

CSE 322  
Intro to Formal Models in CS  
Course Outline

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Core material outlined below usually constitutes most of the course work. Some selection of optional material marked below or other topics fills the rest.

1. Alphabets, strings, languages; operations on them.
2. Ways of formally defining models; states, transitions, acceptance, etc.; nondeterminism.
3. Finite Automata and Regular Expressions (4-5 weeks).
  - (a) Deterministic and non-deterministic FA.
  - (b)  $\epsilon$ -moves.
  - (c) Regular expressions.
  - (d) Right-, and left-linear grammars
  - (e) Equivalence of all of these.
  - (f) Pumping lemma.
  - (g) Closure under  $\cup, \cap, \cdot, *, \neg$ .
  - (h) Optional: two-way FA, transducers, other closure results, state minimization.
4. Context-Free Grammars and Pushdown Automata (4-5 weeks)
  - (a) Grammars, derivations, derivation trees, ambiguity.
  - (b) PDA's and DPDA's.
  - (c) Equivalence of CFG's and PDA's.
  - (d) Pumping Lemma.
  - (e) Closure under  $\cup, \cdot, *$ ; *non*-closure under  $\cap$ .
  - (f) Introduction to parsing.
  - (g) Optional: Grammar manipulations: useless rules, Chomsky & Greibach forms; Ogden's lemma; linear CFL's; variations on acceptance in PDA's; Cocke-Kasami-Younger Algorithm; closure under  $\cap$ -with-regular-set; other closure results.
5. Optional: Turing Machines and Decidability (1–2 weeks; this material is covered in more depth in 431)
  - (a) Definitions.
  - (b) Church-Turing Thesis.
  - (c) Halting Problem.
  - (d) Optional: variations on TM's, an undecidable grammar problem, e.g. CFG intersection =  $\emptyset$ , Post's correspondence problem.
6. Optional: general phrase-structure and context-sensitive grammars, Chomsky hierarchy.