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CS-73

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Pre-Revised)

01363 **Term-End Examination**

June, 2015

CS-73 : THEORY OF COMPUTER SCIENCE

Time : 3 hours *Maximum Marks : 75*

Note : *Question number **1** is **compulsory**. Attempt any **three** questions from the rest.*

1. (a) Give the regular expression for the strings $\{a^2, a^5, a^8, ...\}$. 2

(b) List three applications of Finite Automata. 3

(c) Briefly describe a Non-Deterministic Turing Machine. 5

(d) Tabulate Chomsky hierarchy of grammar with an example for each. 5

(e) Construct FA for the language

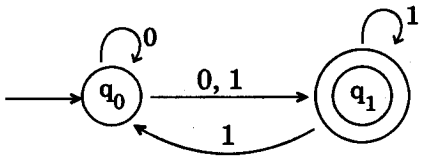
$L(m) = \{aa, bb, aabb, aaaabbbb, ...\}$. 5

(f) Using parse tree, verify whether the following grammar is ambiguous or unambiguous :

$S \rightarrow aSa \mid bSb \mid a \mid b \mid \varepsilon$ 5

(g) Show that if L and M are regular languages, then $L \cap M$ is also regular. 5

2. (a) Derive the equivalent FA from the following NFA : *5*



(b) Convert the following regular expression into a FA : *5*

(aa)* a (bb)*

(c) Give regular expression for all strings that do not end with ab. *5*

3. (a) Show that the language

$L = \{ a^n b^n a^n : n \geq 0\}$ is not regular. *5*

(b) Design a Turing Machine which multiplies the given binary input value by 2. *5*

(c) Explain in brief Universal Turing Machine. *5*

4. (a) Construct a PDA to accept

$L = \{ww^R \mid w \in (0 + 1)^*\}$,

where w^R is reversed w. *5*

(b) Show that the language

$L = \{a^{n^2} b^n : n \geq 0\}$ is not context free. *5*

(c) Show that the predecessor function

pred : $N \rightarrow N$ defined as

$$\text{pred}(n) = \begin{cases} 0 & \text{if } n=0 \\ n-1 & \text{if } n \geq 1 \end{cases}$$

is primitive recursive. *5*

5. (a) Show that the state entry problem is undecidable. *4*

(b) If $f(x) = 2x^3 + 3x^2 + 1$ *6*

then show that

$f(x) = O(x^4)$

and also

$f(x) \neq O(x^2)$.

(c) Define the following : *5*

(i) NP-Complete problem

(ii) NP-Hard problem