ASSIGNMENT-1

Ques 1. Given

$A = \{1,2,3,4\}$ $B = \{2,4,3,1\}$

Since, $\forall x \in A \ni x \in B$

Hence, both set A and B are equal.

2 $A = \{1,3,5,7\}$ $n=4$

Subsets of $A = 2^n = 2^4 = 16$

$\{\}, \{1\}, \{3\}, \{5\}, \{7\}, \{1,3\}, \{1,5\}, \{1,7\}, \{3,5\}, \{3,7\}, \{5,7\}$ $\{1,3,5\}, \{1,3,7\}, \{1,5,7\}, \{3,5,7\}, \{1,3,5,7\}$

3 $A = \{1,2,3,4,5 \ldots\}$

$A = \{x \in N \mid x \geq 1\}$

4 Given $A = \{1,3,5,7,9,11\}$ $B = \{1,2,3,13\}$

$A - B = \{5,7,9,11\}$ $B - A = \{2,13\}$

5 Given $A = \{1,3,5\}$ $B = \{2,4,6\}$ $C = \{1,5,7\}$

$B \cup C = \{1,2,4,5,6,7\}$

$A \cup (B \cup C) = \{1,2,3,4,5,6,7\}$

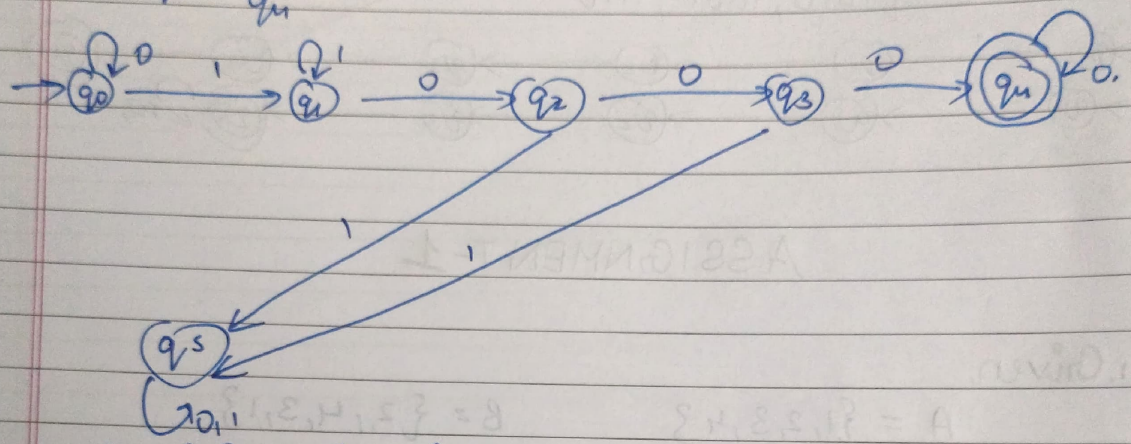
Ques 3 $L = \{1000, 0010 - - - - \}$

$Q = q_0, q_1, q_2, q_3, q_4, q$

$\Sigma = \{a, b\}$

$q_0 = q_0$

$F = q_4$



Transition function $\delta : (q_0, 0) = q_0$ $\delta : (q_5, 0) = q_5$

$\delta : (q_0, 1) = q_1$ $\delta : (q_5, 1) = q_5$

$\delta : (q_1, 0) = q_2$

$\delta : (q_1, 1) = q_1$

$\delta : (q_2, 0) = q_3$

$\delta : (q_2, 1) = q_5$

$\delta : (q_3, 0) = q_4$

$\delta : (q_3, 1) = q_5$

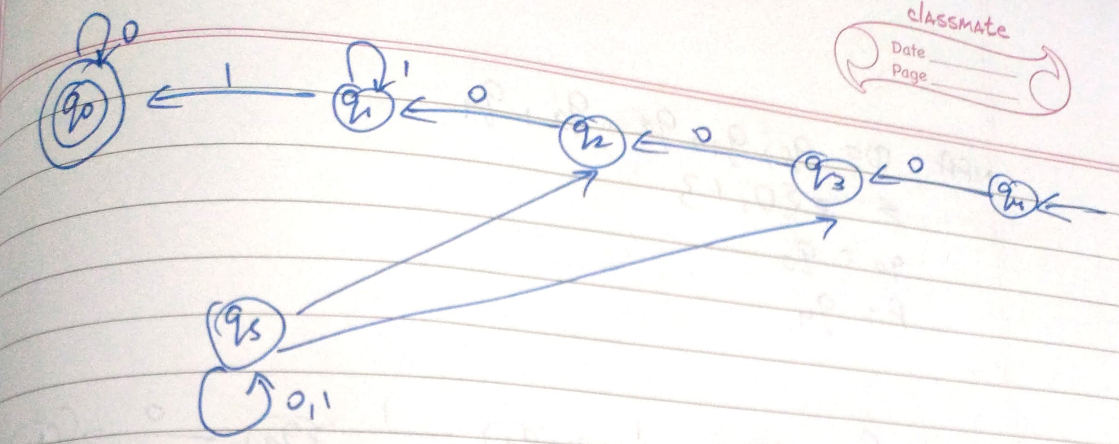
