1. Problem statement:

A sequential combination door lock of a building opens it only when correct password (combination) is entered by the authorized user. Each door has two authorized users who can unlock the door with their secret combination without revealing the same to other. You are required to design a state machine for the combination door lock.

2. Combination pair:

As the sum of our roll number was 353,
Therefore we had the combination 1101 and 0110.

3. FSM design Procedure:

Step 1: Assumptions

1. We have design our FSM using “Mealy Model” because of the following reasons:
    a) Mealy Machine Output is faster than Moore machine .
    b) Mealy machine generally require less states to build password detector so less hardware will be used.

2. We have done our simulation and using D-Flip Flops.

3. All the flip flops are initially reset.

4. We took positive edge triggered Flip flops

5. once the user enters their password the door will unlock for a certain amount of time which depend on clock.

Step 3: State table:

A	E, 0	B,0
B	E,0	C,0
C	D,0	C,0
D	E,0	F,1
E	F,0	F,0
F	E,0	G,0
G	D,1	C,0

Step 4: State minimization (no state minimization is possible)

BC X					
ED,BC X	DE X				
X	X	X			
BF X	CF X	ED, CF X	X		
BG X	CG X	ED, CG X	X	GF X	
X	X	X	X	X	X
A	B	C	D	E	F

Step 5: State Assignment

A=000
B=001
C=010
D=011
E=100
F=101
G=110

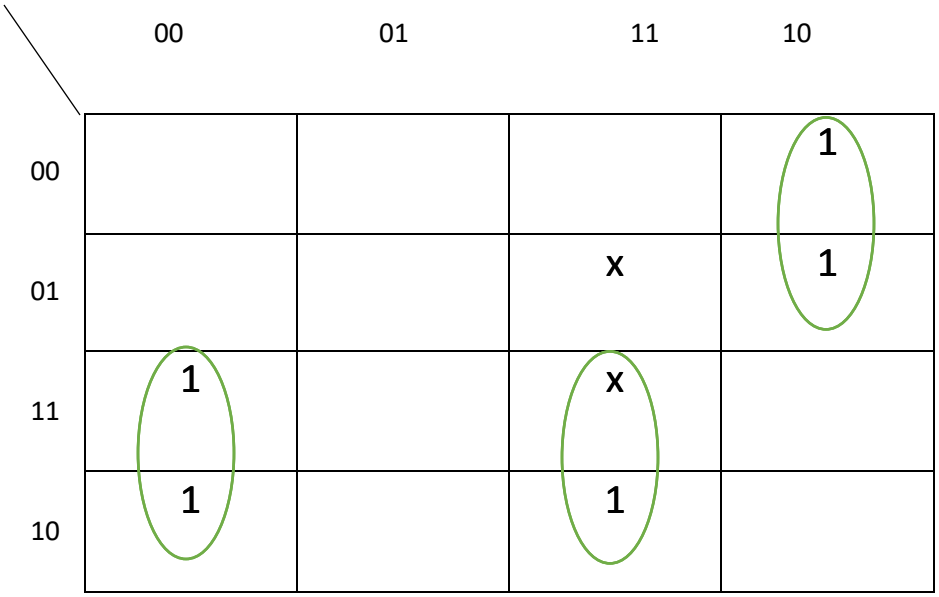
- Assuming the remaining state to be don't care.

Step 6: Truth table

Input	Present State			Next State			Output	Flip Flop Inputs		
X	**Q2**	**Q1**	**Qo**	**Q2+1**	**Q1+1**	**Qo+1**	**Z**	**D2**	**D1**	**Do**
0	0	0	0	1	0	0	0	1	0	0
0	0	0	1	1	0	0	0	1	0	0
0	0	1	0	0	1	1	0	0	1	1
0	0	1	1	1	0	0	0	1	0	0
0	1	0	0	1	0	0	0	1	0	0
0	1	0	1	1	0	0	0	1	0	0
0	1	1	0	0	1	1	1	0	1	1
0	1	1	1	X	X	X	X	X	X	X
1	0	0	0	0	0	1	0	0	0	1
1	0	0	1	0	1	0	0	0	1	0
1	0	1	0	0	1	0	0	0	1	0
1	0	1	1	1	0	1	0	1	0	1
1	1	0	0	1	0	1	0	1	0	1
1	1	0	1	1	1	0	1	1	1	0
1	1	1	0	0	1	0	0	0	1	0
1	1	1	1	x	x	X	X	x	x	X

