

CS 3350: Automata, Computability and Formal Languages
Spring 2026
Syllabus – TLDR; Version

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| What: | CS 3350: Automata, Computability and Formal Languages |
| Where and When: | TWHC 106, Mon and Wed 3:00PM to 4:20PM |
| With whom: | Dr. Christoph Lauter |
| Where is more info: | https://www.christoph-lauter.org/automata/ |
| What if I have questions, if I need support or just someone to talk to: | Dr. Lauter's office is CCSB 3.0610, or call +19157475939 (office) or +19155351773 (private) or text +19155351773 or send email to cqlauter@utep.edu |
| What is important to succeed: | <ul style="list-style-type: none">• Strive to come to class; there is an attendance grade• Note taking is absolutely necessary. This class is heavy on discrete math.• You need a buddy in class! Form a study group.• Be sure when there is a homework assignment due (there will be 3) and when there is a mid-term exam (there will be 2). Make-ups are only possible for medical or family issues that are documented and known to Dr. Lauter before the deadline. |
| What if I feel overwhelmed or need more support: | <ul style="list-style-type: none">• Dr. Lauter is always here for you. Call, text, send email or come to his office. We can talk in Spanish as well. Everything stays confidential.• The course TA holds drop-in hours (office hours). Go see them as well and ask them for extra help.• Did you think of a CASS accommodation? Go see CASS.• Work, caregiving and family obligations are impacting your full potential in this course? Talk to Dr. Lauter right away. There are solutions. Babies, toddlers, kids? Let's talk. There are solutions.• Mental Health issues? Nobody is listening? Contact UTEP Miner Support at https://www.utep.edu/miner-support. |

CS 3350: Automata, Computability and Formal Languages
Spring 2026
Syllabus

- Title:** CS 3350: Automata, Computability and Formal Languages, CRN 23107
Term: Spring 2026
Duration: Wed 01/21/2026 through Wed 05/06/2026
Lecture Time: Mon, Wed 3:00PM to 4:20PM
Lecture Location: TWHC 106
Instructor: Dr. Christoph Lauter, cqlauter@utep.edu
+19157475939 (office) or +19153531773 (private, texting preferred)
Whatever it is, your instructor is here for you. Do not hesitate to call, text or send email.
Life can be hectic even for professors. If you do not get an answer to email in 48h, send a gentle reminder email or just call.
- Drop-In Work Hours with Instructor:** Office (CCSB 3.0610) when door is open, at least Mon-Thu 11:00AM-11:50AM, Email anytime, Phone/Teams during business hours
The instructor cares about every student's success. At moments, the class size being large, it might however happen that the instructor will have to refer you to the TA. The TA cares about student success as much as the instructor and they will hold their own drop-in hours.
- Class Web page:** <https://www.christoph-lauter.org/automata/>
- Prerequisites:**
- General Prerequisites: Data Structures and either Discrete Mathematics or Discrete Structures, both with a grade C or higher.
 - Alternative Prerequisites: Elementary Data Structures and Algorithms and either Discrete Mathematics or Discrete Structures, both with a grade B or higher.
- Description:** Theoretical computing models and the formal languages they characterize: Finite state machines, regular expressions, pushdown automata, context-free grammars, Turing machines and computability. Capabilities and limitations of each model, and applications including lexical analysis and parsing. Major topics include:

1. Regular languages, finite automata, non deterministic finite automata
2. Context-free languages, pushdown automata
3. Parsing, normal forms, ambiguity
4. Pumping lemmas and closure properties
5. Turing machines and other equivalent models
6. Decidable languages, non-decidable languages, recognizable languages, Chomsky hierarchy
7. Enumerability and countability
8. Introduction to complexity analysis and complexity classes

Textbooks:

Required:

- Maheshwair and Smid, **Introduction to the Theory of Computation**, 2014. Free online textbook.

Optional:

- Sipser, **Introduction to the Theory of Computation**, Third Edition, Thomson Course Technology, 2006.
- Papadimitriou, **Computational Complexity**, First Edition, Pearson, 1993.

Student Learning Outcomes:

See appendix below.

Homework Assignments:

- Students are expected to review topics taught in class, work on solutions to assigned problems, and be able to demonstrate skills and solutions during class. Homework assignments will be posted on the course website. Answer will be posted for selected problems.
- To obtain full credit for the homework grade, you will need to present solutions to all 3 (three) homework problems.

