

Handout 2: Syllabus

Professor: Moses Liskov

August *Th 30*: Course policies & syllabus, **homework 1 out**, LaTeX, Introduction. Sets, symbols, alphabets, strings, and languages. Reading: Chapter 0.

September *Tu 4*: **Homework 1 due, homework 2 out**. Deterministic Finite Automata (DFAs), Nondeterministic Finite Automata (NFAs), equivalence of DFAs and NFAs. Reading: Sections 1.1 and 1.2.

Th 6: Regular languages, regular expressions, regular operations. $RE \subset RL$. Reading: Section 1.3, through pg 69.

Tu 11: **Homework 2 due, homework 3 out**. GNFA's, $RL \subset RE$. Reading: Section 1.3.

Th 13: Some non-regular languages. The pumping lemma. Proving languages are non-regular. Reading: Section 1.4.

Tu 18: Context-free grammars (CFGs). Push-down automata (PDAs). Context-free languages. Reading: Section 2.1, and 2.2 through page 114.

Th 20: **Homework 3 due, homework 4 out**. Chomsky normal form. Equivalence of CFGs and PDAs.

Tu 25: Non-context-free languages. Pumping lemma for CFLs. Reading: Section 2.3.

Th 27: Pumping lemma for CFLs, continued. Introduction to Turing Machines (TMs); the Church-Turing thesis. Reading: Section 2.3, section 3.1.

October *Tu 2*: **Homework 4 due, homework 5 out**. Examples of Turing machines. Turing-recognizable languages. Multi-tape TMs, Nondeterministic TMs. Reading: Section 3.1, 3.2, optionally 3.3.

Th 4: Enumerators, equivalence with ordinary TMs. The universal Turing Machine. Deciders, decidable languages. Examples of decidable languages. Reading: Section 4.1, plus page 173.

Tu 9: **Homework 5 due, homework 6 out**. Exam review. Reading: Chapters 0, 1, 2, 3, section 4.1.

Th 11: MIDTERM EXAM

Tu 16: (no class, fall break).

Th 18: Review: TMs and deciders. Uncountability of the real numbers. Counting argument for undecidable languages. Undecidability of A_{TM} . Reading: Section 4.2.

Tu 23: Homework 6 due, homework 7 out. Unrecognizable languages. Proving languages are undecidable / unrecognizable. Reading: Section 4.2, Section 5.1, through page 192.

Th 25: Mapping reductions, Rice's theorem. Reading: Section 5.1.

Tu 30: Computation histories. Undecidability of PCP and MPCP. Reading: Section 5.2.

November *Th 1: Homework 7 due, homework 8 out.* A_{LBA} and E_{LBA} . ALL_{CFG} . Reading: Section 5.3.

Tu 6: The recursion theorem and implications. Reading: Section 6.1

Th 8: Time complexity of TMs. $TIME(f(n))$ class; the class P. Examples. Reading: Sections 7.1, 7.2.

Tu 13: Homework 8 due, homework 9 out. $NTIME(f(n))$ class; the class NP. Polynomial-time reductions. P vs. NP; NP-completeness. Reading: Sections 7.3, 7.4 through top of page 274.

Th 15: NP-completeness of SAT. 3-SAT. Reading: Section 7.4.

Tu 20: Homework 9 due, homework 10 out. 3-SAT, continued. Polynomial-time reductions; proving NP-completeness: CLIQUE. Reading: Section 7.4

Th 22: Thanksgiving break.

Tu 27: Homework 9 due, homework 10 out. Review: NP completeness. SUBSET-SUM, VERTEX-COVER. Widgets. Reading: Section 7.4

Th 29: HAMPATH. Reading: Section 7.4

December *Tu 4:* Advanced topic.

Th 6: Homework 10 due. Exam review; maybe, more advanced topic.

TBA: FINAL EXAM