.
- The final exam is on December 9.
- All three exams are closed-book, closed-notes, written exams.
- The final exam is comprehensive.
- **Missed Exam:** Make-up exam is **not** allowed if any exam is missed unless there is an extra-ordinary circumstance. A missed exam will be counted as a zero.

## Grading

Final **letter grades** will be given according to the following ranges:

A (93–100%), A- (90–92.99%), B+ (87–89.99%), B (83–86.99%), B- (80–82.99%), C+ (77–79.99%), C (70–76.99%), C- (67–69.99%), D (60–66.99%), F (less than 60%).

## Expectations for Student Effort

For each hour of lecture equivalent, students should expect to have a minimum of two hours of work outside class.

## Course Topics

Here is an outline of major topics (modules) of the course.

1. Introduction
2. Regular Languages
3. Context-free Languages
4. Church-Turing Thesis
5. Decidability
6. Reducibility
7. Time Complexity

## Weekly Schedule

See Table 1 for a weekly schedule of topics and assignments.

## Policies

### Conduct

Students are expected to maintain a professional and respectful classroom environment. In particular, this includes:

- silencing personal electronics (non-disruptive devices may be used during class)
- arriving on time and remaining throughout the class.

<b>Week</b>	<b>Topics</b>	<b>Assignments/comments</b>
01 (Aug 19–23)	Intro to course, intro to computation theory	HW0 (survey) out
02 (Aug 26–30)	Review of math concepts, proof techniques, finite automata	HW0 in; HW1 out
03 (Sep 2–6)	Finite Automata	No class 9/2; HW1 in, HW2 out
04 (Sep 9–13)	Regular Expressions	HW2 in, HW3 out
05 (Sep 16–20)	Nonregular Languages	HW3 in
06 (Sep 23–27)	Context-free Languages	Mid-term 1 on 9/25
07 (Sep 30–Oct 4)	Context-free Grammars	HW4 out
08 (Oct 7–Oct 11)	Pushdown Automata	HW4 in, HW5 out
09 (Oct 14–18)	CFG and PDA equivalence	HW5 in
10 (Oct 21–25)	Minimization of Automata; Deterministic CFL	Review for Mid-term 2
11 (Oct 28–Nov 1)	Turing Machines I	Mid-term 2 (10/28); HW 6 Out
12 (Nov 4–8)	Turing Machines II	HW6 in
13 (Nov 11–15)	Decidability	No class 11/11; HW 7 out
14 (Nov 18–22)	Reducibility	HW 7 in
15 (Nov 25–29)	<b>Thanksgiving break</b>	
16 (Dec 2–6)	Time Complexity, Review	Practice
17 (Dec 9–13)	Finals Week	Final Exam on Dec 9

Table 1: Tentative week-by-week schedule of topics and assignments.

### Use of Generative AI Tools and Technologies

The use of generative AI tools and technologies, such as GPT, is allowed for learning purposes about material related to this course. However, using generative AI tools to produce solutions for graded assignments is not permitted. Any solution you submit for grading for homeworks must be your own work.

### Correspondence

All class related correspondence with the instructor will be made via Canvas.

### Attendance

Regular attendance is expected. While students may miss class for urgent reasons, repeated absences that are not cleared with the instructor will factor into the Class Participation portion of the grade.

## Academic Integrity

Academic integrity is the cornerstone of higher education. You are responsible for reading WSU's [Academic Integrity Policy](#), which is based on [Washington State law](#).

If you cheat in your work in this class you will:

- Fail the assignment or exam in which the cheating happened.
- Be reported to the [Center for Community Standards](#).
- Have the right to appeal my decision.
- Not be able to drop the course or withdraw from the course until the appeals process is finished.

If you have any questions about what you can and cannot do in this course, ask me.

If you want to ask for a change in my decision about academic integrity, use [the form](#) at the [Center for Community Standards](#) website. You must submit this request within 21 calendar days of the decision.

## Lauren's Promise:

### WSU's Commitment to Address Discrimination and Harassment

On October 22, 2018, Lauren McCluskey, 21 years old, was murdered by a man she briefly dated on the University of Utah campus, where she was a student. Lauren was raised in Pullman, Washington. Together with her parents, who are professors at WSU, this university community stands firmly behind Lauren's Promise: **WSU will listen and facilitate support and reporting options if someone is threatening you.**

WSU prohibits discrimination and harassment. This includes discriminatory harassment, hate crimes, sexual discrimination, sex-based harassment, stalking, dating violence, domestic violence, sexual assault, and all types of sexual violence.

If you are in immediate danger, call 911.

If you have experienced or have witnessed discriminatory behavior, you can contact the WSU Compliance and Civil Rights (CCR) and/or [the WSU Title IX Coordinator](#). CCR can provide information on reporting options, including confidential resources available to you, and facilitate supportive measures. To contact CCR:

Online: [Online Reporting Form](#)

Email: [ccr@wsu.edu](mailto:ccr@wsu.edu)

Phone: 509-335-8288

For more information, see the WSU [Policy Prohibiting Discrimination and Harassment](#) (Executive Policy 15), WSU Standards of Conduct for Students ([Chapter 504-26 WAC](#)), and the [WSU Notice of Nondiscrimination](#).

## Reasonable Accommodation

Students with disabilities or chronic medical or psychological conditions can request reasonable accommodations. If you need reasonable accommodations to fully participate in your courses, please go to your campus' Access Center/Services website (see links below). Follow the procedures to request accommodations. You may also contact your campus office to schedule an appointment with an Access Advisor.

The Access Center/Services will notify your instructors of your requested accommodations, but you may need to communicate with your instructors about how some of your accommodations will work (by email, Zoom, or in person).

Contact an Access Advisor on your campus:

- Pullman, WSU Global Campus, Everett, Bremerton, and Puyallup: 509-335-3417, <http://accesscenter.wsu.edu>, or email [access.center@wsu.edu](mailto:access.center@wsu.edu)
- Spokane: 509-358-7816, <https://spokane.wsu.edu/studentaffairs/access-resources/>, or email [spokane.access@wsu.edu](mailto:spokane.access@wsu.edu)
- Tri-Cities: 509-372-7352, <http://www.tricity.wsu.edu/disability/>, or email [tricitie.AccessServices@wsu.edu](mailto:tricitie.AccessServices@wsu.edu)
- Vancouver: 360-546-9238, <https://studentaffairs.vancouver.wsu.edu/access-center>, or email [van.access.center@wsu.edu](mailto:van.access.center@wsu.edu)

### **Emergencies on Campus**

To receive emergency alerts on your phone or by email, click on the link to the page of your campus that you can access via this university syllabus website:

<https://syllabus.wsu.edu/university-syllabus/>.

These alerts may include information about active shooter situations and severe weather.

In case of an active shooter, follow these ideas: “Run, Hide, Fight”.

In any emergency, remain ALERT by observing and paying attention to WSU emergency alerts. ASSESS your specific situation, and ACT to ensure your own safety and the safety of others if you are able.

### **Other Policies in the University Syllabus**

Students are responsible for reading and understanding all university-wide policies and resources pertaining to all courses (for instance: accommodations, care resources, policies on discrimination or harassment), which can be found in the university syllabus website:

<https://syllabus.wsu.edu/university-syllabus/>.

### **Academic Dates and Deadlines**

Students are encouraged to refer to the academic calendar often to be aware of critical deadlines throughout the semester. The academic calendar can be found at

<http://registrar.wsu.edu/academic-calendar>.

### **Changes**

This syllabus is subject to change. Updates will be posted on the course website.