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|-----------------------------------|---|
| Workload & Attendance: | <p>This course requires participation during the in-class lectures, in addition to the daily readings and the homeworks. Students should read the textbook before the corresponding class. Attendance in the lecture will be checked. It is part of the workload for this class to redact the class notes in Latex on one or two occasions.</p> <p>Please form study groups. You are encouraged to discuss the approach and understand the problem. However, the write up, programming, and actual solutions to the homeworks are individual work. If you use someone's work for your own, you are committing plagiarism.</p> |
| Readings: | <p>Students should read and understand the textbook chapters before these chapters are discussed in the lecture.</p> |
| Drop-In Hour Visits: | <p>The instructor is always here for your questions, to explain unclear points or to give extra help with the material we will be focusing on. It is easy to get a hold of the instructor during his drop-in hours (office hours). Every student is supposed to see the instructor during drop-in hours at least 3 (three) times per semester, even if we end up chatting about the weather. These drop-in hour visits will count toward the course grade.</p> |
| Slides, Script: | <p>No scholae sed vitae discimus. We need to discover the concepts of formal languages and automata, like little Alan Turings, by ourselves. Slides are hindering our comprehension, as they only give us the impression that we understood things. The instructor will hence refrain from presenting slides. There is no official script, yet. It is part of the workload for this class to redact the class notes in Latex on one or two occasions. Details for this class note taking and redacting will be explained in class. A link to a shared git repository will be published in the course website. The instructor's handwriting is not faster than yours, so you can essentially copy everything from the blackboard.</p> |
| Tests and Testing Policy: | <p>Three tests will be given: two mid-term tests and a final. All tests are cumulative, with an emphasis on recent material. There is of course partial credit for partially correct answers. No make up tests are given but for documented medical emergencies known to the instructor before the exam starts. The instructor reads enough Spanish to understand Mexican doctors' notes.</p> |

Grading:

Letter grade:

| Points range | Grade |
|--------------|-------|
| [90; 100] | A |
| [80; 90) | B |
| [70; 80) | C |
| [60; 70) | D |
| [0; 60) | F |

Grading breakdown:

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|-----------------------|-----|
| Midterm Exam I | 10% |
| Midterm Exam II | 10% |
| Final Exam | 32% |
| Homework | 25% |
| Class attendance | 8% |
| Latex Class Redaction | 10% |
| Drop-In Hour Visits | 5% |

This course is a challenging one and the instructor knows about that challenge. We become stronger in overcoming challenges together. The instructor will tell stories about his own studies and past challenges in class. He is committed to maintain a good level of passing grades. The grades are not the most important thing; what you learn is what is important.

Make-Ups:

Make-ups are not allowed. Make-up work will be given only in the case of a documented emergency. Note that make-up work may be in a different format than the original work, may require more intensive preparation, and may be graded with penalty points. If you miss an assignment and the reason is not considered excusable, you will receive a zero. It is therefore important to reach out to the instructor **before** the respective exam starts, resp. **before** the homework assignment deadline is up, and explain with proper official documentation why you missed a given course requirement. Once a deadline has been established for make-up work, no further extensions or exceptions will be granted. The instructor reads enough Spanish to understand Mexican doctors' notes. This make-up policy may sound harsh; it is not meant to be harsh, but fair for everyone. The instructor is fully aware that a lot of his students' have family, work and other obligations and that life can be extremely hectic. **If you talk to the instructor before a deadline or exam, he promises that he will do everything reasonably possible to find a solution.**

Approximate Schedule:**Course**

The course schedule of topics and assignments will be posted on the course website.

- Accommodations:** The University is committed to providing reasonable accommodations to students with documented disabilities. Students who become pregnant may also request reasonable accommodations, in accordance with state and federal laws and regulations and University policy. Accommodations that constitute undue hardship are not reasonable. To make a request, please register with the UTEP Center for Accommodations and Support Services (CASS). Contact CASS at 915-747-5148, email them at cass@utep.edu, or apply for accommodations online via the CASS portal.
The instructor not only honors all CASS accommodations but invites students to seek help from CASS for additional accommodations, in particular if you suspect that you might have an undocumented disability. These accommodations are not unfair, but a means to make an unfair world a little bit more fair.
- Names:** The instructor will abide by all state and federal laws concerning the use of names and pronouns. He enjoys freedom of speech and he will use that freedom of speech to the largest extent possible. Please let him know if you want him to use a particular way of addressing you.
- Caregiver Responsibilities Policy:** The instructor has two kids himself and he has the greatest respect for students who are balancing their pursuit of education with the responsibilities of caring for children or other family members. You are heroes. If ever you run into challenges that require you to miss a class or if your caregiving responsibilities are interfering with your ability to engage in learning, please contact the instructor. We will find a solution to support your learning. Anecdotally, the instructor has once taught a class at another institution with a student's baby in his arms. It was fun!
- School-Life Conflict:** Many students face obstacles to their education as a result of work or family obligations or unforeseen personal difficulties. If you are experiencing challenges throughout the term that are impacting your ability to succeed in this course, or in your undergraduate career more broadly, please reach out to the instructor immediately. We can work on a plan for your academic success. You can reach out in Drop-In Hours (Office Hours), through email or through a phone call.

