NPTEL Video Course - Computer Science and Engineering - Theory of Computation

Subject Co-ordinator - Prof. Somenath Biswas

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - What is theory of computation? Set membership problem, basic notions like alphabet, strings, form
Lecture 2 - Introduction to finite automaton
Lecture 3 - Finite automata continued, deterministic finite automata(DFAs), language accepted by a DFA
Lecture 4 - Regular languages, their closure properties
Lecture 5 - DFAs solve set membership problems in linear time, pumping lemma
Lecture 6 - More examples of nonregular languages, proof of pumping lemma, pumping lemma as a game, converse
Lecture 7 - A generalization of pumping lemma, nondeterministic finite automata (NFAs), computation trees for
Lecture 8 - Formal description of NFA, language accepted by NFA, such languages are also regular
Lecture 9 - 'Guess and verify' paradigm for nondeterminism
Lecture 10 - NFA's with epsilon transitions
Lecture 11 - Regular expressions, they denote regular languages
Lecture 12 - Construction of a regular expression for a language given a DFA accepting it. Algebraic closure
Lecture 13 - Closure properties (Continued...)
Lecture 14 - Closure under reversal, use of closure properties
Lecture 15 - Decision problems for regular languages
Lecture 16 - About minimization of states of DFAs. Myhill-Nerode theorem
Lecture 17 - Continuation of proof of Myhill-Nerode theorem
Lecture 18 - Application of Myhill-Nerode theorem. DFA minimization
Lecture 19 - DFA minimization (Continued...)
Lecture 20 - Introduction to context free languages (cfls) and context free grammars (cfgs). Derivation of st
Lecture 21 - Languages generated by a cfg, leftmost derivation, more examples of cfgs and cfls
Lecture 22 - Parse trees, inductive proof that L is L(G). All regular languages are context free
Lecture 23 - Towards Chomsky normal forms
Lecture 24 - Simplification of cfgs continued, Removal of epsilon productions
Lecture 25 - Elimination of unit productions. Converting a cfg into Chomsky normal form. Towards pumping lemm
Lecture 26 - Pumping lemma for cfls. Adversarial paradigm
Lecture 27 - Completion of pumping lemma proof. Examples of use of pumping lemma. Converse of lemma does not
Lecture 28 - Closure properties continued. cfls not closed under complementation
Lecture 29 - Another example of a cfl whose complement is not a cfl. Decision problems for cfls

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Lecture 30 - More decision problems. CYK algorithm for membership decision
Lecture 31 - Introduction to pushdown automata (pda)
Lecture 32 - pda configurations, acceptance notions for pdas. Transition diagrams for pdas
Lecture 33 - Equivalence of acceptance by empty stack and acceptance by  final state
Lecture 34 - Turing machines (TM)
Lecture 35 - Execution trace, another example (unary to binary conversion)
Lecture 36 - Example continued. Finiteness of TM description, TM configuration, language acceptance, definiti
Lecture 37 - Notion of non-acceptance or rejection of a string by a TM. Multitrack TM, its equivalence to sta
Lecture 38 - Simulation of multitape TMs by basic model. Nondeterministic TM (NDTM). Equivalence of NDTMs wit
Lecture 39 - Counter machines and their equivalence to basic TM model
Lecture 40 - TMs can simulate computers, diagonalization proof
Lecture 41 - Existence of non-r.e. languages, recursive languages, notion of decidability
Lecture 42 - Separation of recursive and r.e. classes, halting problem and its undecidability
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