$\delta : (q_4, 0) = q_4$

$\delta : (q_4, 1) = q_4$

Transition Table

States	Input 0	Input 1
q_0	q_0	q_1
q_1	q_2	q_1
q_2	q_3	q_5
q_3	q_4	q_5
q_4	q_4	q_4
q_5	q_5	q_5

2

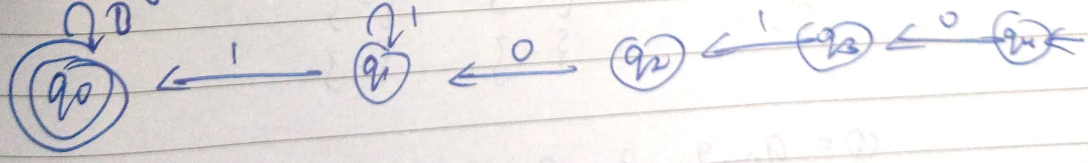


3 Yes, it is a valid finite automation because it has:
→ finite no. of states i.e 6
→ initial state q_0
→ final state q_0

It is NFA (nondeterministic finite automata) because from q_5 there are 3 possible tranitions on 1. In DFA we have at most one transaction from each symbol

4 Step1 - Remove unreachable states → q_5 (no incoming edge, only self loop.

Step 2 Diagram



Quest Given

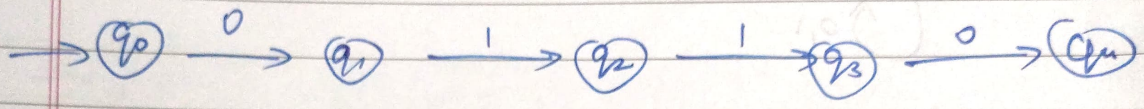
String begins with 01
String ends with 10
L = {01101, 011101, ...}

NFA $Q = q_0, q_1, q_2, q_3, q_4$

$\Sigma = \{0, 1\}$

$q_0 = q_0$

$F = q_4$



Transition fun

$\delta : (q_0, 0) = q_1$

$\delta : (q_1, 1) = q_2$

$\delta : (q_2, 1) = q_3$

$\delta : (q_3, 0) = q_4$

DFA

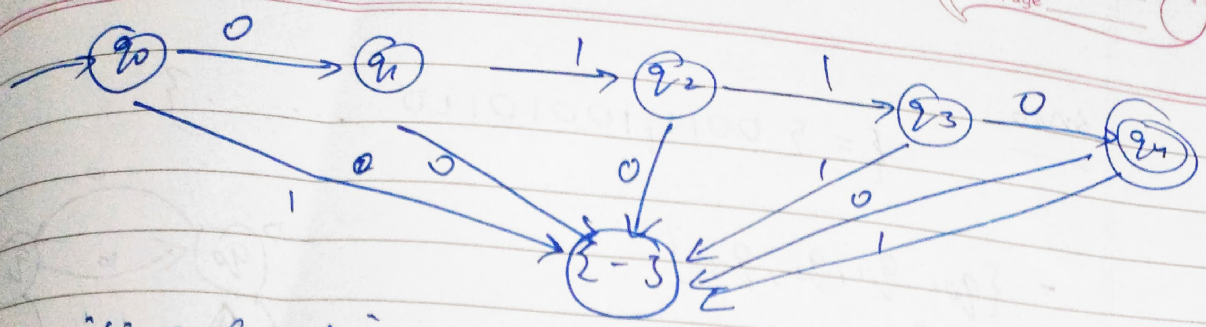
State	Input 0	1
q_0	q_1	$\{-\}$
q_1	$\{-\}$	q_2
q_2	$\{-\}$	q_3
q_3	q_4	$\{-\}$
q_4	$\{-\}$	$\{-\}$
$\{-\}$	$\{-\}$	$\{-\}$

