Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

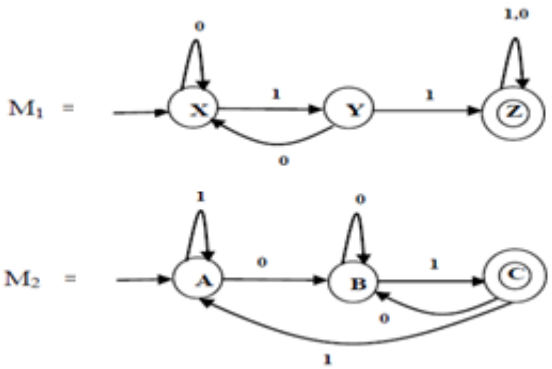
Subject Code:2160704 Date:06/06/2022

Subject Name:Theory of Computation

Time:10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

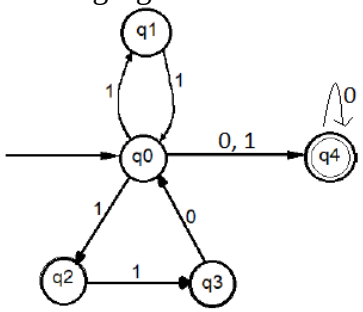
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define Equivalence Relation.	**03**
	(b)	Define one-to-one function. Justify whether the function f : R → R^+ defined by $f(n)=n^2$ is bijection or not.	**04**
	(c)	Draw Finite Automata to accept following over input alphabets Σ ={0, 1} 1. The language accepting strings not containing '00' . 2. The language accepting even number of 0's and odd numbers of 1's	**07**
Q.2	**(a)**	Define FA , NFA , NFA- Λ.	**03**
	(b)	Find a regular expression of following subsets of {0, 1}* 1. The language of all strings that contain odd number of 1's 2. The language of all strings with next to last symbol 0.	**04**
	(c)	Write Principle of Mathematical Induction. Prove that for every n ≥ 0, 0+1+2+3+.....+n = n(n+1)/2	**07**
		OR	
	(c)	Let M1 and M2 be the FAs pictured in Figure, recognizing languages L1 and L2 respectively.  Draw FAs recognizing the following languages. a. L1 U L2' b. L2 - L1	**07**
Q.3	**(a)**	Explain ambiguous grammar with example.	**03**
	(b)	Define Moore machine and Design it to generate 1's complement of binary number..	**04**
	(c)	Define Context Free Grammar. Find context-free grammar for the language: a. $L = \{a^i b^j c^k \mid j=i+k\}$ b. $L = \{ x \in \{0,1\}* \mid n0(x) = n1(x)\}$.	**07**

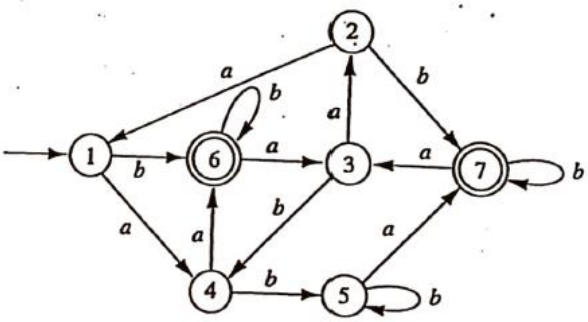
OR

Q.3 **(a)** Explain how to Convert moore machine to mealy machine **03**

(b) Using subset construction method Convert NFA- Λ to NFA for following figure. **04**



(c) Find minimum state FA for following figure. **07**



Q.4 **(a)** State the pumping lemma for Context Free Language. **03**

(b) Using kleene's Theorem Draw NFA-Λ for ((01)*10 + (00)*)* **04**

(c) Define PDA. Convert the CFG with following productions into its equivalent PDA. **07**

$S \rightarrow [S] \mid SS \mid \wedge$

OR

Q.4 **(a)** Write a short note on Universal Turing Machine. **03**

(b) Using pumping lemma prove that the language palindrome is not regular **04**

(c) Given the context-free grammar G, find a CFG G' in Chomsky Normal Form. **07**

S→ 0A0 | 1B1 | BB,
A→ 0B | C
B→ S1 | A
C→ 01 | Λ

Q.5 **(a)** Define Turing Machine. **03**

(b) Design a PDA to accept $L = \{xcx^r \mid x \in (a,b)^*\}$. **04**

(c) Develop a Turing Machine to accept palindromes over {a,b}* **07**

OR

Q.5 **(a)** Write a short note on Halting problem . **03**

(b) Design a PDA to accept $L = \{ X / N_a(X) = N_b(X) , X \in \{a,b\}^*\}$ **04**

(c) Develop a Turing Machine to accept the language L = {WW / W ∈ {a,b}*} **07**

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