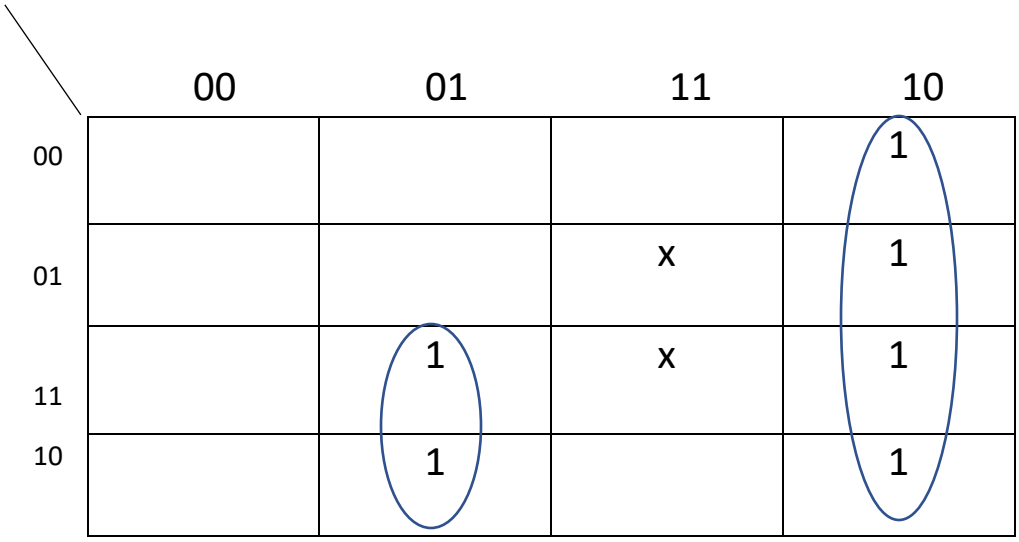
Step 7: State equations

A) For Do:



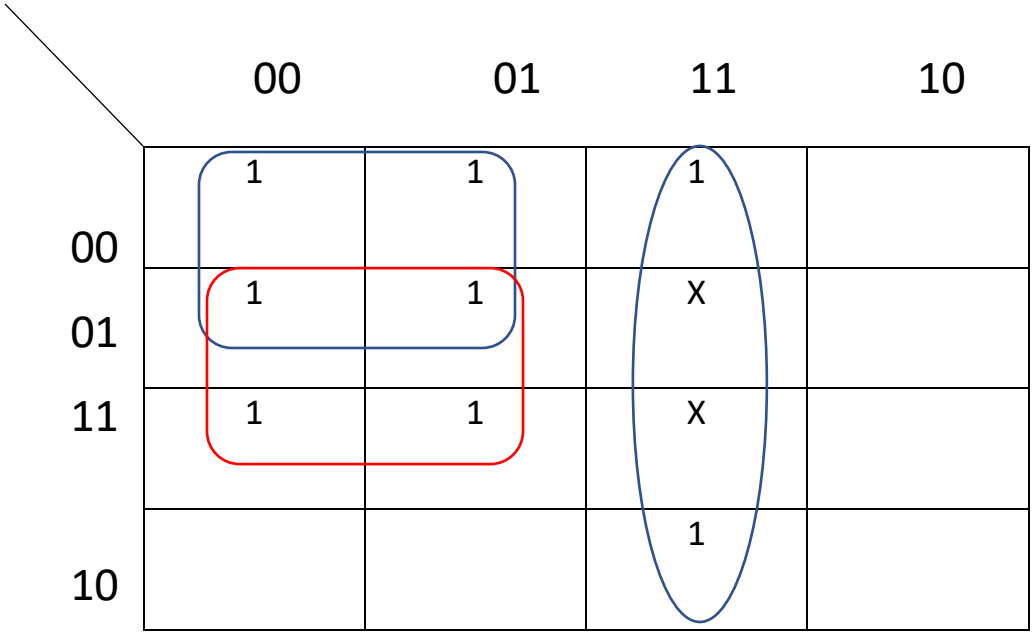
Do=X'Q1Qo' + XQ1'Qo' + XQ1Qo

B) For D1:



