

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (OLD) EXAMINATION – SUMMER 2022****Subject Code:160704****Date:08/06/2022****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.

- Q.1 (a)** Draw FA for accepting: **07**
 (i)The string in $\{0,1\}^*$ ending in 1 and not containing substring 00.
 (ii)The strings with odd no of 1's and odd no of 0's.

(b) Answer the following:

- 1** In each case, say whether the statement is tautology, a contradiction or neither and in case of neither find a simpler statement that is logically equivalent. **04**

1> $(p \rightarrow q) \wedge (p \rightarrow \neg q)$

2> $p \vee (p \rightarrow q)$

- 2** In each case, a relation on the set $\{1,2,3\}$ is given. Of the three properties, reflexivity, symmetry and transitivity, determine which ones the relation has. Give reasons. **03**

1> $R = \{(1,3),(3,1),(2,2)\}$

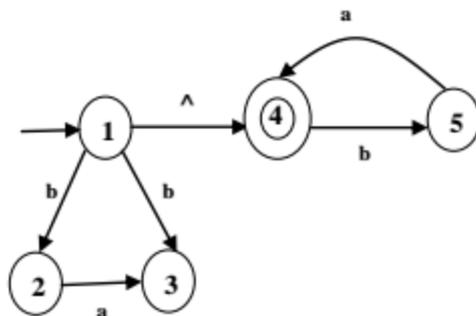
2> $R = \{(1,1),(2,2),(3,3),(1,2)\}$

3> $R = \emptyset$

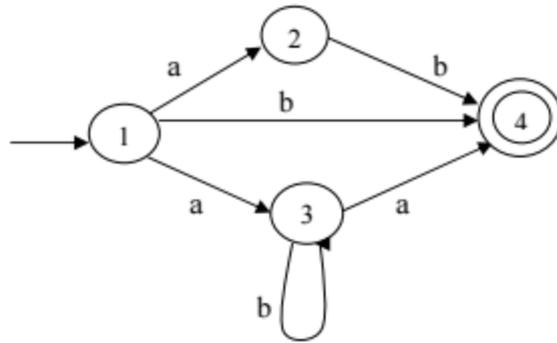
- Q.2 (a)** Define δ^* for! FA- NFA and NFA- Λ . Also Calculate $\delta^*(1, ab)$ and $\delta^*(1, abaab)$ from the following transition table. **07**

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

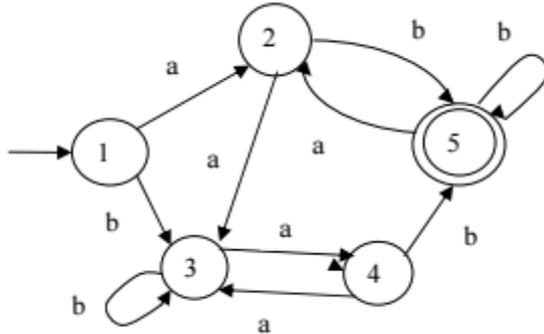
- (b)** Convert the following NFA- Λ into FA. **07**

**OR**

- (b)** Convert following NFA into equivalent DFA. Draw DFA and give Transition Table for it. **07**



Q.3 (a) Find a minimum – state FA accepting language of the given FA. **07**



(b) Answer the following:
1 Find a CFG in Chomsky normal form for the following Grammar G. **03**
 G has productions $\{ S \rightarrow SS \mid (S) \mid \wedge \}$

2 Give the context free grammar for the following. **04**

1> $L = \{ x \in \{0,1\}^* \mid n_0(x) \neq n_1(x) \}$

2> $L = \{ x \in \{0,1\}^* \mid n_0(x) = n_1(x) \}$

OR

Q.3 (a) Prove “The pumping lemma for regular languages” and use it to prove that the Palindromes language is not regular. **07**

(b) Check whether the given grammar is in CNF **07**

$S \rightarrow bA \mid aB$

$A \rightarrow bAA \mid aS \mid a$

$B \rightarrow aBB \mid bS \mid b$

If it is not in CNF, Find the equivalent CNF.

Q.4 (a) Give transition table for deterministic PDA recognizing the following language. **07**

$\{ a^n b^{n+m} a^m \mid n, m \geq 0 \}$

(b) Prove The Theorem: “ If L_1 and L_2 are context – free languages, then the languages $L_1 \cup L_2, L_1L_2, L_1^*$ are also CFL.” **07**

OR

Q.4 (a) Design and draw a deterministic PDA accepting strings with more a’s than b’s. Trace it for the string “abbabaa”. **07**

(b) Prove that any Regular Language can be accepted by FA. **07**

Q.5 (a) Write Short note on Universal Turing Machine. **07**

(b) Construct Turing Machine to delete one letter from an alphabetic input String. **07**

OR

Q.5 (a) Draw a transition diagram for a Turing machine accepting the following language. **07**

$\{ a^n b^n c^n \mid n \geq 0 \}$

(b) Differentiate Turing machine, PDA and FA with example. **07**
