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### CSCI-3080 Discrete Structure
### Quiz 7: Chapter 9 -- Finite-Sate Machine & Turing Machines
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1. Please draw the state graph for the following finate state machine, and compute the output sequence for the given input sequence.

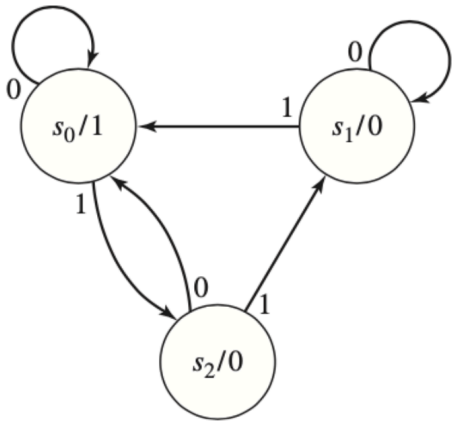
(a)
Input:10001

10001

Present state	Next state		Output
	Present input		
	0	1	
s_0	s_0	s_2	1
s_1	s_1	s_0	0
s_2	s_0	s_1	0

Solution:

(1) State Graph:

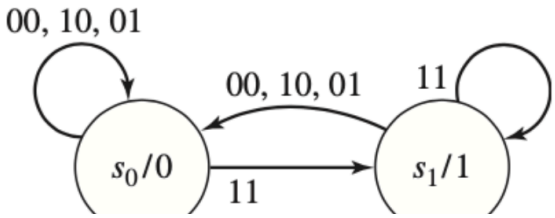


(2) Output: **01110** (Please ignore the first bit produced by the inital state.)

2.

(a) Please construct a finite-state machine that will compute the bitwise AND of two binary input string.

Solution:

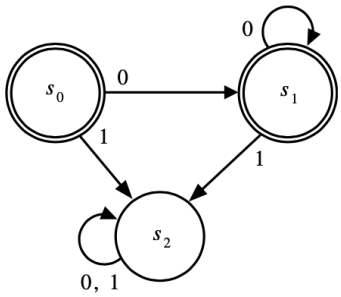


(b) Write the output for the input sequence consisting of the strings 11011 and 10010 (read left to right)

Solution: **10010** (Please ignore the first bit produced by the inital state.)

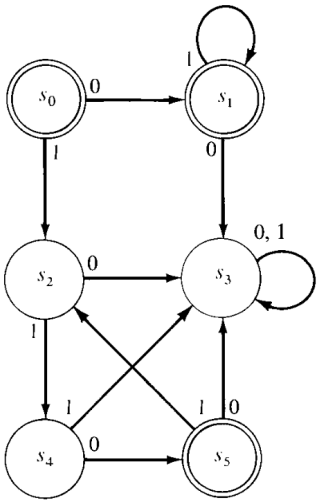
3. Please give a regular expression for the set recognized by the following finite-state machine.

(a)



Solution: 0*

(b)

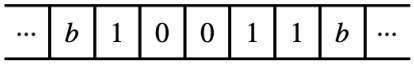


Solution: 01* ∨ (110)*

4. Consider the Turing Machine

(0, 0, 0, 0, L)
(0, 1, 0, 1, R)
(0, b, b, 0, L)
(1, 0, 0, 1, R)
(1, 1, 0, 1, R)

(a). What is its behavior when started on the tape



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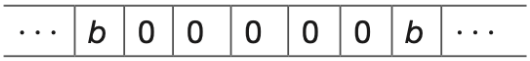
(b). What is its behavior when started on the tape

Solution:

1. **a.** halts with final tape 

b. does not change the tape and moves forever to the left

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5. Find a Turing machine that recognizes the set of all unary strings consisting of an even number of 1s (this includes the empty string).

Note: In computer science, unary notation is a way of representing numbers using only the symbol '1'.

Solution:

One answer: State 2 is a final state.

$(0, b, b, 2, R)$	blank tape or no more 1's, go to final state
$(0, 1, 1, 1, R)$	has read odd number of 1's
$(1, 1, 1, 0, R)$	has read even number of 1's

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