

310245



Seat No.	
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T.E. (Computer) (Semester – I) Examination, 2014
THEORY OF COMPUTATION
(2008 Course)

Time : 3 Hours

Max. Marks : 100

- Instructions :**
- 1) Answers to the **two** Sections should be written in **separate** answer books.
 - 2) Answer **any three** questions from each Section.
 - 3) **Neat** diagrams must be drawn **wherever** necessary.
 - 4) Figures to the **right** side indicate **full** marks.
 - 5) Use of calculator is **allowed**.
 - 6) Assume suitable data if **necessary**.

SECTION – I

1. a) Define the following formally with example. 6
 - i) Alphabet
 - ii) Non deterministic finite automata
 - iii) Deterministic finite automata.
- b) An NFA with states 1-5 and input alphabet {a, b} has following transition table : 6

q	$\delta(q, a)$	$\delta(q, b)$
1	{1, 2}	{1}
2	{3}	{3}
3	{4}	{4}
4	{5}	Φ
5	Φ	{5}

- i) Draw transition diagram
 - ii) Calculate $\delta^*(1, ab)$
 - iii) Calculate $\delta^*(1, abaab)$.
 - c) Give the Mealy and Moore machine for the following processes. "For input from $(0+1)^*$, if input ends in 101, output x, if input ends in 110, output y; otherwise output z". 6
- OR
2. a) Define the Moore and Mealy machine and how the equivalence of Moore and Mealy machines can be established with example. 6

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- b) Construct NFA and DFA for accepting all possible string of zeroes and ones not containing 101 as a substring. 8
- c) Differentiate between NFA and DFA. 4
3. a) Let L be any subset of 0^* . Prove that L is regular. 4
- b) For each of the following draw DFA of following regular expression : 8
- i) $(11+00)^*$
- ii) $(111+100)^*0$.
- c) Show that $P^*(QP^*)^*=(P+Q)^*$. 4
- OR
4. a) Write R.E. for the following : 6
- i) $\Sigma = (0, 1)$ odd number of 1's in strings.
- ii) $\Sigma = (0, 1)$ Triple 0 must never appear in strings. 6
- b) Explain following application of R.E. 6
- i) GREP utilities of unix.
- ii) Finding pattern in text.
- c) Write a short note on pumping lemma. 4
5. a) Give the CFG for the following languages : 8
- i) $(011+1)^*(01)^*$
- ii) $0^i1^j+k0^k$.
- b) Give an ambiguous grammar for if then else statement and then re-write an equivalent unambiguous grammar. 8
- OR
6. a) Give CFG for set of odd length settings in $\{0, 1\}^*$ with middle symbol '1'. 4
- b) Convert following grammar to CNF. 6
- $S \rightarrow ABA$
- $A \rightarrow aA \mid \epsilon$
- $B \rightarrow bB \mid \epsilon$
- c) Construct the right linear grammar corresponding to the regular expression. 6
- $R = (0 + 1)1^* (1 + (01)^*)$

SECTION – II

7. a) Construct the PDA and then its equivalent CFG for the language L as given below : 16
- $L = \{ XcX^r \mid X \in \{a, b\}^* \text{ and string } X^r \text{ is the reverse of string } X \}$
- b) Justify with suitable example the following statement : 2
- Two-stack PDA is more powerful than one-stack PDA.
- OR



8. a) Convert the Pushdown Automata (PDA) with the following moves into a Context Free Grammar (CFG) : 12
- $\delta(q_0, a, Z_0) = \{(q_0, a, Z_0)\}$
 $\delta(q_0, a, a) = \{(q_0, aa)\}$
 $\delta(q_0, b, a) = \{(q_1, \epsilon)\}$
 $\delta(q_1, b, a) = \{(q_1, \epsilon)\}$
 $\delta(q_0, \epsilon, Z_0) = \{(q_1, \epsilon)\}$
- b) Design a PDA for the following grammar : 6
- $S \rightarrow aSb \mid bSa \mid SS \mid \Lambda$
- Is the resultant PDA deterministic or non-deterministic ? Justify your answer.
9. a) Design Turing Machines for the following languages : 14
- i) $L = \{x \mid x \in \{0, 1\}^* \text{ such that } x \text{ is an even or odd palindrome string}\}$
 ii) $L = \{x \mid x \in \{a, b\}^* \text{ having strings equal number of 'a's and 'b's}\}$
- b) What are the limitations of Turing Machine. 2
- OR
10. a) Design a TM to copy a string over $\{a, b\}^*$. 8
- b) Write short notes on : 8
- i) TM and halting problem
 ii) Post machines.
11. a) Show that if L_1 and L_2 are recursive languages, then $L_1 \cup L_2$ and $L_1 \cap L_2$ are also recursive. 8
- b) Show that both P and NP are closed under the operations of union, intersection, concatenation and Kleene's closure. 8
- OR
12. a) Define and explain Recursive and Recursively Enumerable Languages. 8
- b) Write short notes on : 8
- i) Undecidability
 ii) Post Correspondence Problem.

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