CS3383, THEORY of AUTOMATA, Spring 2015

Instructor: Michael Gelfond
Email Address: Michael.Gelfond@ttu.edu
Office: 313

Textbook: "Introduction to the Theory of Computation", Michael Sipser, third edition.

Course Objectives: The objective of this course is to learn what can and cannot be represented by important classes of abstract machines and grammars.

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

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

Tests: Tests will include questions checking the students understanding of definitions and theorems (including precise formulations and some proofs).

Students will be expected to demonstrate mastery of the use of specification languages discussed in class, and of the corresponding decidability algorithms. Some questions may test understanding of relative importance of the results and their history.

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.

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 Chapter 1-4 and Chapter 7 from the textbook: I'll omit some proofs and, if time permits, add a few extra section, e.g. Section 6.4.

Lecture Schedule (subject to change as necessary)

- 1/14 Introduction
- 1/16 Sets and their representation
- 1/21 Languages
- 1/23 Regular languages
- 1/26 Deterministic finite automata
- 1/28 Nondeterministic finite automata

- 1/30 Finite automata and regular languages
- 2/2 Languages that are not regular
- 2/4 Use of Pumping Theorem for regular languages
- 2/6 Finite automata and algorithms
- 2/9 Review
- 2/11 Test
- 2/13 Context-free grammars and languages
- 2/16 Reasoning about context-free grammars
- 2/18 Pushdown automata
- 2/20 Languages that are not context-free
- 2/23 Use of Pumping Theorem for context-free languages
- 2/25 Chomsky normal form
- 2/27 Decidability of context-free languages
- 3/2 More on decidability
- 3/4 Context-free languages and parsing
- 3/6 Review
- 3/9 Test
- 3/11 Turing Machines
- 3/13 Computing with Turing machines
- 3/23 Computable functions
- 3/25 Church-Turing thesis
- 3/27 Extensions of Turing Machines

- 3/30 Grammars
- 4/1 Recursively enumerable languages
- 4/3 Universal Turing machine
- 4/8 The halting problem
- 4/10 The halting problem
- 4/13 Undecidable recursively enumerable languages
- 4/15 Church-Turing Thesis and Limits of computation
- 4/15 Review
- 4/17 Review
- 4/20 Test
- 4/22 Computational complexity
- 4/24 P and NP problems
- 4/27 Review
- 4/29 Review
- 5/1 Review
- 5/4 Review