Total no. of Pages: 03 Roll no………………

VI SEMESTER

B.Tech. (M & C)

END TERM EXAMINATION ***May-2023***

MC 304 Theory of Computation

Time: 03:00 Hours ***Max. Marks: 50***

Note : All questions are compulsory.
Assume suitable missing data, if any.

Q.1 [a] Construct a Moore machine equivalent to the mealy machine below: [5][CO1,3]

Present State	Next State			
	a = 0		a = 1	
	State	Output	State	Output
$\rightarrow q_1$	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	1	q_3	1
q_4	q_3	0	q_1	1

Figure 1: Mealy to Moore Conversion

[b] Prove/Disprove that each of the classes of languages in Chomsky classification (Type 0, Type 1, Type 2 and Type 3) is closed under concatenation. [5][CO2]

Q.2 ATTEMPT ANY TWO PARTS IN THIS QUESTION.

[a] Using Pumping lemma prove that the language $\{1^p \mid p \text{ is prime}\}$ is not regular. [5][CO1,2]

[b] If L is a regular set over Σ, then show that L^T and $\Sigma^* - L$ *are* also regular. [5][CO2,3]

[b] Consider context free grammar G: $S \rightarrow aSb|aS|a$. Construct:

(i) a pda accepting the L(G) by empty store.

(ii) a pda accepting the L(G) by final state.

[5][CO3,4]

Q.5 [a] What type of moves are possible in a Turing machine. Explain. Consider the Turing machine M given by transition diagram below. Obtain the computation sequence of M for processing the input string 0011.

[5][CO1]

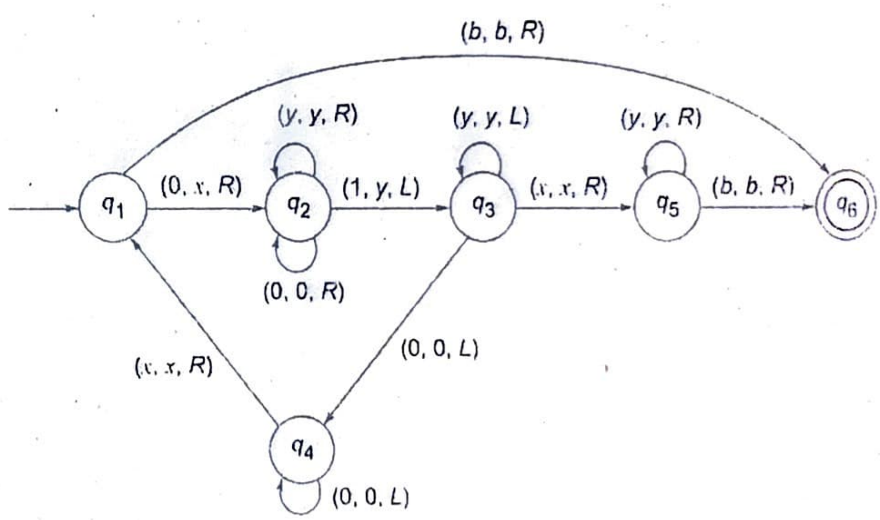

Figure 3: Turing Machine, M

[b] Construct a Turing Machine that accepts $\{0^n1^n \mid n \geq 1\}$.

[5][CO1,3]

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Roll no........

VI SEMESTER

B Tech

End Term Examination **May 2025**

MC304 Theory of Computation

Time:3 hours **Marks 50**

Note: Attempt all Questions

Q1. Answer the following questions with Justifications. [10][CO1,2][L5]

(a)The set of all strings over {a, b}of even length is represented by which of the following regular expressions

(i) $(ab + aa + bb + ba)^*$ (ii) $(aa + bb)^*$

(b) If L is the set of all strings over {a, b} containing at least one a then it is not represented by which regular expression

(i) $(a + b)^*a(b + a)^*$ (ii) $b^*a\ (a + b)^*$ (iii) $(a + b)^*a$

(c) $\{a^n | n \geq 1\}$ is a which type of grammar

(i) context free but not regular (ii) regular (iii) context sensitive but not context free

(d) Consider the grammar G which has the following productions $S \to aB|bA, A \to aS|bAA|a\ B \to bS|aBB|b$ state which of the following statement are true or False

(i) $abbbaa \in L(G)$ (ii) $aab\ not \in L(G)$ (iii) $L(G)$ has some strings of odd length

(e) $\{a^n b^n\ | n \geq 1\}$ is accepted by a pda then which one is correct,

(i) accepted by null store and also by final state

(ii) Accepted by null store but not by final state

Q2 (a) Consider the more machine described by the transition table given bellow. Construct the corresponding mealy machine [5] {CO1][L2]

Present state	Next state		Output
	$a = 0$	$a = 1$	
$\to q1$	q1	q2	0
$q2$	q1	q3	0
$q3$	q1	q3	1

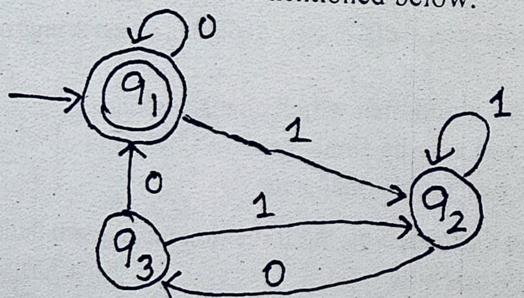
Figure 1 Moore to mealy machine construction

(b) Construct a minimum state automation equivalent to the finite automation whose transition table is given bellow.
5][CO1][L

State	0	1	
$\rightarrow q0$	q1	q5	
$q1$	q6	q2	
Final $q2$	q0	q2	
$q3$	q2	q6	continuing
$q4$	q7	q5	
$q5$	q2	q6	
$q6$	q6	q4	
$q7$	q6	q2	

Q3(a) Using Pumping Lemma prove that the language $\{1^p \mid p \text{ is prime}\}$ is not a context free language
[5][CO2][L4]

(b) Using Algebraic methods for Arden's theorem find the regular expression accepted by the automation mentioned below.
[5][CO1][L6]



Q4 Attempt any two parts of the questions

(a) Given the grammar $S \rightarrow AB,\ \ A \rightarrow a,\ \ B \rightarrow C|b, C \rightarrow D,\ D \rightarrow E, E \rightarrow a$,
Find the equivalent grammar, which is reduced and has no unit productions
[5][CO4][L2]

(b) Reduce the following grammar to Chomsky Normal form, $S \rightarrow 1A\,|0B,\ A \rightarrow 1AA|0S|0, B \rightarrow 0BB|1S|1$
[5][CO4][L2]

(c) State and prove the Pumping Lemma for context free Language
[5][CO4][L2]

Q5. Attempt Any Two parts of the questions

(a)Construct a pda accepting the empty store of the following language $\{a^n b^m c^n \mid m, n \geq 1\}$
[5][CO3][L6]

(b) Consider the Turing machine descriptions given in table mentioned bellow and draw the computation sequence of the input string 00, up to fifteen terms
[5][CO3][L4]

Transition table of Turing machine to Question 5(b)

Present state	Tape Symbols b	0	1
$\rightarrow q1$	1Lq2	0Rq1	
$q2$	bRq3	0Lq2	1Lq2
$q3$		bRq4	bRq5
$q4$	0Rq5	0Rq4	1Rq4
Final $q5$	0Lq2		

(c) Design a Turing machine over $\{1, b\}$, which can compute a concatenation function over $\Sigma = \{1\}$. If a pair of words (w1, w2) is the input the output has to be w1w2.
[5][CO3][L6]