Bahria University, Islamabad Campus
Department of Computer Sciences
Assignment 1
Due: Week 3, 4 during class Total Marks: 10
Class: BSCS 4A,B MSCS 0A

Roll No: **Name:**

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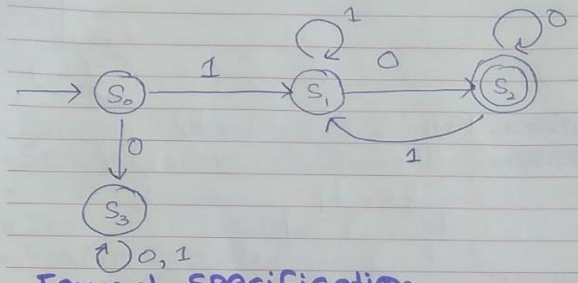
1. Design DFA and provide formal specifications. Alphabet is {0,1} in all the questions.

   a. The set of strings that begin with a 1 and ends with a 0.

Q:1:-
(a) Sol:-
Start = 1 , end = 0
$L_1 = \{10, 100, 110, 1000, 1100, \dots\}$



Formal specification:-
DFA $(Q, \Sigma, \delta, q_0, F)$

- Set of all state:- $Q = \{S_0, S_1, S_2, S_3\}$
- Alphabets:- $\Sigma = \{0, 1\}$
- Initial state:- $q_0 = \{S_0\}$
- Final state:- $F = \{S_2\}$
- Transition Function:- $\delta = Q \times \Sigma \rightarrow Q$

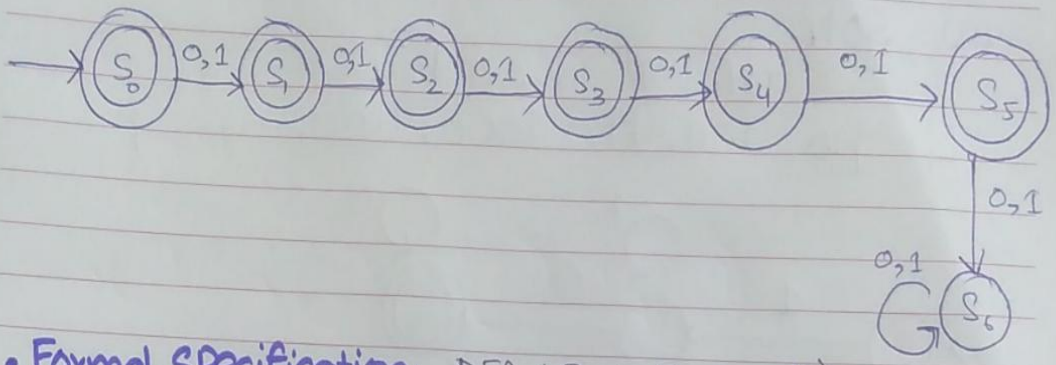
State	0	1
→ S_0	S_3	S_1
S_1	S_2	S_1
* S_2	S_2	S_1
S_3	S_3	S_3

b. The set of all the strings whose length is at most 5.

day / date:

(b) Sol:-

length is atmost 5



- Formal specification:- DFA $(Q, \Sigma, \delta, q_0, F)$.
- set of all state:- $Q = \{S_0, S_1, S_2, S_3, S_4, S_5, S_6\}$.
- Alphabets:. $\Sigma = \{0, 1\}$.
- Initial state:- $q_0 = \{S_0\}$
- Final state:. $F = \{S_0, S_1, S_2, S_3, S_4, S_5$
- Transition Functions:- $\delta = Q \times \Sigma \rightarrow Q$

State	0	1
→ * S_0	S_1	S_1
* S_1	S_2	S_2
* S_2	S_3	S_3
* S_3	S_4	S_4
* S_4	S_5	S_5
* S_5	S_6	S_6
S_6	S_6	S_6

2. Design DFA and provide formal specifications. Alphabet is {0,1} in all the questions.

   a. The set of all the strings with 0100 at the end.

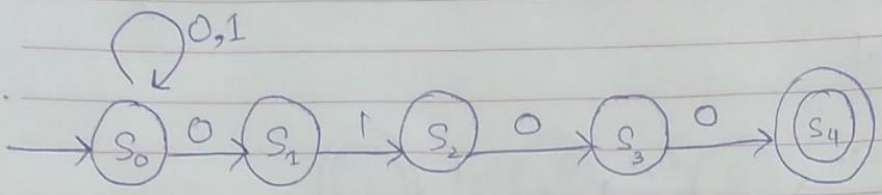
day / date:

Q:No:02:-

(a) Sol:-

End = 0100.

$L_1 = \{0100, 00100, 10100, 010100, 100100, \ldots\}$



- Formal Specification:- NFA $(Q, \Sigma, q_0, F, \delta)$
- Set of all State:- $Q = \{S_0, S_1, S_2, S_3, S_4\}$
- Alphabets:- $\Sigma = \{0, 1\}$
- Initial State:- $q_0 = \{S_0\}$
- Final State:- $F = S_4$
- Transition Function:- $\delta = Q \times \Sigma \rightarrow Q$

State	0	1
→ S_0	$\{S_0, S_1\}$	$\{S_0\}$
S_1	ϕ	$\{S_2\}$
S_2	$\{S_3\}$	ϕ
S_3	$\{S_4\}$	ϕ
* S_4	ϕ	ϕ

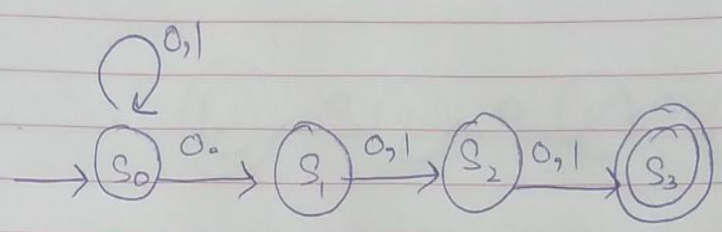
b. The set of all the strings with 0 at the 3rd last position.

day / date:

(b) Sol:-

3rd last position = 0

$L_1 = \{000, 1000, 0000, 0011, 1011, \text{-----}\}$



- **Formal Specification:-** NFA$(Q, \Sigma, q_0, F, \delta)$
- **Set of all State:-** $Q = \{S_0, S_1, S_2, S_3\}$
- **Alphabets:-** $\Sigma = \{0, 1\}$
- **Initial state:-** $q_0 = \{S_0\}$
- **Final State:-** $F = \{S_3\}$
- **Transition Function:-** $\delta = Q \times \Sigma \to Q$

State	0	1
→ S_0	$\{S_0, S_1\}$	$\{S_0\}$
S_1	$\{S_2\}$	$\{S_2\}$
S_2	$\{S_3\}$	$\{S_3\}$
* S_3	ϕ	ϕ