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BICS-018

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

Term-End Examination

00014

December, 2017

BICS-018 : THEORY OF COMPUTATION

Time : 3 hours *Maximum Marks : 70*

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

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1. (a) Discuss the equivalence among DFA, NFA and NFA with ε moves. Give suitable examples for each. *6*

(b) Construct a DFA for equivalent Regular Expression R : *4*

$$R = (01 + 2^*)^* 1$$

2. (a) Describe the term Deterministic PDA. Show that $\{a^n b^n \mid n > 1\} \cup \{a^m b^{2m} \mid m > 1\}$ cannot be accepted by deterministic PDA. *5*

(b) Construct a PDA equivalent to the Context-Free Grammar (CFG)

$S \rightarrow 0BB, B \rightarrow 0S, B \rightarrow 1S, B \rightarrow 0$

and test whether 010 satisfies the PDA. *5*

3. (a) Explain Pumping Lemma for Context-Free Language (CFL) and prove that the language $L = \{0^k \mid k \text{ is a perfect square}\}$ is not a CFL. 5

(b) Differentiate between Turing Machine (TM) and Pushdown Automata (PDA). Design a TM to recognize all strings consisting of even number of 1's. 5

4. (a) How does a Moore machine differ from a Mealy machine ? Design a Moore and Mealy machine to convert each occurrence of substring 100 with 101. 5

(b) What is Chomsky Normal Form ? Convert the following grammar to Chomsky normal form : 5

$S \rightarrow AaB \mid aaB; A \rightarrow \varepsilon; B \rightarrow bbA \mid \varepsilon$

5. (a) What is Context-Free Grammar (CFG) ? Construct a reduced grammar equivalent to the grammar

$S \rightarrow aAa; A \rightarrow Sb \mid bCC \mid DaA$

$C \rightarrow abb \mid DD; E \rightarrow aC; D \rightarrow aDA$ 5

(b) Differentiate between recursive and recursive enumerable languages. Verify that the union of two recursively enumerable languages is recursively enumerable. 5

6. (a) State the Vertex Cover problem with the help of suitable example. 5

(b) Discuss the Travelling Salesperson problem with the help of suitable example. 5

7. (a) Differentiate between Deterministic and Non-deterministic Pushdown Automata. Explain the relation between Pushdown Automata and Context-Free Grammars. 5

(b) State and explain Rice's Theorem with the help of suitable example. 5

8. (a) Compare and contrast the following : 5

(i) Decidability and Undecidability

(ii) Context Sensitive Grammar and Context-Free Grammar

(b) Discuss Myhill-Nerode theorem with its applications. 5

9. (a) What is Finite Automata (FA) ? Construct a Non-Deterministic Finite Automata (NDFA) accepting {ab, ba} and use it to construct a deterministic automation, accepting the same set. 5

(b) When is a Grammar said to be

(i) Ambiguous ?

(ii) Reduced ? 5

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

(a) Modifications of Turing Machine

(b) Chromatic Number Problem

(c) Significance of NFA with $\wedge$-transitions

(d) Church's Hypothesis

(e) NP-Complete Problem