National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Theory of Automata	**Course Code:**	CS 301
Program:	BS CS	**Semester:**	Fall 2019
Duration:	60 Minutes	**Total Marks:**	30
Paper Date:	September 24, 2019.	**Weight**	15
Section:	N/A	**Page(s):**	2
Exam Type:	Midterm Exam 1		

Student : Name:_____ **Roll No.**_____

Instruction/Notes:
1. Attempt on the question paper in the provided space. Extra sheets will NOT be marked.
2. One A4 hand written help sheet is allowed in the exam

QUESTION 1 **Marks: 20**

i. Tick all regular expressions which express
L = {w | w ∈ {0,1}* and w has no consecutive 0 and no consecutive 1}
a. (10)*+(01)*
b. (10 + 01)*
c. (0(10)* + 1(01)*)*
d. ((01)*0 + (10)*1)*

ii. Tick all regular expressions which express
L = {w | w ∈ {0,1}* and length of w is at least 2 and w does not end with 10}
a. (0+1)*(00 + 11 + 01)
b. (0+1)*((00)* + (11)* + (01)*)
c. 0*(00 + 11 + 01) + 1*(00 + 11 + 01)
d. (0+1)*((0+1)1) + (0+1)*00

iii. Write down all strings of the language given by the regular expression: (1+010+ε)(0+ε)

iv. Write down the first three shortest strings that belong to: L = {$(a^k b^k)^k$ | k > 1}

v. Is it possible that for any language (denoted by L) L*=L? If so what is L? _____

vi. Suppose $L_1 = \phi$ $L_2 = \{a,b,c\}$ then L_1L_2 = _____

For parts vii-x consider the NFA machine M of Figure 1.

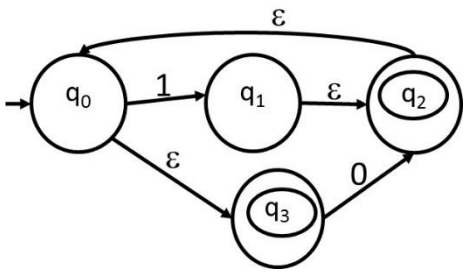

Figure 1: NFA-ε Machine M

vii. What is $\delta^*(q_1,1)$ for M? _____

viii. What is $\delta^*(q_0,11)$ for M? _____

ix. What is the null closure $\varepsilon\{q_0,q_1\}$? _____

x. When ε transitions are removed from M to make an NFA without any null transitions, then what is the set of final states?

Roll Number: _____

QUESTION 2 **Marks: 5**

Construct a DFA using the method of subset construction from the following NFA machine N. Only fill out the given **state transition table** of the resulting DFA. No additional working is required.

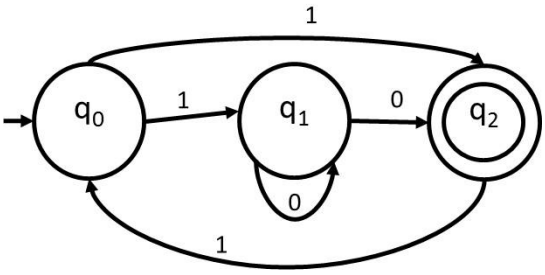

Figure 2: NFA Machine N

State	0	1

QUESTION 3 **Marks: 5**

Make a state transition diagram for a DFA for:

L = {w | w ∈ {0,1}* and w has at least one 0 and at least one 1}