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CS-73

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

00699

Term-End Examination

December, 2017

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) Find the regular expression for the strings

$L = \{baa, abaa, aaabaa \ldots\}$ 2

(b) List three applications of CFG. 3

(c) Differentiate between Deterministic Push-down Automata (DPDA) and Non-deterministic Push-down Automata (NPDA). 5

(d) Tabulate the Chomsky Hierarchy of Grammars with examples. 5

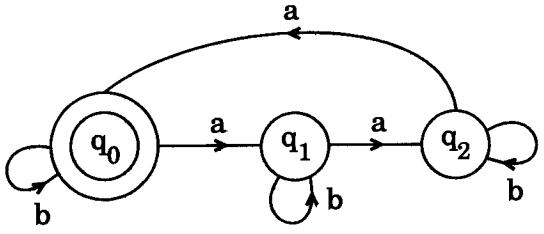
(e) Define Ambiguity in Context-Free Grammar (CFG). Show that the Grammar $S \rightarrow SbS \mid a$ is ambiguous. 5

(f) If L_1 and L_2 are two Regular Languages over alphabet Σ, then show that union of L_1 and L_2 (i.e., $L_1 \cup L_2$) is also Regular. 5

(g) Construct a Non-deterministic Finite Automata accepting a set of all strings over {a, b} ending in aba. Use it to construct a DFA accepting the same set of strings. 5

2. (a) Construct a DFA with reduced states equivalent to the regular expression $10 + (0 + 11)\, 0^*\, 1$. 5

(b) Find the Regular Expression (R.E.) for the following Finite Automata : 5



(c) Write a CFG for the Regular Expression

$r = 0^*\, 1\, (0 + 1)^*$. 5

3. (a) Construct the Push-down Automata for the following language : 5

$L = \{a^n\, b^{n+1} \mid n = 1, 2, 3, ...\}$

(b) Prove that the language

$L = \{0^k \mid k \text{ is prime}\}$ is not regular. 5

(c) Explain a Turing Machine (TM) with the help of an example. 5

4. (a) Define NP-class of problems. List three problems which are NP-complete. 5

(b) Show that $L = \{a^n b^n c^n \mid n \geq 1\}$ is not context-free. 5

(c) Prove that the function $f(x, y) = x * y$ is primitive recursive. 5

5. (a) Prove that the Halting Problem of a Turing Machine is undecidable. 5

(b) Define the following : 5

(i) Primitive recursive vs Recursive functions

(ii) NP-hard problems

(c) Define O (Big "oh") Notation. Show that $5n^2 + 3n + 2 = O(n^2)$. 5