Problem Statement

The Finite State Machine Project 1 is a four-bit password checker, checking four binary values, applied one at a time to the FSM. The FSM must only reset once all four bits have been input, even if the bits are wrong.

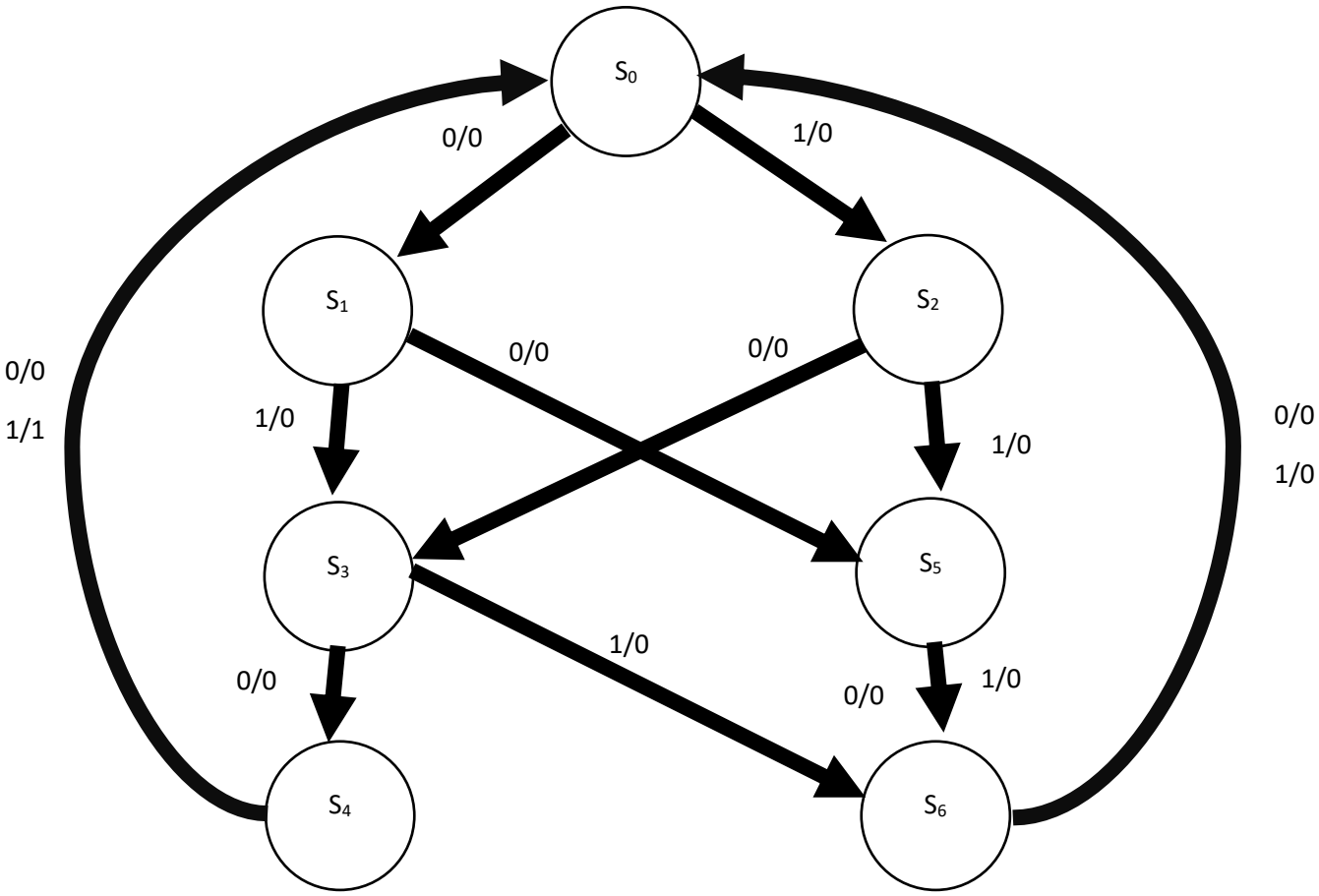
Two possible passwords exist: 0101 and 1001 (or 5 and 9). If either of these numbers are detected, then it outputs a “true”, a single bit 1. Otherwise, it outputs 0.

For this, I have assumed that every single input with be a 0 or 1 and have not accounted for undeclared or invalid bits. Also, the FSM will continue to check for a correct code, even after the correct code has been entered.

Finite State Machine Design

Because the output is dependent on the current input, this FSM is a Mealy machine.

