

Syllabus

Basics

Alphabets, Strings, Languages and Classes

Regular Languages

Definition and Models

Closure Properties

Regular Expressions

Equivalence of Finite Automata and Regular Expressions

Pumping Lemma

Context-Free Languages

Definitions

Normal Forms

Pushdown Automata

Equivalence of CFLs and PDAs

CFL Pumping Lemma

Deterministic CFLs

Turing Machines

Multiple Tapes and RAMs

Nondeterministic

Church-Turing Thesis

Computability Theory

Decision Problems

Decidable and Recognizable Sets

Universal Turing Machines

Undecidability

Halting Problem

Rice's Theorem

Recursion Theorem

Complexity Theory

Time and Space (memory)

Multiple Tapes and RAMs

Nondeterministic Computation

DTIME, DSPACE, NTIME, NSPACE

Basic relationships

Savitch's Theorem

Nondeterministic Space closed under complement

Time and Space Hierarchies

The P versus NP problem

Definitions of P and NP

Robustness of definitions

NP-completeness of Satisfiability and other problem

Implications of NP-completeness and how to handle it

Beyond NP

PSPACE

Exponential-Time

Provably Intractable Problems

Other Models of Efficient Computation

Brief discussion of probabilistic, parallel and quantum computation