

# Syllabus. Automata, Computability, and Formal Languages. Cs 3350, Spring 2024.

January 15, 2024

## 1 General Information

**Class Time:** Tuesday and Thursday 1:30-2:50 pm

**Room:** Education Building 112

**General Prerequisites:** CS 2302 “Data Structures” and either Discrete Mathematics or Discrete Structures, both with grades C or higher.

**Alternative Prerequisites:** CS 2401 “Elementary Data Structures and Algorithms” and either Discrete Mathematics or Discrete Structures, both with grades B or higher.

**Instructor:** Dr. Leobardo Valera, email lvalera@utep.edu, office CCSB 2.0902F,

**Office hours:** Mondays to Thursday 12:00-1:00 pm.

## 2 Major Topics Covered in the Course

- Regular languages, finite automata (FA), non deterministic FA (NFA)
- Context-free languages, pushdown automata (PDA)
- Parsing, normal forms, ambiguity
- Pumping lemmas and closure properties
- Turing machines and other equivalent models
- Decidable languages, non-decidable languages, recognizable languages, Chomsky hierarchy

## 3 Learning Outcomes

### 3.1 Level 1: Knowledge and Comprehension

Level 1 outcomes are those in which the student has been exposed to the terms and concepts at a basic level and can supply basic definitions. The material has been presented only at a superficial level. Upon successful completion of this course, students will be able to:

1. Describe implications of Church-Turing thesis.
2. 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.
3. Describe and explain the diagonalization process as used in proofs about computability.
4. Describe the difference between feasible and non-feasible algorithms, describe the limitations of the current formalization of feasibility as polynomial-time.
5. Describe the main ideas behind the concepts of NP and NP-hardness, know examples of NP-hard problems.

## 4 Level 2: Application and Analysis

Level 2 outcomes are those in which the student can apply the material in familiar situations, e.g., can work a problem of familiar structure with minor changes in the details. Upon successful completion of this course, students will be able to:

1. Convert a non-deterministic finite automaton into an equivalent deterministic finite automaton.
2. Convert a non-deterministic finite automaton into an equivalent regular expression.
3. Convert a regular expression into an equivalent finite automaton.
4. Construct a regular expression for a regular language.
5. Convert a context-free grammar into an equivalent pushdown automaton.
6. Construct a context-free grammar for a given context-free language.
7. Design an algorithm for a machine model to simulate another model.
8. Build simple Turing machines.
9. Prove formally properties of languages or computational models.
10. Apply a parsing algorithm.
11. Build a parse tree or a derivation from a context-free grammar.
12. Use the closure properties in arguments about languages.

## 5 Level 3: Synthesis and Evaluation

Level 3 outcomes are those in which the student can apply the material in new situations. This is the highest level of mastery. Upon successful completion of this course, students will be able to:

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

## 6 Textbook

Introduction to the Theory of Computation, by Michael Sipser (all editions are OK). This book is available at the bookstore and through major online book retailers, and you are expected to acquire a copy for your use in this course. Photocopied textbooks are illegal and their use will not be tolerated.

## 7 Assignments

Homework assignments will be announced on the class.

## 8 Exams

There will be three tests and the final exam

Exam 1: February 20

Exam 2: March 26

Exam 3: April 17

Fina Exam: May 09, 1-3:45 pm

## 9 Special Accommodations

If you have a disability and need classroom accommodations, please contact the Center for Accommodations and Support Services (CASS) by email to [cass@utep.edu](mailto:cass@utep.edu). For additional information, please visit the CASS website at <http://www.sa.utep.edu/cass>. CASS's staff are the only individuals who can validate and if need be, authorize accommodations for students.

## 10 Scholastic Dishonesty

Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but not limited to cheating, plagiarism, collusion, submission for credit of any work or materials that are attributable to another person.

Cheating is:

1. copying from the test paper of another student;
2. communicating with another student during a test to be taken individually;
3. giving or seeking aid from another student during a test to be taken individually;
4. possession and/or use of unauthorized materials during tests (i.e. crib notes, class notes, books, etc.);
5. substituting for another person to take a test;
6. falsifying research data, reports, academic work offered for credit.

Plagiarism is:

1. using someone's work in your assignments without the proper citations;
2. submitting the same paper or assignment from a different course, without direct permission of instructors.

To avoid plagiarism see: [https://www.utep.edu/student-affairs/osccr/\\_Files/docs/Avoiding-Plagiarism.pdf](https://www.utep.edu/student-affairs/osccr/_Files/docs/Avoiding-Plagiarism.pdf)

Collusion is

1. unauthorized collaboration with another person in preparing academic assignments.

Instructors are required to – and will – report academic dishonesty and any other violation of the Standards of Conduct to the Dean of Students.

**NOTE:** When in doubt on any of the above, please contact your instructor to check if you are following authorized procedure.

## 11 Grading

<b>Exam 1:</b>	15%
<b>Exam 2:</b>	20%
<b>Exam 3:</b>	20%
<b>Final Exam:</b>	25%
<b>Homework:</b>	15%
<b>Quizzes:</b>	5%