



TROY UNIVERSITY
CS372 FORMAL LANGUAGES & THE THEORY OF COMPUTATION
COURSE SYLLABUS

INSTRUCTOR INFORMATION:

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STUDENT EXPECTATION STATEMENT:

It is assumed the student entering this course will already have a fundamental understanding of Discrete Mathematics.

COURSE DESCRIPTION:

This course is to study various computational models and how they relate to each other. Contents include finite automata, regular expressions and languages, context-free grammars and languages, Turing machines, un-decidable and intractable problems.

COURSE OBJECTIVES:

We will study the following topics:

Formal Languages

1. Finite State Automata.
2. Regular Expressions and Regular Grammars.
3. Context-free Grammars and Pushdown Automata.

Computability

4. Computation models: Turing machines (TM).
5. Turing-decidable and Turing-recognizable languages.
6. Enhancements of TMs: multi-tape TMs, non-deterministic TMs. Equivalence of these and the standard TM.
7. Diagonalization. Acceptance problem is undecidable; Acceptance problem is recognizable; the complement of the Acceptance problem is unrecognizable.
8. Reductions. Examples of other undecidable languages. Rice's theorem. Post's Correspondence Problem (PCP) is undecidable.

Complexity

9. Running time of Turing Machines. The classes P, NP, NP-hard, and NP-complete.
10. Cook-Levin Theorem. SAT is NP-complete. Some reductions.

TEXTBOOK(S) AND/OR OTHER MATERIALS NEEDED:

Michael Sipser. *Introduction to the Theory of Computation* (3rd edition), Cengage Learning (2012). Required.

SCHEDULE (TENTATIVE TO CHANGE)

Week	Topic	Readings
1	Course introduction and syllabus overview Discussion of the basic ideas of the Computation Theory Group project registration	Chapter 0
2	Finite Automata, Deterministic Finite Automata, Nondeterminism	Section 1.1
3	Closure Properties of Regular Languages, Regular Expressions Equivalence between Regular Expressions and Finite Automata	Section 1.2, 1.3
4	Regular Pumping Lemma, Non Regular Languages	Section 1.4, 2.1
5	Context Free Languages: Context Free Grammars and Pushdown Automata	Section 2.2
6	Equivalence between Context Free Grammars and Pushdown Automata, CF Pumping Lemma, Non Context Free Languages	Section 2.3, 3.1
7	Turing Machines, TM Variants, Church-Turing Thesis	Section 3.2
Midterm Exam		
8	Decision Problems for Automata and Grammars	Section 4.1
9	Undecidability, Reducibility	Section 4.2, 5.1
10	Post's Correspondence Problem	Section 5.2, 5.3, 6.1, 6.2
11	Time Complexity, P and NP	Section 7.1
12	SAT, NP-Completeness	Section 7.2, 7.3, 7.4
13	Rehearsal	
14	Final Exam: group project final defense	

BREAKOUT OF HOW GRADES WILL BE DETERMINED:

Course Grade Components Approximate % of Grade

Attendance and contribution	20
Homework assignments	30
Midterm	20
Final exam: group project	30

The overall course grade is based upon the student's performance on the weekly assignments, class participation, midterm exam and group project.

ASSIGNMENT OF GRADES:

Grades will be assigned according to point system on the following scale:

A	90 - 100
B	80 - 89
C	70 – 79
D	60 – 69
F	59 and below

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