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CS-73

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

Term-End Examination

00095

June, 2018

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.*

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1. (a) Determine a deterministic Finite State Automaton from the given non-deterministic Finite State Automaton

$$M = (\{q_0, q_1\}, \{a, b\}, \delta, q_0, \{q_1\})$$

with the state table diagram for δ given below : *8*

δ	a	b
q_0	$\{q_0, q_1\}$	$\{q_1\}$
q_1	ϕ	$\{q_0, q_1\}$

(b) Obtain the regular expression for the languages given by *4*

(i) $L_1 = \{a^{2n} b^{2m+1} \mid n \geq 0, m \geq 0\}$

(ii) $L_2 = \{a, bb, aa, abb, ba, bbb, ...\}$

(c) Given a CFG $G = (N, T, P, S)$ with

$$N = \{s\},\ T = \{a, b\} \text{ and}$$

$$P = \left\{ \begin{array}{l} (1)\ S \to aSb \\ (2)\ S \to ab \end{array} \right\}.$$

Obtain the derivation tree and the language generated L(G). *6*

(d) Show that there exists no algorithm for deciding whether any one CFG is ambiguous. *6*

(e) Prove that the function $f(x, y) = \max(x, y)$ is primitive recursive. *6*

2. (a) Define a regular set. Using Pumping Lemma, show that the language $L = \{a^n b^k : n > k \text{ and } n \geq 0\}$ is not regular. *8*

(b) Tabulate the Chomsky hierarchy with an example for each type of grammar. *7*

3. (a) Reduce the given CFG with Productions given by

$S \to abSb \mid a \mid aAb$ and

$A \to bS \mid aAAb$

to Chomsky Normal form. *10*

(b) Prove that if L is a CFL, then L* is also a CFL. *5*

4. (a) Construct a Turing Machine that recognizes the language $L = \{0^{n,m} : n, m \geq 0\}$. *10*

(b) Write a short note on Universal Turing Machine. *5*

5. (a) With a suitable example, explain various asymptotic notations in detail. *10*

(b) Discuss the applications of finite automata. *5*