$Q = q_0, q_1, q_2, q_3, q_4$

$\Sigma = \{0, 1\}$

$F = q_4$

$q_0 = q_0$



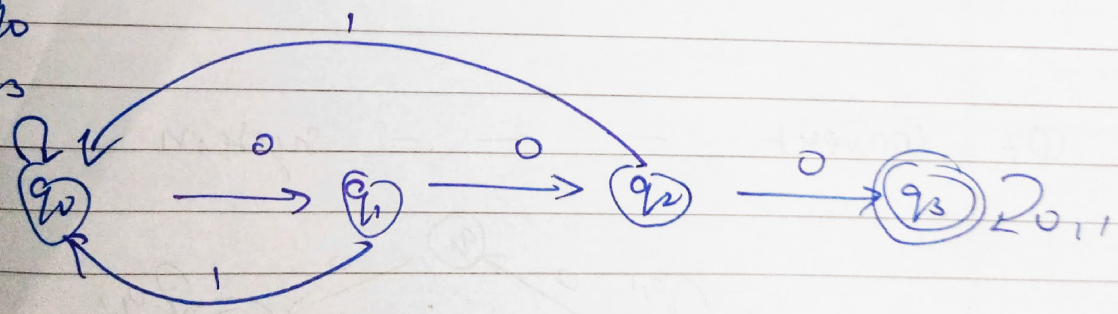
Transition function

$\delta : (q_0, 0) = q_1$
$\delta : (q_0, 1) = \{-\}$
$\delta : (q_1, 0) = \{-\}$
$\delta : (q_1, 1) = q_2$
$\delta : (q_4, 0) = \{-\}$

$\delta : (q_2, 0) = \{-\}$
$\delta : \{q_2, 1\} = q_3$
$\delta : (q_3, 0) = q_4$
$\delta : (q_5, \phi) = \{-\}$
$\delta : (q_4, 1) = \{-\}$

Ques Given $L = \{000, 1000, 10001, ---\}$

$Q = q_0, q_1, q_2, q_3$
$\Sigma = \{0, 1\}$
$q_0 = q_0$
$F = q_3$



Transition function

$\delta : (q_0, 0) = q_1$
$\delta : (q_0, 1) = q_1$
$\delta : (q_1, 0) = q_2$
$\delta : (q_1, 1) = q_0$
$\delta : (q_2, 0) = q_3$
$\delta : (q_2, 1) = q_0$
$\delta : (q_3, 0) = q_3$
$\delta : (q_3, 1) = q_3$

Transition Table

states	Input 0	1
q_0	q_1	q_1
q_1	q_2	q_0
q_2	q_3	q_0
q_3	q_4	q_3

Ans 6

$L = \{0011, 10010110 \ldots\}$

$= \{q_0, q_1, q_2, q_3\}$

$q_0 = q_0$

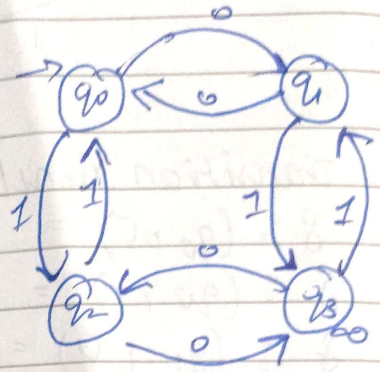
$q_f = q_0$

$\delta(q_0, 0) = q_1, \delta(q_0, 1) = q_2$

$\delta(q_1, 0) = q_0, \delta(q_1, 1) = q_3$

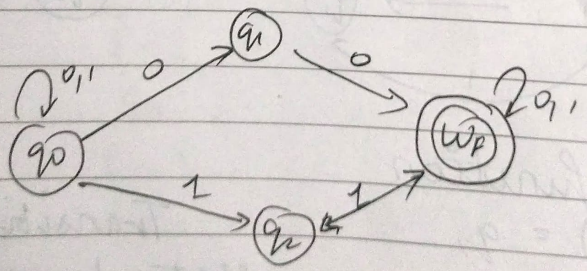
$\delta(q_2, 0) = q_3 \quad \delta(q_2, 1) = q_0$

