Roll Number: _____

Thapar Institute of Engineering and Technology, Patiala

Department of Computer Science and Engineering

B E- COE, CSE (VI Semester) MST	Course Code: UCS701 Course Name: Theory of Computation
March 10, 2023, 3:30 PM	
Time: 2 Hours, M. Marks: 30	Name Of Faculty: Sunita Garhwal, Nitigya Sambyal, Chinmaya Panigrahy, Nidhi Kalra, Shashank Sheshar, Javed Imran.

Note: Attempt all questions with proper justification. Assume missing data, if any, suitably.

Q1. Given the regular expression r = $(101|10)^*$ (5)

a) Convert the given r into NFA using Thompson's construction.
b) Convert the obtained NFA into DFA using subset construction.
c) Minimize the obtained DFA in 1 (b).

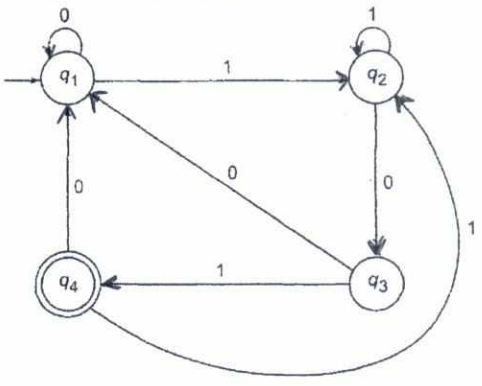
Q2. Construct a deterministic finite automaton over $\sum = \{a, b\}$ such that (6)

a) It recognizes the language G_1 = {w ∈ Σ*, where |w| ≥ 2 and the second symbol from right-hand side of w is b}.
b) It recognizes the language G_2 = {w ∈ Σ* | w = saba for some string s ∈ Σ*}.
c) It recognizes the language G_3 = {$a^n b^m$ | n, m>=1 and n+m is even}.

Q3. a) Construct a Moore machine over $\sum = \{a, b\}$ which counts the occurrences of substring "baba" in the input string. Convert it into an equivalent Mealy machine. (3)

Q3 b) Write a regular expression to represent all the even length strings over Σ={0,1} and ensure the number of zeros and ones are also even. (2)

Q4. a) Write down regular expression corresponding to the following finite automaton using Arden's Theorem. (3)



[P.T.O.]

Q4. (b) Convert the given NFA with q_1 as initial and q_f as final state into its equivalent DFA:

Current State	Input symbol	
	a	b
q_1	q_1, q_2	q_1
q_2	-	q_f
q_f	-	-

(2)

Q5. (a) Find all strings in language L=((a+b)*b(a+ab)*) of length less than four. (1)

Q5. (b) Consider the following productions of the regular grammar G:

S -> aA | a
A -> aA | aB | a
B -> bB | c

Write the regular expression corresponding to regular grammar G. (1)

Q5. (c) Write right linear grammar for L= ba + (a + bb) a*b. (2)

Q6. (a) Using Pumping Lemma, prove that the language L is not regular (3)

$L = \{a^{n^2} \mid n \geq 0\}$

Q6. (b) Consider languages L_1 and L_2 respectively where (2)

L_1 = { w | 00 is not a substring of w }
L_2 = { w | w ends with 01 }
Construct a DFA for the language $L_1 - L_2$.