No. of Printed Pages : 3

CS-73

# BACHELOR OF COMPUTER APPLICATIONS (PRE-REVISED)

01554

## Term-End Examination

## June, 2013

## CS-73 : THEORY OF COMPUTER SCIENCE

*Time : 3 hours* *Maximum Marks : 75*

*Note : Question **no. 1** is **compulsory**. Attempt **any three** from the rest.*

1. (a) Construct a Deterministic Finite Automate (DFA) that recognises the following language : 4

   $L = \{w \in \{a, b\}^* : w \text{ ends with either aa or bb}\}$

   (b) Draw an NDFA that accept all strings over $\Sigma = \{0, 1\}$ containing 0101 as a substring. 3

   (c) Using pumping lemma of regular language, show that the language $L = \{a^n b^n\}$ is not regular. 5

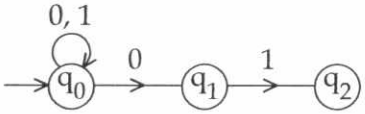
   (d) Explain the chomsky classification of grammar with the help of an example. 5

   (e) Design a Turing Machine (TM) to reverse a given string w to $w^R$ over $\Sigma = \{a, b\}$ 5

(f) Define context - Free grammar (CFG). Write a CFG for the language : $L = \{a^n b^m c^m d^n : n, m \geq 1\}$ 4

(g) Prove that the Union of two recursive languages $L_1$ and $L_2$ is also recursive. 4

2. (a) Obtain the DFA equivalent to the following NFA. 5




(b) Show that if L is regular, then the complement of L (that is L') is also regular. 5

(c) Prove that $L = \{a^i b^i c^i : i \geq 1\}$ is not a context free language. 5

3. (a) Construct a PDA to accepts language $\{(a, b)^n : n \geq 1\}$ by empty stack. 5

(b) Let G be the grammar 10

$S \rightarrow aB / bA$

$A \rightarrow a / aS / bAA$

$B \rightarrow b / bS / aBB$

For string aaabbabbba find

(i) Left most derivation

(ii) Right most derivation

(iii) Parse tree

(iv) Is the grammar unambiguous ?

4. (a) Design a TM over $\Sigma = \{a, b\}$ with no more than three states that accepts the language (a (a + b)*). 5

(b) Define the Chomsky Normal Form for context free grammar (CFG). Is the following CFG is in CNF ? Justify your answer. 5

$$\begin{pmatrix} S \rightarrow AB \\ A \rightarrow BS/b \\ B \rightarrow SA/a \end{pmatrix}$$

(c) Explain the concept of Universal Turing Machine. 5

5. (a) Show that the function $f(x, y) = x + y$ is primitive recursive. 5

(b) Does Post Correspondence Problem (PCP) with following two list : A = (10, 011, 101) and B = (101, 11, 011) have a solution ? Justify your answer. 5

(c) Differentiate between $\Omega$ and $\theta$ notations with the help of an example. 5

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