D1 = Q1Qo' + XQ1'Qo

For D2:



D2= Q1Qo+ X'Q1' + Q2Q1'

For Zo:

We get Zo directly from truth table

Zo= x'Q2Q1Qo'

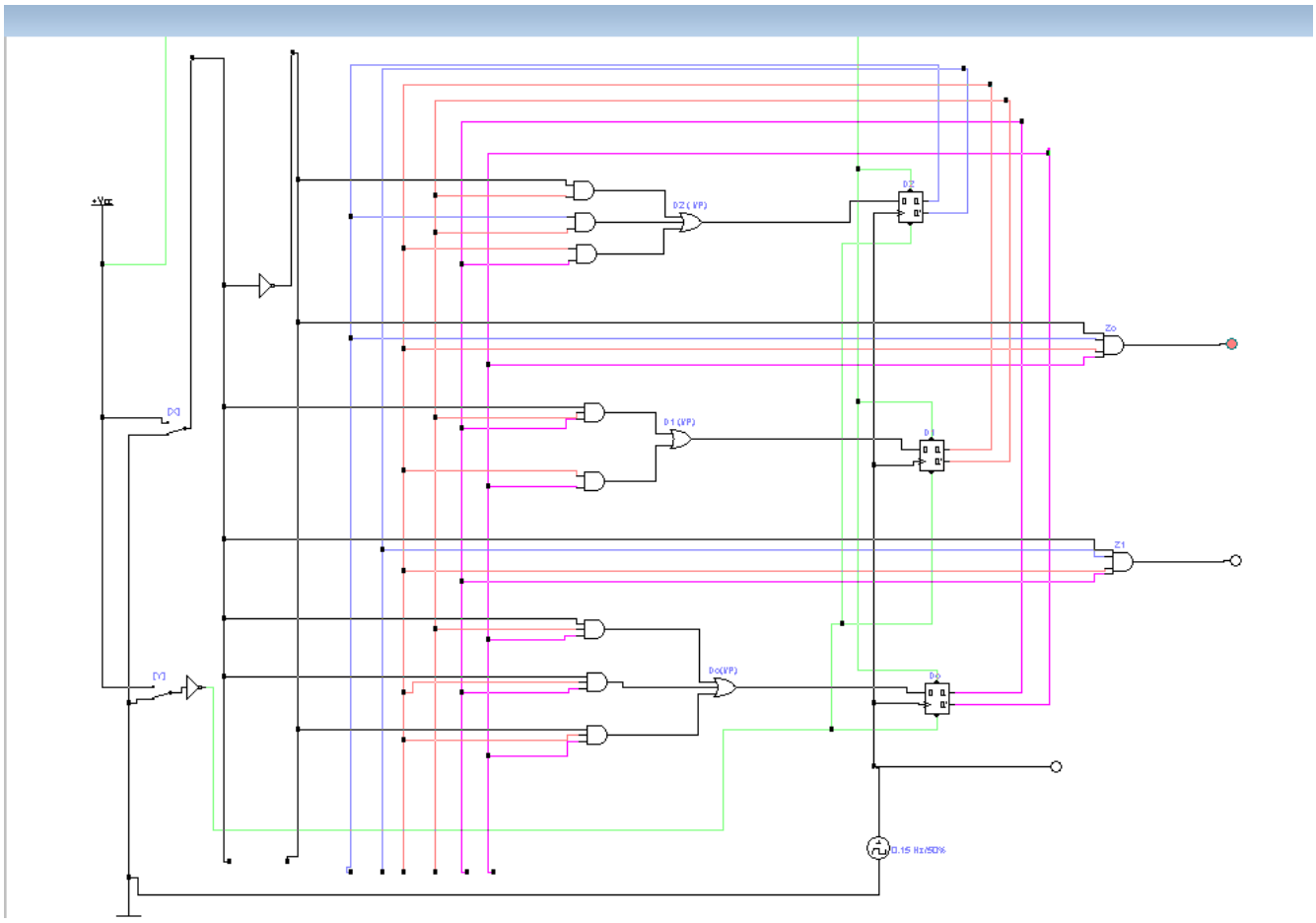
For Z1:

