B. Tech Degree IV Semester Examination April 2011

CS/IT 404 AUTOMATA LANGUAGES AND COMPUTATION

(*2006 Scheme*)

Time : 3 Hours Maximum Marks : 100

PART – A

(Answer ***ALL*** questions)

(8 x 5 = 40)

I. (a) State the relation between Regular Languages and Finite Automata.
(b) State Myhill-Nerode theorem.
(c) Define Chomsky Normal Form and Greibach Normal Form.
(d) State Pumping Lemma for context free languages.
(e) Explain the working of a Standard Turing Machine.
(f) Explain Multitrack Turing Machine.
(g) What are Recursive and Recursively Enumerable Languages?
(h) Explain Chomsky Hierarchy.

PART – B

(4 x 15 = 60)

II. (a) Define a DFA. Construct a DFA for the language. $L = \{w / w$ has odd number of 1's and even number of $0's\}$ (8)

(b) Prove the equivalence of NFA and DFA. (7)

OR

III. (a) Prove that the following languages are not regular using Pumping Lemma:

(i) $\{o^n 1^m 2^n \mid n, m \geq 1\}$

(ii) $\{a^n b^{2n} \mid n \geq 1\}$. (6)

(b) Construct an NFA for the regular expression $(a+b)^* a\ bb$. (4)

(c) Differentiate Moore Machine and Mealy Machine. (5)

IV. (a) Define Ambiguous Grammar. Show that the following grammar is ambiguous :

$$E \rightarrow E+E \mid E*E \mid (E) \mid I$$

$$E \rightarrow a \mid b \mid c$$ (8)

(b) Convert the following CFG to GNF: $S \rightarrow ab\,Sb \mid aa$ (7)

OR

V. (a) Find a CFG that generates the language $L = \{a^n b^{n+1} \mid n \geq 0\}$. (6)

(b) Define a PDA. Design a PDA to accept the language $L = \{ww^R \mid w \in \{0+1\}^*\}$. (9)

VI. (a) Design a Turing Machine that accepts the language $L = \{a^n b^n \mid n \geq 0\}$. (7)

(b) Write short notes on the following –
(i) Non-deterministic TM (ii) Universal TM (8)

OR

VII. (a) Design a Turing Machine that recognizes the language $L = \{wcw \mid w \text{ in } (a+b)^+\}$. (8)

(b) Explain how a Turing Machine can simulate subroutines. (7)

VIII. (a) Show that if L is Recursive, so is $\overline{L}$. (6)

(b) State Halting Problem of Turing Machine. Show that the Halting Problem of Turing Machine is undecidable. (9)

OR

IX. (a) Define Linear Bounded Automata. (5)

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

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