B. Tech Degree V Semester (Supplementary) Examination May 2006

CS 504 AUTOMATA LANGUAGES AND COMPUTATION
(Prior to 2002 Admissions)

Time : 3 Hours   Maximum Marks : 100

I.   (a)   Construct DFA for the following sets over alphabet $\sum = \{0,1\}$:

       (i)   The set of strings where the number of 0's in every string is multiple of three.   (10)
       (ii)   The set of strings either start with 01 or end with 01.

   (b)   Differentiate DFA and NFA with suitable examples.   (10)

OR

II.   (a)   Design a NFA for the language, $L = \{(a^n : n \geq 0) \cup (b^n a : n \geq 1)\}$.   (5)

   (b)   Design a DFA for the language, \

$$L = \left\{ w : n_a(w) \geq 1, n_b(w) = 2, w \in \{a,b\}^* \right\}.$$ (5)

   (c)   Discuss about conversion of NFA with ε – transitions to NFA without ε – transitions with suitable example.   (10)

III.   (a)   Explain the various steps for minimization of DFA by using Myhill Nerode's theorem. Give an example.   (15)

   (b)   Design a Moore machine which counts the occurrence of substring aab in input string.   (5)

OR

IV.   (a)   Write regular expression for the language,

$$L = \{a^n b^m : (n+m) \text{ is even}\}.$$ (5)

   (b)   Discuss the equivalence of Mealy machine and Moore machine.   (5)

   (c)   State and prove pumping lemma for regular sets.   (10)

V.   (a)   Find a derivation tree of $a * b + a * b$ given that $a * b + a * b$ is in $L(G)$, where G is given by

$$s \to s + s / s * s$$
$$s \to a / b.$$ (5)

   (b)   Briefly explain how to eliminate useless symbols from a context free grammar.   (5)

   (c)   Prove that the family of context free languages is closed under union, concatenation and kleene star closure.   (10)

OR

VI.   (a)   Define Chomsky Normal Form and Greibach Normal Form in reference to context free languages. Give suitable examples.   (10)

   (b)   Construct the push down automata for the language,

$$L = \{a^n b^{n+1} / n = 1,2,3.....\}.$$ (5)

   (c)   Write a CFG, which generates palindrome for binary numbers.   (5)

VII.   (a)   Explain Turing machine model.   (10)

   (b)   Prove that the following function is turing computable,

$$f(m) = \begin{cases} m-2, & \text{if } m > 2 \\ 1, & \text{if } m \leq 2. \end{cases}$$ (10)

OR

VIII.   (a)   Briefly describe Multiple Tapes Turing machine and Non-deterministic Turing machine. (10)

   (b)   Design a Turing machine that replace every 0 with 1 and every 1 with 0 in a binary string.(10)

IX.   (a)   Define Chomsky hierarchy of languages.   (10)

   (b)   Prove the following theorems :
       (i)   The union of two recursive language is recursive
       (ii)   The union of two recursively enumerable languages is recursively enumerable.   (10)

OR

X.   (a)   Write short note on the following :
       (i)   Universal Turing Machine   (ii)   Halting problem.   (10)

   (b)   State and prove theorems that shows the relation between classes of languages.   (10)

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