We get Z1 directly from truth table

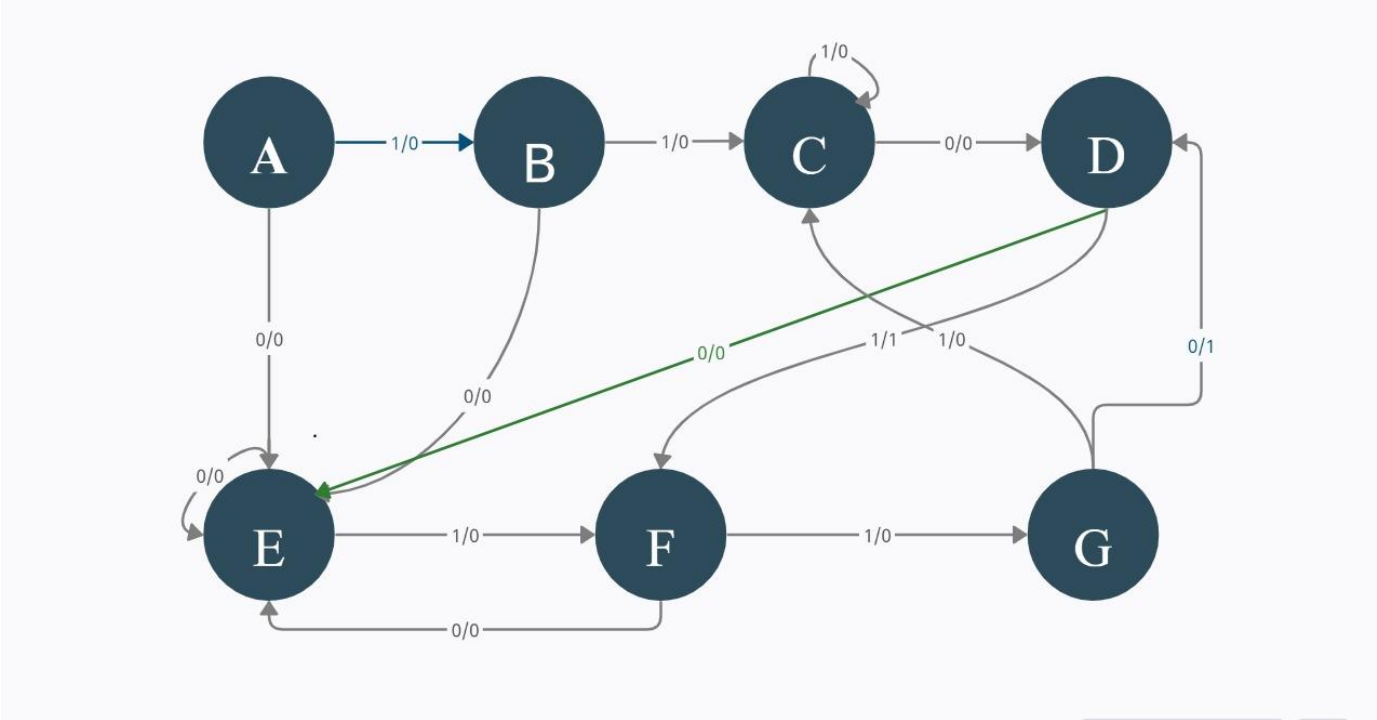
Z1= xQ2'Q1Qo

Step 8: Simulation of Circuit Diagram:

