No. of Printed Pages : 3 03504 CS-73

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

Term-End Examination

December, 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 $\{a, a^4, a^7 ...\}$. *2*

(b) List three applications of regular expressions. *3*

(c) Describe briefly the Deterministic Turing Machine. *5*

(d) Tabulate the Chomsky hierarchy of grammar with an example. *5*

(e) Convert the following regular expression into an FA : *5*

$(aa)^* (bb)^*$

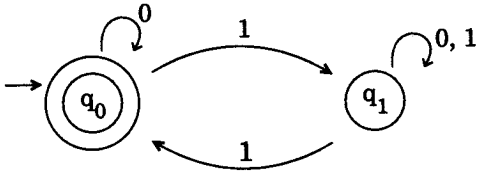
(f) Using parse tree, verify whether the given grammar is ambiguous or not. *5*

$S \rightarrow aS \mid aSb \mid X$

$X \rightarrow Xa \mid a$

(g) Show that if L is a regular language, then $\overline{L}$ is also regular. *5*

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



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

ab* (ab)* a*

(c) Give a regular expression for all strings that have no two consecutive a's. 5

3. (a) Show that the language

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

(b) Design a Turing Machine which accepts all the strings of the language

$L(m) = \{ a^n b^n c^n : n \geq 1 \}$. 5

(c) Explain the Non-Deterministic Turing Machine, with an example. 5

4. (a) Construct a PDA to accept

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

where w^R means Reversed w. 5

(b) Show that the language

$L = \{ a^n b^n a^n : n \geq 1 \}$ is not context free. 5

(c) Show that the following function

$$eq\ (m, n) = \begin{cases} 1 & \text{if } m = n \\ 0 & \text{else} \end{cases}$$

is primitive recursive. 5

5. (a) Show that the blank tape halting problem is undecidable. 4

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

then show that

$$x^3 = O(f(x))$$

and also

$$x^4 = O(f(x)).$$ 6

(c) Show that the Travelling Salesman problem is NP complete. 5
