

## T.E. (Computer) (Semester – I) Examination, 2010 THEORY OF COMPUTATIONS

(2003 Course) Time: 3 Hours Max. Marks: 100 N.B.: 1) Answer three questions from each Section. 2) Answer to the two Sections should be written in separate answer -books. 3) Neat diagrams must be drawn whenever necessary. 4) Figures to the right indicate full marks. 5) Assume suitable data, if necessary. SECTION - I 1. a) Define the Moore and Mealy machine and how the equivalence of Moore and Mealy machines can be design? With any example. — A ASA — ? (d) 6 1. b) Construct NFA and DFA for accepting all possible strings of zeroes and ones which does not contain 011 as a substring. 10 OR 2. a) Design a Moore machine for the 1's complement of binary number. 6 2. b) Design DFA for a language of string 0 and 1 that 016 a) Describe the language answer with the example string derive from the gramm 01 driw gnibn3 (IOUS II) Ending with 11 III) Ending with 1 3. a) Prove the formula 6 a) (r\*s\*)\* = (r + s)\*b) (00\*1)\*1 = 1 + 0(0 + 10)\*113. b) Find the regular expression corresponding to each of the following subset of  $\{0,1\}*$ a) The language of all strings not containing the substring 000 b) The language of all strings that do not contain the substring 110 c) The language of all strings containing both 101 and 010 as substring.



4. a) Consider the two regular expressions  $r = 0^* + 1^*$   $s = 01^* + 10^* + 1^*0 + (0^*1)^*$ . a) find the string corresponding to r but not to s b) find the string corresponding to s but not to r c) find the string corresponding to both r and f 4. b) For each of the following draw DFA of following regular expression 8 a) (11 + 00)\* b) (111 + 100)\*0 5. a) In each case, show that the grammar is ambiguous, and find the equivalent unambiguous grammar 12 a)  $S \rightarrow SS/a/b$ b)  $S \rightarrow ABA \quad A \rightarrow aAb/\epsilon \quad B \rightarrow bB/\epsilon$ c)  $S \rightarrow aSb / aaSb / \epsilon$ 5. b) Prove that  $L = \{a^i b^i c^i / i \ge 1\}$  is not a CFL. 6 The Design a Moore machine for the 1's complement of his No number 1 6. a) Describe the language generated by each of these grammar and justify your answer with the example string derive from the grammar of the productions given below. 12 1)  $S \rightarrow aSa/bSb/aAb/bAa$  $A \rightarrow aAa/bAb/a/b/\epsilon$ 2)  $S \rightarrow bT/aT/\epsilon$  $T \rightarrow aS/bS$ 6. b) Convert the following Grammar to CNF 6  $S \rightarrow AACD_{000}$  anguage of all strings not containing the substring 0.000I accompanies of all strings that do not contain the substract  $A \rightarrow A$  $C \rightarrow aC / a$  6 010 bns 101 dod gninis containing both 101 and 010 a  $C \rightarrow aC / a$  $A \rightarrow aDa / bDb / \epsilon$ 



## SECTION - II

7. a) Construct pushdown automata for each of the following language. 12 1) the set of all string over alphabet {a, b} with exactly equal number of a's and b's 2) the set of all string over alphabet {a, b} with the language of even length palindromes 3) the set of all string over alphabet {a, b} with the language of odd length palindromes & a foreigning office goods gold would be a 7. b) Show that if L is accepted by a PDA in which no symbols are removed from the stack, then L is regular, and one speed of paidoan gainst our formation to 6 () [we [a, b] / w contains the same number of a's and NO 8. a) Consider the PDA with the following moves: 8  $\delta(q_0, a, z_0) = \{(q_0, a, z_0)\}$  moisserges in logar and rubing OFO and D to I  $\delta(q_0, a, a) = \{(q_0, aa)\}$  $\delta(q_0, b, a) = \{(q_1, \in)\}$  $\delta(q_1,b,a) = \{(q_1,\in)\}$  and the abdatestiment elevients of a similar as tast work (d  $\delta(q_0, \in, z_0) = \{(q_1, \in)\}$ Obtain CFG equivalent to PDA. 8. b) Give the CFG generating the language accepted by the following PDA:  $M = (\{q_0, q_1\}, \{0, 1\}, \{Z_0, X\}, \delta, q_0, Z_0, \phi)$  where  $\delta$  is given below 8 what the set of languages Lover  $\{0,1\}$  so th  $\{(q_0,XX_0p)\}=\{(Q_0,1,Q_0p)\}$  alverthe set of languages Lover  $\{0,1\}$  so the  $\{(Q_0,Q_0p)\}$  $\delta(q_0, 1, X) = \{(q_0, XX)\}$  $\delta(q_0, 0, X) = \{(q_1, X)\}$  $\delta(q_0, \in, Z_0) = \{(q_0, \in)\}$  $\delta(q_1, 1, X) = \{(q_1, \in)\}$ 

