B.Tech. Degree V Semester Examination, January 2002

CS 504 AUTOMATA LANGUAGES AND COMPUTATION

(1999 Admissions)

Time: 3 Hours *Maximum Marks: 100*

MODULE - I

(a) Construct a DFA which accepts all strings over the alphabet {0, 1} having an odd number of zeros. (10)

(b) Prove that given an NFA, there is an equivalent DFA. (10)

OR

II (a) Establish the equivalence of NFA with and without E-moves. (10)

(b) Suppose δ is the transition function of a DFA. Prove that for any input strings x and y, $\delta(q, xy) = \delta(\delta(q, x), y)$. (10)

MODULE - II

III. (a) Establish the Equivalence of Moore and Meelay machines. (10)

(b) Construct the finite automata equivalent to the following regular expressions:

(i) $(10 + 01)^*$

(ii) $01^* + 10^*$ (10)

OR

IV. (a) State and prove Myhill-Nerode theorem. (10)

(b) Which of the following are regular sets? Prove your answer.

(i) $\{0^{2n} | n \geq 1\}$

(ii) $\{0^n | n \text{ is a prime}\}$ (10)

MODULE - III

V. (a) Explain the term 'useless symbol' with the help of an example. (3)

(b) Prove that any context-free language without ε is generated by a grammar in which all productions are of the form $A \rightarrow BC$ or $A \rightarrow a$, where A, B, C are variables and a is a terminal. (7)

(c) Explain the term Push Down Automata. Distinguish betweeen deterministic and non-deterministic Push Down Automata. (10)

OR

VI. (a) State and prove the pumping lemma for context free languages. (10)

(b) Show that context free languages are closed under homomorphism. (10)

MODULE - IV

VII. (a) Discuss the basic model of a Turing machine. Explain the term 'Language accepted by by a Turing machine. (10)

(b) Construct a turing machine which recognizes the language $\{w\, c\, w | w \text{ in } (a+b)^+\}$. (10)

OR

VIII. (a) Explain the use of subroutines in designing a turing machine to implement multiplication. (10)

(b) Explain the term 'non deterministic turing machine'. Show that if L is accepted by a non deterministic Turing machine M_1, then L is accepted by some deterministic Turing machine M_2. (10)

MODULE - V

IX. (a) Distinguish between decidable and undecidable problems. Prove that it is undecidable whether a Turing Machine halts on all inputs. (10)

(b) Prove that if L has a regular grammar, then L is a regular set. (10)

OR

X. (a) Explain the term 'Context Sensitive Language'. Show that if L is a Context Sensitive Language, then L is accepted by some linear bounded automata. (10)

(b) Prove that there is a recursive language that is not context-sensitive. (10)

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