$\delta(q_3, 0) = q_2, \delta(q_3, 1) = q_1$



S/I	0	1
q_0	q_1	q_2
q_1	q_0	q_3
q_2	q_3	q_0
q_3	q_2	q_1

Q7 Convert — — — system

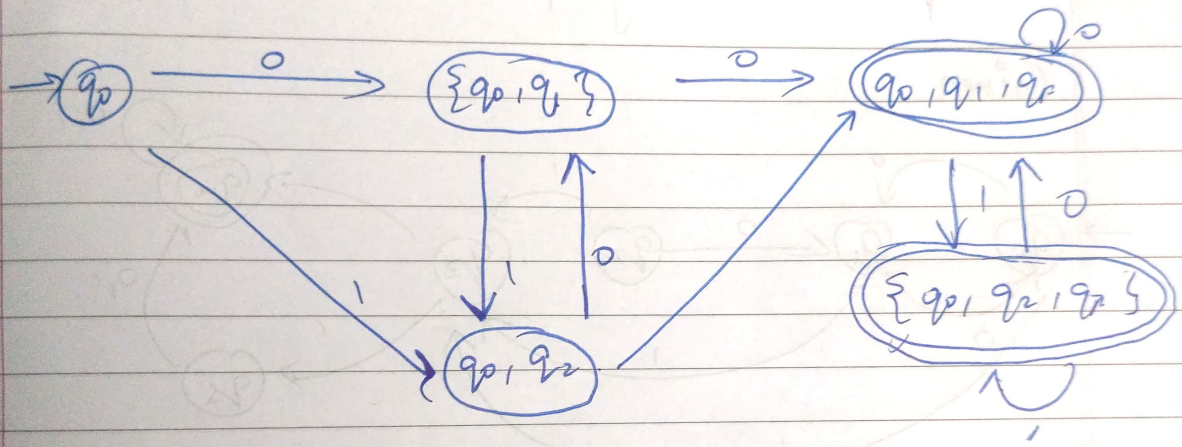


NFA

States / Input	0	1
q_0	$\{q_0, q_1\}$	$\{q_0, q_2\}$
q_1	q_f	—
q_2	—	q_f
q_f	q_f	q_f

DFA transition table

States/input	0	1
q_0	$\{q_0, q_1\}$	$\{q_0, q_2\}$
$\{q_0, q_1\}$	$\{q_0, q_1, q_f\}$	$\{q_0, q_2\}$
$\{q_0, q_2\}$	$\{q_0, q_1\}$	$\{q_0, q_1, q_f\}$
$\{q_0, q_1, q_f\}$	$\{q_0, q_1, q_f\}$	$\{q_0, q_2, q_f\}$
$\{q_0, q_2, q_f\}$	$\{q_0, q_1, q_f\}$	$\{q_0, q_2, q_f\}$