 $\delta(q_1, 0, Z_0) = \{(q_0, Z_0)\}$ 



9. a) Explain the following variations of the turing machine. 8 1) Single infinite tape Turing machine 2) Multitape or Multitrack Turing Machine 3) Multitape or Multi track Turing machine 9. b) Design a turing machine for accepting the strings with an equal number of 0's 2) the set of all string over alphabet [37b] with the language of s. 'I bnath 8 OR 10. a) Design the post machine which accepts the strings of a & b having odd length and the element at the center is 'a'. 10. b) Construct the Turing machine to accept the language 10 1)  $\{w \in \{a, b\}^* / w \text{ contains the same number of a's and b's} \}$ 2)  $\left\{ w \in \{a,b\}^* \ \middle| \ w = w^R \right\}$  is a considering PDA with the following moves: 11. a) Let G be a CFG and r be a regular expression. Show that the problem 10 1) L(G) = L(r)2)  $L(r) \in L(G)$  are undecidable 11. b) Show that an infinite recursively enumerable set has an infinite recursive subset. 6 OR 12. a) Show that if  $L_1$  and  $L_2$  are recursive languages then  $L_1 \cup L_2$  and  $L_1 \cap L_2$ 8 12. b) Show that the set of languages Lover {0, 1} so that neither Lnor L' is recursively enumerable is uncountable. 8  $\{(X_{n}p)\} = (X_{n}0_{n})/6$ B/I/10/4,060

 $S(q_n, \epsilon, Z_n) = \{(q_n, \epsilon)\}$ 



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		1) Single infinite tape Turing machine	
		2) Multitape or Multitrack Turing Machine	
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9.	b)	Design a turing machine for accepting the strings with an equal number of 0's and 1's.	8
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10.	b)	Construct the Turing machine to accept the language and American Montage and	10
		1) $\{w \in \{a, b\}^* / w \text{ contains the same number of a's and b's} \}$	
		2) $\left\{ w \in \{a,b\}^* \ \middle  \ w = w^R \right\}$ B $\rightarrow$ bB/s (a) $\left\{ w \in \{a,b\}^* \ \middle  \ w = w^R \right\}$ (b) Some substitution of the property	
11.	a)	Let G be a CFG and r be a regular expression. Show that the problem	10
		1) $L(G) = L(r)$ { $(g_{B \to 0})$ } = $(g_{A \to 0})$ }	
		2) $L(r) \in L(G)$ are undecidable $\{(g_{a,p})\} = (g_{a,p})^{2}$	
11.	b)	Show that an infinite recursively enumerable set has an infinite recursive	
		subset.	6
		Obtain CFC equivalent to PDA	
12.	a)	Show that if $L_1$ and $L_2$ are recursive languages then $L_1 \cup L_2$ and $L_1 \cap L_2$	
		also recursive. The state of t	8
12.	b)	Show that the set of languages Lover {0, 1} so that neither Lnor L' is recursively	
		enumerable is uncountable. $\{(XX_{-0}p)\} = (X_{-1}L_{-0}p)\delta$	8
		$\{(X_{ij}p)\} = (X_i \cup X_{ij})X_{ij}$	060
		B/I/10/4,	000