Case 1: When “0110” is Applied at input

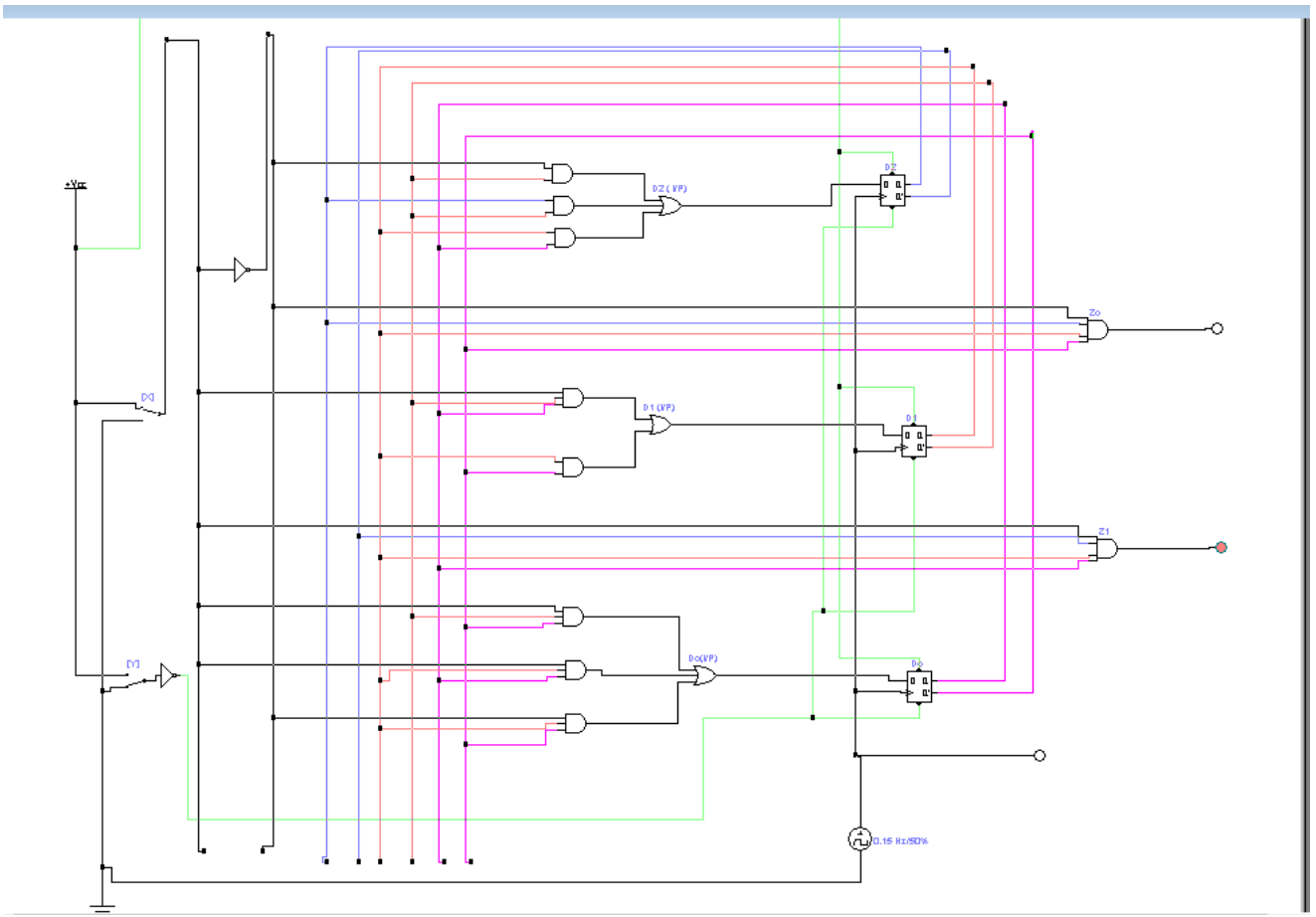


Step 2: Mealy Machine



- As there are 7 states **3 D flip flops** will be used.

Case 2: When “1101” is applied at input



Case 3: When an invalid input is applied