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BICS-018

B.Tech. – VIEP – COMPUTER SCIENCE AND ENGINEERING (BTCSVI)

Term-End Examination

00933

December, 2016

BICS-018 : THEORY OF COMPUTATION

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks.*

1. (a) Construct a DFA accepting all strings ω over {0, 1} such that the number of 1's in ω is 3 mod 4. *5*

(b) Construct a finite automaton equivalent to the regular expression $(0 + 1 (0 + 01)^* 00)^*$. *5*

2. (a) What is a context-free grammar ? Construct a reduced grammar to the following grammar : *5*

$S \rightarrow aAa$

$A \rightarrow Sb / bCC / DaA$

$C \rightarrow abb / DD$

$E \rightarrow aC$

$D \rightarrow aDA$

(b) What is pumping lemma for regular sets ? Show that $L = \{0^i 1^i \mid n \geq 1\}$ is not regular. 5

3. (a) Construct the transition systems equivalent to the regular expression $(ab + a)^* (aa + b)$. 5

(b) Prove the following identity : 5

$$(a^* ab + ba)^* a^* = (a + ab + ba)^*$$

4. (a) Define ambiguous grammar and give an example. Show that the following grammar is ambiguous : 5

$$S \rightarrow aSbS / bSaS / \varepsilon$$

(b) Construct a finite automaton equivalent to the regular expression $(10 + (0 + 11)1^* 0)$. 5

5. Describe Turing Machine. Design a Turing machine that accepts the language

$L = \{w = \{a, b, c\}^* \mid w$ contains equal number of a's, b's and c's$\}$. 10

6. Define Deterministic Push Down Automata (DPDA). Design a DPDA for the language $L = \{a^m b^n \mid m > n \geq 1\}$. 10

7. What is Church's hypothesis ? Explain it. Also describe undecidability and Rice's theorem. 10

8. Explain recursive and recursively enumerable languages with their applications and also compare and contrast decidability and undecidability. 10

9. What is the difference between recursive and recursively enumerable languages ? Show that the union of two recursively enumerable languages is recursively enumerable. *10*

10. Write short notes on any ***two*** of the following : *2×5=10*

(a) NP-complete and NP-hard problems

(b) Equivalence among DFA, NFA and NFA with e-move

(c) Hamiltonian path and Chromatic number problems