State	Sequence Received
S_0	Reset
S_1	0
S_2	1
S_3	01 / 10
S_4	010 / 100
S_5	Two incorrect inputs
S_6	Three incorrect inputs



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Current State (ABC)	Input	Next State (ABC)	Output
S_0 (000)	0	S_1 (001)	0
	1	S_2 (010)	0
S_1 (001)	0	S_5 (101)	0
	1	S_3 (011)	0
S_2 (010)	0	S_3 (011)	0
	1	S_5 (101)	0
S_3 (011)	0	S_4 (100)	0
	1	S_6 (110)	0
S_4 (100)	0	S_0 (000)	0
	1	S_0 (000)	1
S_5 (101)	0	S_6 (110)	0
	1	S_6 (110)	0
S_6 (110)	0	S_0 (000)	0
	1	S_0 (000)	0
S_7 (111)	0	X (XXX)	X
	1	X (XXX)	X

A = C INPUT' + BC + AC + AB INPUT

AB	C INPUT 00	01	11	10
00				1
01		1	1	1
11			X	X
10			1	1

B = C INPUT + AC + A'B' INPUT + A'BC' INPUT'

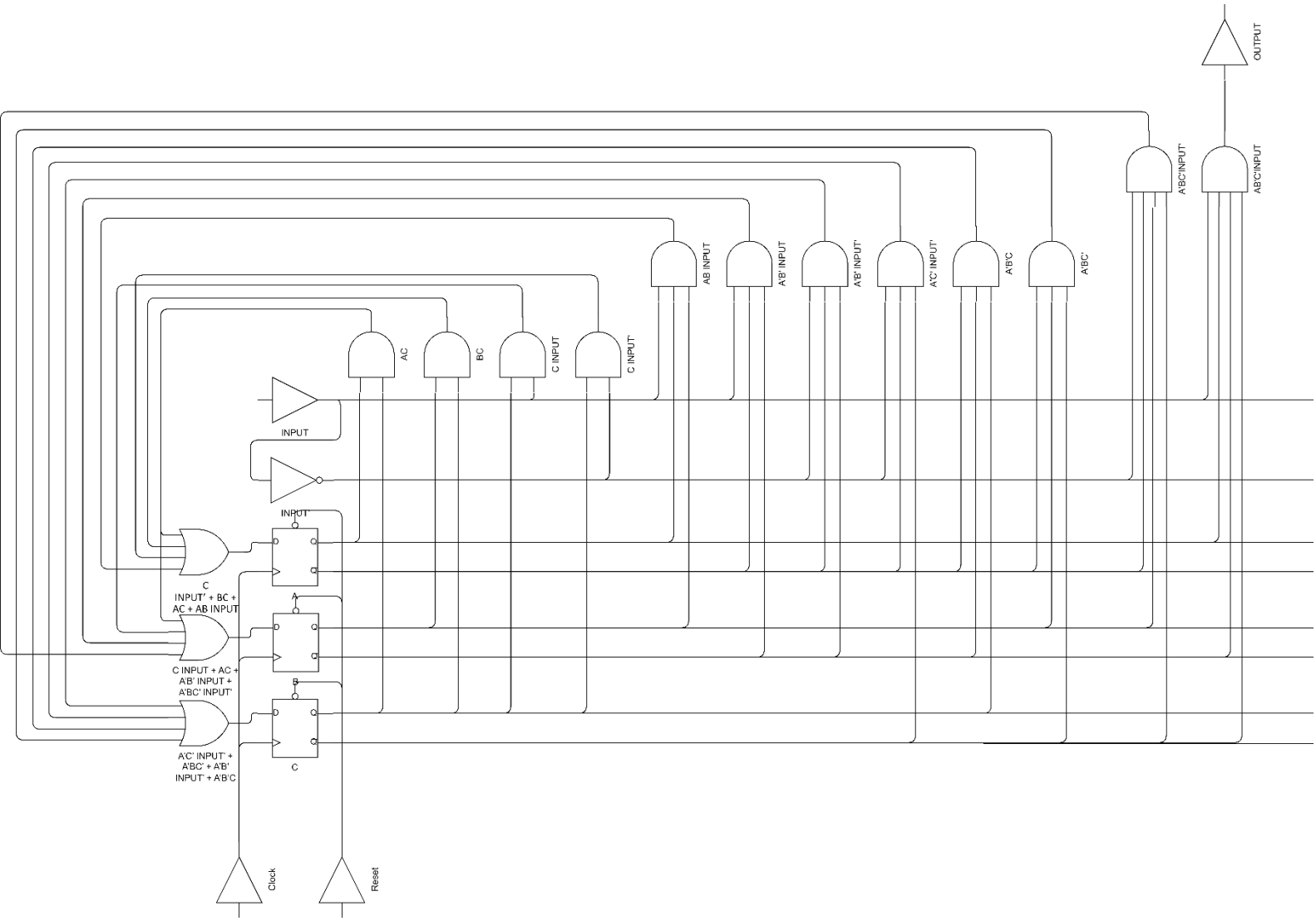
AB	C INPUT 00	01	11	10
00		1	1	
01	1		1	
11			X	X
10			1	1

C = A'C' INPUT' + A'BC' + A'B' INPUT' + A'B'C

AB	C INPUT 00	01	11	10
00	1		1	1
01	1	1		
11			X	X
10				

OUTPUT = AB'C' INPUT

AB	C INPUT 00	01	11	10
00				
01				
11			X	X
10		1		



The Verification Plan

To test this FSM, it's fairly easy to just test every possible 4-bit integer, and see which integer causes the machine to output a 1. To achieve this, I have 2 for loops; one to pick the number, and the other to split the number into the single bit chunks the FSM receives. As we can see here, the machine outputs a 1 after 5 (0101) and 9(1001), as expected.