For DFA

$Q = q_0, \{q_0, q_1\}, \{q_0, q_2\}, \{q_0, q_1, q_f\}, \{q_0, q_2 q_f\}$

$\Sigma = \{0, 1\}$

$q_0 = q_0$

$F = \{q_0, q_1, q_0\}, \{q_0, q_2, q_f\}$

Transition function

$\delta : (q_0, 0) = \{q_0, q_1\}$

$\delta : (q_0, 1) = \{q_0, q_2\}$

$\delta : \{q_0, q_1\}, 0) = \{q_0, q_1, q_f\}$

$\delta : \{q_0, q_1\}, 1) = \{q_0, q_2\}$

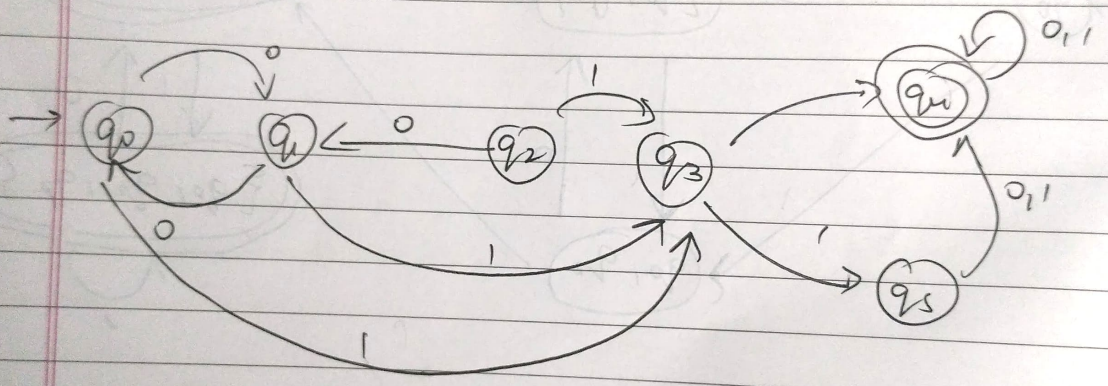
$\delta : (\{q_0, q_2\}, 0) = \{q_0, q\}$

$\delta : \{q_0, q_2\} = \{q_0, q_1, q_f\}$

Ques 8

Step 1 : Remove the unreachable states
Step 2 : Create the transition table of given DFA.
Step 3 : Create the transition table for non-final states
Step 4 : Create the transition table for final states.
Step 5 : Remove duplicate rows from both the table.
Step 6 : Redraw DFA with transition table formed after combining final ~~sta~~ and non-final stat

Given



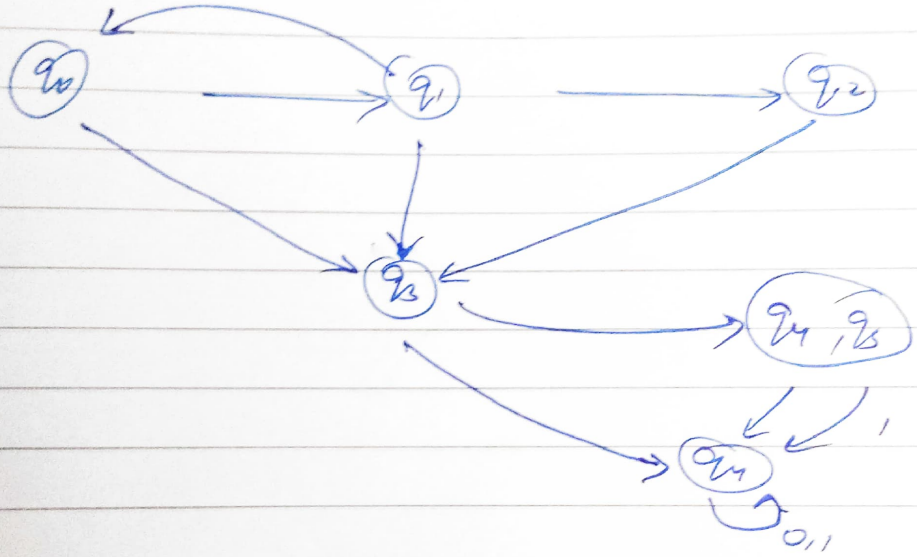
The above diagram is NFA (Nondeterministic finite automata

NFA

States	0	1
q_0	q_1	q_3
q_1	q_0	q_3
q_2	q_1	q_3
q_3	q_4	$\{q_4, q_5\}$
q_4	q_4	q_4
q_5	q_4	q_4

DFA

States	0	1
q_0	q_1	q_3
q_1	q_0	q_3
q_3	q_4	$\{q_4, q_5\}$
q_4	$\{q_4\}$	q_4
$\{q_4, q_5\}$	$\{q_4\}$	q_4
q_2	q_1	q_3



Step 1 Remove unreachable states

q_2 is unreachable so we remove

Step 2 DFA Transition table

States	0	1
q_0	q_1	q_3
q_1	q_0	q_3
q_3	q_4	$\{q_4, q_5\}$
q_4	q_4	q_4
$\{q_4, q_5\}$	q_4	q_4