NEPAL COLLEGE OF INFORMATION TECHNOLOGY
MFCS ASSIGNMENMENT_3.1

Level: Bachelor Semester – Spring Year: 2020
Programme: BEIT (2nd semester) Time: 1 week
Course: Mathematical Foundation of Computer Science

Students are required to give their answers in their own words as far as practicable.

1. Define finite state machine. Draw the transition diagram of the following transition table.

I		f				g
S	a	b	c	a	b	c
σ_0	σ_1	σ_0	σ_2	1	1	2
σ_1	σ_0	σ_2	σ_2	2	0	0
σ_2	σ_3	σ_3	σ_0	1	0	1
σ_3	σ_1	σ_1	σ_0	2	0	2

2. Construct Deterministic Finite Automata (Transition Diagram only) that accepts only those string with following properties:
   a. Ends with "01" over Σ=(0 , 1)
   b. Ends with "11" over Σ=(0 , 1)
   c. Ends with "abb" over Σ=(a , b)
   d. Ends with "abba" over Σ=(a , b)
   e. Ends with "aa" or "bb" over Σ=(a , b)
   f. Starts with "a" over Σ=(a , b)
   g. Starts with "ab" over Σ=(a , b)
   h. Starts with "aba" over Σ=(a , b)
   i. Starts with "aa" or "bb" over Σ=(a , b)
   j. Contains at least one "b" over Σ=(a , b)
   k. Contains exactly one "b" over Σ=(a , b)
   l. Contains exactly two "a" over Σ=(a , b)
   m. Contains at most two "a" over Σ=(a , b)
   n. Contains substring "ab" over Σ=(a , b)
   o. Contains substring "abaab" over Σ=(a , b)
   p. Contains substring "aba" over Σ=(a , b)
   q. Contains Three consecutive 0 over Σ=(0 , 1)
   r. Doesn't contain substring "aba" over Σ=(a , b)
   s. Every "a" is followed by "bb" over Σ=(a , b)
   t. Every "0" is followed by "11" over Σ=(0 , 1)
   u. Second symbol from LHS is always "b" over Σ=(a , b)
   v. Contains even number of "a" over Σ=(a , b)
   w. Contains odd number of "a" over Σ=(a , b)
   x. Contains odd number of "a" and even number of "b" over Σ=(a , b
   y. Ends with "111" and contains odd number of "1" over Σ=(1 , 0)

3. Design FSM that performs serial addition.

4. Define Deterministic Finite Automata. Design a Finite automata that accepts only those set of strings over {a, b} that starts and ends with different symbol. Precisely, only those strings starts and ends with different symbol should be accepted and other string should be rejected. Your design should include the proper definition of the finite automata, transition table and transition diagram.

5. Construct Non-Deterministic Finite Automata(Transition Diagram only) that accepts only those string with following properties:
   a. Starts with "ab" over $\Sigma=(a , b)$
   b. Ends with "bab" over $\Sigma=(a , b)$
   c. Contains substring "abb" over $\Sigma=(a , b)$
   d. Starting and ending with "a" over $\Sigma=(a , b)$
   e. Starting and ending with same symbol over $\Sigma=(a , b)$
   f. Starting and ending with different symbol over $\Sigma=(a , b)$

6. Convert following in Deterministic finite automata(up to transition diagram only)
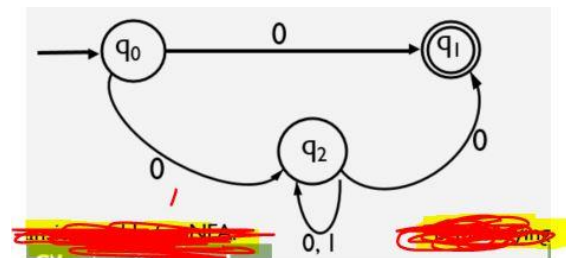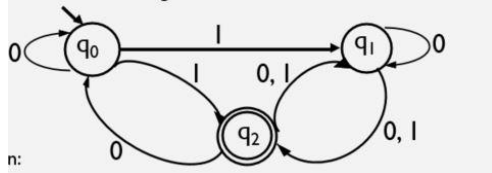
7. Define Non- Deterministic Finite Automata. Point out key difference between NFA and DFA. Construct NFA that accepts all string in which second last bit is 1(second symbol from RHS is 1) and convert it into equivalent DFA. Your design should include the proper definition of the finite automata, transition table and transition diagram.