Mental Health, Counseling Services and UTEP Community of Care:

UTEP fosters a Community of Care, please visit <https://www.utep.edu/miner-support>

All of us need a support system, and many students benefit from the use of counseling services. The UTEP Counseling and Psychological Services center is located in the Union Building West, Room 202. It can be reached at +19157475302 or through <https://www.utep.edu/counsel>. The UTEP Counseling and Psychological Services works with students to identify and address issues related to personal growth, self-confidence, anxiety, depression, eating disorders, academic difficulties and career indecision. For urgent mental health needs, students should call or walk into the health center. **The instructor of this CS class is not a health professional but will support you in finding help, walking with you to the UTEP Counseling and Psychological Services center or calling the appropriate service with you, if you approach him before, in or after class or at any moment when you see him on campus. He has done so in the past with other students at UTEP. You are not alone.**

Cell phones:

Please silence your mobile devices or put them into a vibrate mode for the duration of class - they are disruptive for your fellow students. No mobile devices (cell phones, PDAs, laptops etc.) are allowed during the exams and will result in your expulsion from the test, unless other arrangements are announced before that particular test.

Class recordings:

The instructor will not take the burden of recording the classes. If the group of students wants to self-organize and record the classes, the instructor is all in favor of this solution. However, in this case, students must abide by federal and state law governing in-class recordings, in particular FERPA, as well as with UTEP policies. When in doubt of the legality of making a recording available to other students in this class, students should first consult with the instructor. **FERPA prevents in-class recordings to be made publicly available.** Students may not share recordings outside of this course. Doing so may result in disciplinary action and legal consequences. The instructor will of course abide by the same laws and will respect your privacy. This means he will not and cannot share class recordings with people not enrolled in the class or TAs/IAs.

Scholastic Integrity:

- Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the Office of Community Standards (<https://www.utep.edu/student-affairs/standards/>) for possible disciplinary action. To learn more, please visit HOOP: Student Conduct and Discipline (<https://www.utep.edu/hoop/section-2/student-conduct-and-discipline.html>).
- Submitted work should be unmistakably your own. You may not transcribe or copy a solution taken from another person, book, or other source (e.g., a web page). Professors are required to report academic dishonesty and any other violation of the Standards of Conduct to the Dean of Students.
- Some AI technologies or automated tools, particularly generative AI such as ChatGPT or DALL-E, can be beneficial during the early brainstorming stages of an activity, and you are welcome to explore them for that purpose. However, keep in mind that AI-generated ideas are not your own and may hinder your ability to think critically and creatively about a problem. It is also important to remember that these technologies often “hallucinate” or produce materials and information that are inaccurate or incomplete—even providing false citations for use. That said, you are not allowed to submit any AI-generated work in this course as your own. If you use any information or materials created by AI technology, you are required to cite it like you would any other source. Consider how this will affect your credibility as a writer and scholar before doing so. Any direct use of AI-generated materials submitted as your own work will be treated as plagiarism and reported to the Office of Community Standards.

- Permitted collaboration: Students may discuss requirements, background information, test sets, solution strategies, and the output of their programs. However, implementations and documentation must be their own creative work. Students are required to document advice received from others and all resources utilized in the preparation of their assignments.
- If academic dishonesty is suspected: The Dean of Students office will be contacted for adjudication. A temporary “incomplete” grade will be issued if their investigation extends beyond the grading period.

Appendix: CS 3350 Learning Outcomes

Level 1:

- Describe implications of the Church-Turing thesis
- Describe problems for which an algorithm exists, and problems for which there are no algorithms (non-recursive, non-recursively enumerable languages) and describe the implications of such results
- Describe and explain the diagonalization process as used in proofs about computability
- Describe the difference between feasible and non-feasible algorithms, describe the limitations of the current formalization of feasibility as polynomial-time
- Describe the main ideas behind the concepts of NP and NP-hardness, know examples of NP-hard problems

Level 2:

- Convert a non-deterministic finite automaton into an equivalent deterministic finite automaton
- Convert a non-deterministic finite automaton into an equivalent regular expression
- Convert a regular expression into an equivalent finite automaton
- Construct a regular expression for a regular language
- Convert a context-free grammar into an equivalent pushdown automaton
- Construct a context-free grammar for a given context-free language
- Design an algorithm for a machine model to simulate another model
- Build simple Turing machines
- Prove formally properties of languages or computational models

- Apply a parsing algorithm
- Build a parse tree or a derivation from a context-free grammar
- Use the closure properties in arguments about languages

Level 3:

- Compare regular, context-free, recursive, and recursively enumerable languages
- Compare finite automata, pushdown automata, and Turing machines