CS3383, THEORY of AUTOMATA, Spring 2017

Instructor: Michael Gelfond
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Office Hours: MW 2:30 - 3:30 or by appointment.

Textbook: "Elements of the Theory of Computation", H. Lewis and C. Papadimitriou

Course Objectives: The objective of this course is to learn what can and cannot be represented by important classes of abstract machines and grammars, and to classify functions and relations into complexity classes such as P, NP, and NP-complete.

Key Topics: Regular languages and finite state automata, context free languages and push down automata, Turing machines, Churchs Thesis and the halting problem, complexity classes such as P, NP and NP-complete, proof techniques in automata theory such as pumping lemmas and diagonal arguments.

Course Prerequisites: CS1382

Expected Prior Knowledge and Skills: programing and algorithm de-Expected Prior Knowledge and Skills: programing and algorithm design experience sign experience

Learning Outcomes: Students are expected to be:

- Familiar with formal methods, such as abstract machines and formal grammars, for defining infinite sets of strings by finite means. (a, f, k)
- Able to classify these methods according to their expressive power. (a, k)
- Able to state Churchs Thesis, its significance, and arguments in its favor. (a)

Assessment methods of all of the above: exams and assignments.

Methods of Assessment:

Three Tests - 100 points each

Final exam (comprehensive) - 150 points

Homework - 50 points

Homework Policy: Normally homework will be given once a week. Each submitted homework with a reasonable attempt on the solution is five points. Questions about the homework (as well as other questions related to the subject material) are encouraged. Students are expected to spend at least two hours preparing for each class.

Attendance Policy:

- You are expected to attend every lecture.
- If you are absent, it is your responsibility to obtain class notes and handouts (if any) from your classmates.
- There are no makeup exams for unexcused absences.
- A student who is absent from classes for the observance of a religious holy day will be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence (p.49). I should be invormed about the absence in advance.

Academic Conduct: Policy of the Department and the University will be followed.

Students with Disabilities: Any student who, because of a disability, may require special arrangements in order to meet course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided.

The Intended Material

I intend to cover most of material from Chapter 1-4 and part of Chapter 5 from the textbook. If time allows some material from Chapter 6 will also be covered.

Lecture Schedule (subject to change as necessary)

- 1/20 Introduction.
- 1/25 Sets and their representations.
- 1/27 Languages and the Decision Problem.
- 1/30 Regular languages and deterministic finite automata (DFA).
- 2/1 Regular languages and deterministic finite automata (DFA).
- 2/3 Nondeterministic finite automata (NFA).
- 2/6 Nondeterministic finite automata (NFA).
- 2/8 Languages that are not regular.
- 2/10 Languages that are not regular.
- 2/13 Automata and Regular Expressions as specification languages.
- 2/15 Review.
- 2/17 Test.
- 2/20 Discussion.
- 2/24 Context-free grammars and languages.
- 2/27 Context-free grammars and languages.
- 3/1 Pushdown automata.
- 3/3 Pushdown automata.
- 3/6 Languages that are not context-free.
- 3/8 Languages that are not context-free.

- 3/10 Decidable Languages.
- 3/20 Chomsky normal form.
- 3/22 Decidability of context-free languages.
- 3/24 Review.
- 3/27 Test.
- 3/29 Discussion.
- 3/31 Turing machines and the Church-Turing Thesis.
- 4/3 Turing machines and the Church-Turing Thesis.
- 4/5 Turing machines and the Church-Turing Thesis.
- 4/7 Turing machines and the Church-Turing Thesis.
- 4/10 Enumerable and not-enumerable Languages.
- 4/12 Undecidable problems.
- 4/14 Undecidable problems.
- 4/19 Undecidable problems.
- 4/21 Review.
- 4/24 Test.
- 4/26 Discussion.
- 4/28 Measuring time complexity.
- 5/1 P and NP problems,
- 5/3 NP-completeness.
- 5/5 Review.

The pace is tentative. It will mainly depend on the degree of preparedness of the class.