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CS/M.Tech (CSE)/SEM-1/PGCS-105-B/2010-11

2010-11
THEORY OF COMPUTATION

Time Allotted : 3 Hours | *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* of the following. 5 × 14 = 70

1. a) Design an FA for the RE $a^* + (ab + a)^*$ 5

   b) Is $L = \{a^{2n} \mid n \geq 1\}$ regular ? 4

   c) Construct a grammar G generating $\{xx \mid x \in (a,b)^*\}$. 5

2. a) Using the pumping lemma prove that $L = \{a^P \mid P \text{ is a prime}\}$ is not regular. 4

   b) Prove
   $(1 + 00^*1) + (1 + 00^*1)(0 + 10^*1)^* (0 + 10^*1) = 0^*1(0 + 10^*1)^*$. 5

   c) Write the CFG for the language $L = \{0^i 1^j 2^k \mid i = j \text{ or } j = k\}$. 5

3. a) State and prove pumping lemma for regular language. 8

   b) Show that $L=\{a^n b^n c^n \mid n \geq 1\}$ is not context-free but context-sensitive. 6

4. a) Construct a PDA A equivalent to the following CFG :

   $S \rightarrow OBB, B \rightarrow 0S \mid 1S \mid 0.$

   Test whether 010^4 is in $N(A)$. 7

   b) Construct a PDA accepting by empty store of the following language :

   $L=\{a^n b^m c^n \mid m,n \geq 1\}$. 7

5. a) Construct a CFG that generates the language $L=\{wcw^r \mid w \in (a,b)^*\}$. 4

   b) Reduce the following grammar to GNF : 6

   $S \rightarrow AB, A \rightarrow BS, A \rightarrow b, B \rightarrow SA, B \rightarrow a.$

   c) Prove that CFLs are not closed under intersection and complement operation. 4

6. a) Design a TM which can multiply two positive integers. 8

   b) Construct a TM that accepts the language $01^* + 10^*$. 6

7. a) Design a turing machine that converts a binary string into its equivalent unary string. 5

b) Construct a turing machine that enumerates $\{0^n 1^n \mid n \geq 1\}$. 4

c) Construct a turing machine that can accept the strings over { 0, 1 } containing even number of 1's. 5