

1. Course number and name

CptS 317: Automata and Formal Languages

2. Credits and contact hours

3 credits, 3 lecture hours

3. Instructor's or course coordinator's name

Yinghui Wu

4. Textbook, title, author, and year

J.E. Hopcroft, R Motwani, and JD Ullman. *Introduction to Automata Theory, Languages and Computation* (3rd ed.). Addison Wesley/Pearson.

5. Specific course information

a. *Catalog description:* Finite automata, regular sets, pushdown automata, context-free language, Turing machines and the halting problem.

b. *Prerequisites or corequisites:* Cpt S 122 (with a C or better) Math 216 (with a C or better)

Prerequisite Grade Requirements: C or better; Topic Pre-requisites: Data structures; Discrete structures

6. Specific goals for the course

By the end of the course, students will be able to

- Understand core concepts in automata theory and theory of computation (1a, 1b, 1c)
- Identify different formal language classes and their relationships (2a, 2b, 2c)
- Design grammars and recognizers for different formal languages (6a, 6b, 6c)
- Prove or disprove theorems in automata theory using its properties (1a, 1b, 1d, 2a, 2b, 6a, 6b,6c)
- Determine the decidability and intractability of computational problems (6a, 6b, 6c)

7. Brief list of topics to be covered

The course is divided into three logical parts: Part I) Regular languages; Part II) Context free languages; and Part III) Turing Machines and Decidability. Specific topics covered under these three parts are as follows:

- (Part I: Regular languages)
 - Finite Automata (DFA, NFA, e-NFA), their equivalence
 - Regular expressions
 - Pumping lemma for regular languages
 - Closure properties of regular languages
 - Equivalence and minimization of DFAs
- (Part II: Context free languages)
 - Context free grammars
 - Pushdown Automata
 - Pumping lemma for CFLs

- Closure properties of CFLs
- (Part III: Turing machines and Decidability)
 - Turing machines (single tape, multi-track, multi-tape, non-deterministic)
 - Recursive and Recursively enumerable languages, decidability
 - Undecidability, Diagonalization technique, computability vs. intractability