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Total No. of Questions-8] [Total No. of Printed Pages-3

B.E. V Semester Examination

BE-V/12 (A)

233904

COMP. ENGG.

Course No. COM-504

(Automata & Formal Languages)

Time Allowed-3Hours *Maximum Marks-100*

Note : Attempt **five** questions at least two questions from each section. Each question carries **20** marks.

Section - A

1. a) Why do we need to study NFA if we have less number of states in DFA? Justify. **(7)**

b) Design the DFA for "Even number of a's and Odd number of b's". Design a machine to check the divisibility by 4. **(13)**

2. a) State the theorem on pumping Lemma for regular expressions **(8)**

b) Prove by using pumping Lemma that the language L is not regular, such that:

$$L = \{w \varepsilon \sum^{*} : \sum = \{a,b\} \text{ and } N_a(w) < N_b(w)\} N_a(w)$$

represents number of a's in w. **(6)**

c) How do you define a PDA? What is the difference between FA and PDA? **(6)**

3. a) Find DFA and Re ssion when the DFA a all strings correspon ression (*0 (0+1)*. explain how to conv to Regular Expression by eliminating states? **(10)**

b) Construct a FA that acc 0+1}* . Obtain a derivation tree for the string 00110 g grammar:

$S \to A0S / 0 / SS$

$A \to S / 1A / 10$ **(10)**

4. Prove or disprove each of the following statements, stating clearly any well-known results that you use.

a) For any regular expressions r and s, the regular expressions $(r^*s^*)^*$ *and* $(rls)^*$ always denote the same language. **(10)**

b) Let L be a regular language over an alphabet $\sum$. Then the language consisting of those $u \in \sum^*$ such that there is some $v \in \sum^*$ with $uv \in L$, is also a regular language.**(10)**

Section - B

5. a) Explain optimization of grammars with examples and perform the optimization for grammar:

$S \rightarrow XY \quad X \rightarrow Zb \quad Y \rightarrow bW \quad Z \rightarrow AB \quad W \rightarrow Z$

$A \rightarrow aA|bA|\in \quad B \rightarrow Ba|Bb|$. **(10)**

b) Construct a PDA for following language: $L = \{a^n b^{2n} | n >= 1\}$ **(10)**

6. a) Design a Turing Machine to accept the set of all palindrome over $\{0,1\}^*$. Draw a transition diagram for the Turing Machine of the above. **(10)**

b) Define pumping Lemma. How is it used in CFG? Explain with an example. **(10)**

7. Explain Halting problem of Turing Machine. What are the consequences of Halting Problem? **(20)**

8. Write short notes on:

a) Decidability problem **(10)**

b) Universal Turing Machine. **(10)**