# GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– VI (NEW) EXAMINATION – WINTER 2021

Subject Code:3160704   **Date:24/11/2021**
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 one-to-one, onto and bijection function	**03**
	(b)	The given relation R on set A= {1,2,3} determine whether the Relation is reflexive, symmetric or transitive, give reason. R ={(1,1), (1,2), (1, 3),(2,1), (2, 2), (3, 1),(3,3)}	**04**
	(c)	Write Principle of Mathematical Induction. Prove that for every $n \geq 1$, $1 + 3 + 5 + \ldots + (2n - 1) = n^2$	**07**
Q.2	**(a)**	Define FA and Write recursive definition of NFA	**03**
	(b)	Find a regular expression of following subsets of $\{0, 1\}*$ 1. The language of all strings that begin or end with 00 or 11. 2. The language of all strings ending with 1 and not containing 00.	**04**
	(c)	Draw Finite Automata to accept following over input alphabets $\Sigma =\{0, 1\}$ (i) The language accepting strings not ending with '01' . (ii)The language accepting strings next to last symbol '0'	**07**

OR

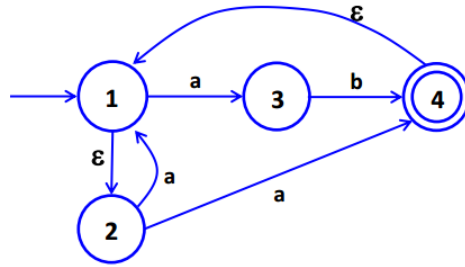|			
	(c)	Let M1 and M2 be the FAs pictured in Figure, recognizing languages L1 and L2 respectively.	**07**
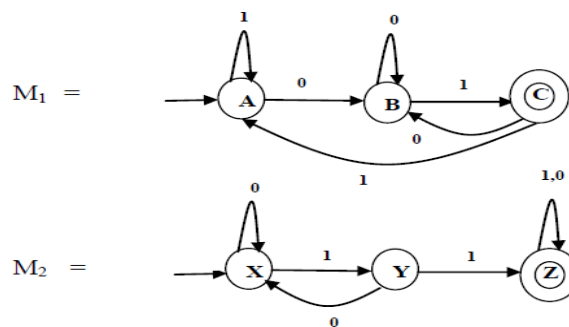
Draw FAs recognizing the following languages.
a. L1 U L2
b. L1 - L2

Q.3	**(a)**	Give the difference between moore machine and mealy machine.	**03**
	(b)	Define Context Free Grammar. Find context-free grammar for the language: L= {$a^i b^j c^k$	j=i+k}	**04**

(c) Convert NFA- Λ to FA for following figure. **07**

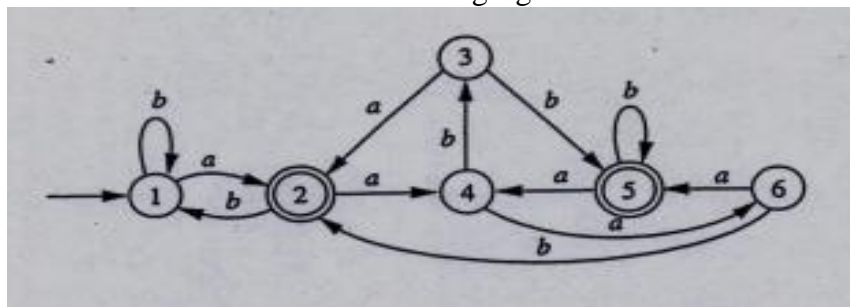OR

Q.3 **(a)** Define Ambiguous grammar. for following grammar say whether the grammar is ambiguous or not. give reason **03**
S→ABA, A→aA | Λ , B→bB | Λ

(b) Design and mealy machine that gives output 1 if input of sequence abb comes, other wise 0. **04**

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

Q.4 **(a)** State pumping lemma for regular languages. **03**
(b) Give an unambiguous grammar for SIMPLE CALCULATOR contain +, -, *, /,(,) operator for terminal 'id'. And draw a parse tree for (id+id)*id-id **04**
(c) Write Kleen's Theorem part -1. **07**

OR

Q.4 **(a)** Find the CFG for the regular expression : (01*1 + 1)* (01)* **03**
(b) Using kleene's Theorem Draw NFA-Λ for ((0+1)*10 + (00)*)* **04**
(c) Given the context-free grammar G, find a CFG G' in Chomsky Normal Form. **07**

    S -> AaA | CA | BaB
    A -> aaBa | DC
    B -> bb | aS
    C -> Ca | bC | D
    D -> bD | Λ

Q.5 **(a)** Define Pushdown Automata **03**
(b) Design a PDA to accept L = {xcy | x, y∈ (a,b)* and |x| = |y|}. **04**
(c) Develop a Turing Machine to accept palindromes over {a,b}* **07**

OR

Q.5 **(a)** Define grammar and Chomsky hierarchy. **03**
(b) Design a PDA to accept L = {a^{n}b^n | n>=0}. **04**
(c) Develop a Turing Machine to accept the language L = {X / N$_a$(X)=N$_b$(X) , X ∈ {a,b}*} **07**

****

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:3160704   **Date:01/06/2022**
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: Set, Subset, Complement	**03**
	(b)	Write and explain the principle of mathematical induction using example.	**04**
	(c)	Draw Finite automata for following regular expression: (i). $(0 + 1)^*(1 + 00)(0 + 1)^*$ (ii). $(111 + 100)^*0$	**07**
Q.2	**(a)**	Explain Regular language & Regular expressions	**03**
	(b)	Find a regular expression corresponding to each of the following subsets of $\{0,1\}^*$ (i). the language of all strings that do not end with 01 (ii). the language of all strings that begin with or end with 00 or 11	**04**
	(c)	Prove Kleene's theorem part-1	**07**
		OR	
	(c)	Explain procedure to minimize finite automata	**07**
Q.3	**(a)**	Define Context free grammar & context free language	**03**
	(b)	Write CFG for following (i) $L=\{a^i b^j c^k \mid i=j \text{ or } j=k\}$ (ii) $L=\{a^i b^j c^k \mid j>i+k\}$	**04**
	(c)	Convert following CFG to CNF : S -> S(S)/^	**07**
		OR	
Q.3	**(a)**	Define Regular grammar and give example.	**03**
	(b)	Explain types of derivation and ambiguity.	**04**
	(c)	Convert following CFG to CNF : S->aX/Yb X->S/^ Y->bY/b	**07**
Q.4	**(a)**	What is a pushdown automaton? Explain.	**03**
	(b)	Give the difference between top down and bottom up parsing.	**04**
	(c)	Design and draw deterministic PDA Accepting "Balance string of brackets"	**07**
		OR	
Q.4	**(a)**	Explain deterministic pushdown automata.	**03**
	(b)	Explain conversion from PDA to CFG.	**04**
	(c)	Design and draw PDA to accept string with more a's than b's.	**07**

Q.5	(a)	What is Turing machine? Explain its capabilities.	03
	(b)	Explain Church Turing thesis.	04
	(c)	Design a Turing machine to copy a string.	07

OR

Q.5	(a)	Explain Primitive Recursive Functions.	03
	(b)	Explain Universal Turing machine	04
	(c)	Design a Turing machine to delete a symbol.	07

****