Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2021

Subject Code:2160704 Date:05/08/2021

Subject Name:Theory of Computation

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define DFA and NFA and NFA- Λ **03**

(b) Write Regular Expressions corresponding to each of the following subsets of {0,1}* **04**
(i) The language of all strings containing both 101 and 010 as substrings.
(ii) The language of all strings that do not end with 01.

(c) Use the principle of mathematical induction to prove that **07**
$1 + 3 + 5 + \ldots + (2n-1) = n^2$ for all n>0 where r is an odd integer & n is the number of terms in the sum.

Q.2 **(a)** Define onto, one-to-one, and bijection functions. **03**

(b) Using constructive approach determine NFA- Λ for the regular expression **04**
(0 + 1)*1(0 + 1).

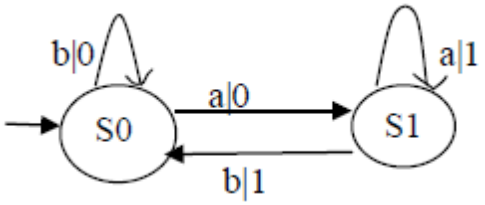
(c) Convert the CFG, G ({S,A,B},{a,b},P , S) to CNF , where P is as follows **07**
S → aAbB

A → Ab | b

B → Ba | a

OR

(c) Convert the Mealy machine shown in given figure into Moore machine. **07**



Q.3 **(a)** Define CFG. When is a CFG called an 'ambiguous CFG'? **03**

(b) Draw FA for accepting: The strings with odd no of 1's and odd no of 0's. **04**

(c) Convert following NFA- Λ to NFA **07**

q	δ(q, Λ)	δ(q, 0)	δ(q, 1)
A	{B}	{A}	φ
B	{D}	{C}	φ
C	φ	φ	{B}
D	φ	{D}	φ

OR

Q.3 **(a)** Give recursive definitions of the extended transition functions, δ^* for DFA and NFA. **03**

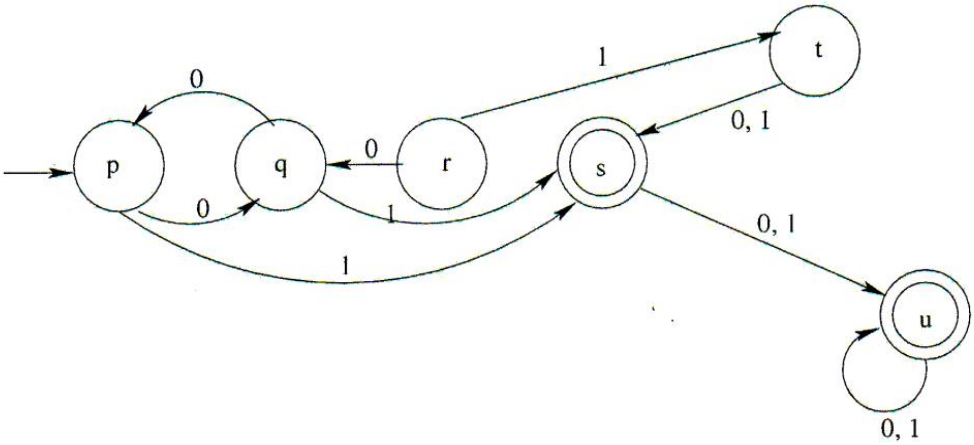
(b) For the language L = { xcx^r | x → {a,b}* } design a PDA(Push Down Automata). **04**

(c) Write Kleene's Theorem part-I, Any regular language can be accepted by a finite automation. **07**

Q.4 **(a)** State pumping lemma for regular languages. **03**

(b) Explain push down automata with example. **04**

(c) Minimize the DFA shown in Fig: **07**



OR

Q.4 **(a)** What is Turing Machine? Write advantages of TM over FSM. **03**

(b) Write a short note on Universal Turing Machine. **04**

(c) Convert the following grammar to a PDA: **07**
I → a | b | Ia | Ib | I0 | I1
E → I | E * E | E + E | (E)

Q.5 **(a)** What are the applications of regular expressions and finite automata? **03**

(b) Consider following grammar: **04**
S → ASB | Λ
A → aAS | a
B → SbS | A | bb
i. Eliminate useless symbols, if any.
ii. Eliminate Λ productions.

(c) Draw a Turing Machine(TM) to accept Palindromes over {a,b}. (Even as well as Odd Palindromes). **07**

OR

Q.5 **(a)** Define grammar and chomsky hierarchy. **03**

(b) Write a short note on church-turing thesis. **04**

(c) Write a Turing Machine to copy strings. **07**

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