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Experiment 4 (Analysis of a Sequential Circuit)

Preliminary Work:

Step 1: State the inputs and outputs of the state registers.

Inputs: N2, N1, N0, clock, reset

Outputs: S2, S1, S0

Step 2: State the inputs and outputs of the combinational block.

Inputs: x, S2, S1, S0

Outputs: N2, N1,N0, y1, y0

Step 3: Write each output (including next state bits) as a function of the inputs.
N 2 =S2S1'S0'x + S2'S1S0x
N 1 =S2'S1'S0x + S2'S1S0'x
N 0 = S2'x' + S2S1'S0'x' + S2'S1S0'x
Y 1 = S2'S1S0x' + S2S1'S0'x'
Y 0 = S2'S1S0'x' + S2S1'S0'x'

Step 4: Draw the truth table for the combinational circuit.

#	S2	S1	S0	X	N2	N1	N0	Y1	Y0
0	0	0	0	0	0	0	1	0	0
1	0	0	0	1	0	0	0	0	0
2	0	0	1	0	0	0	1	0	0
3	0	0	1	1	0	1	0	0	0
4	0	1	0	0	0	0	1	0	1
5	0	1	0	1	0	1	1	0	0
6	0	1	1	0	0	0	1	1	0
7	0	1	1	1	1	0	0	0	0
8	1	0	0	0	0	0	1	1	1
9	1	0	0	1	1	0	0	0	0
10	1	0	1	0	0	0	0	0	0

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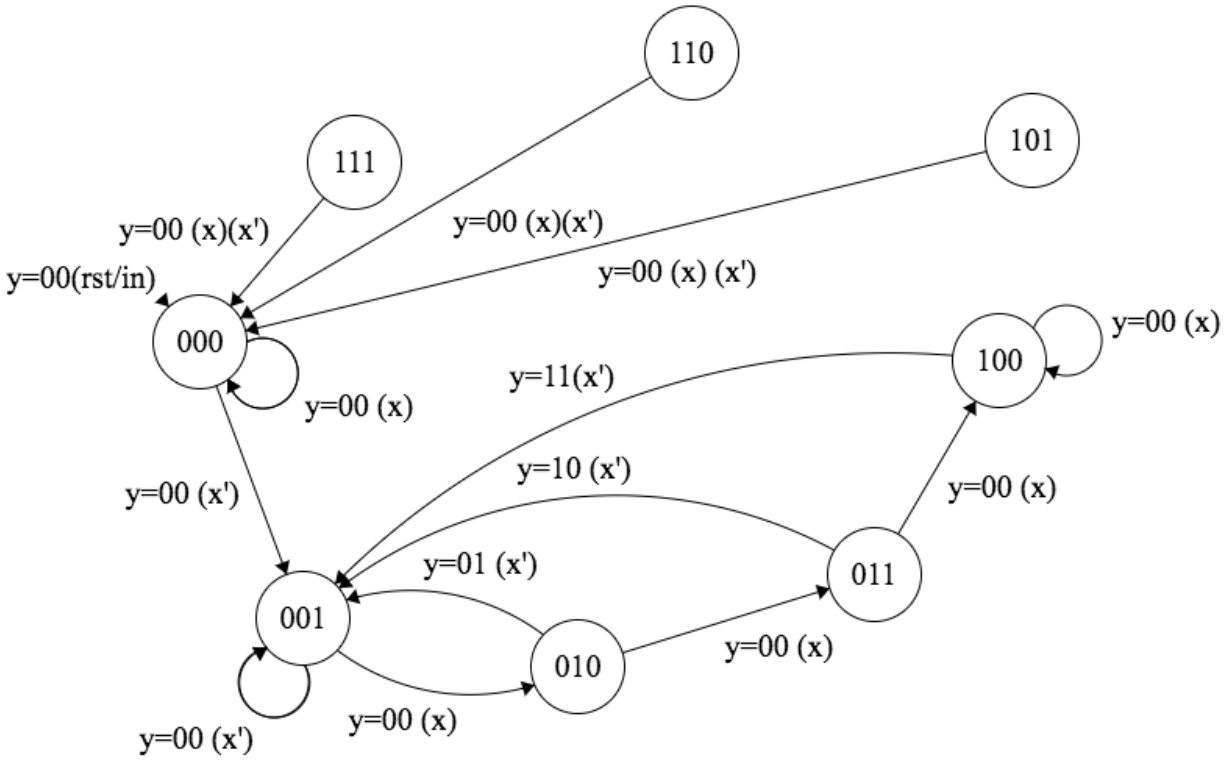
11	1	0	1	1	0	0	0	0	0
12	1	1	0	0	0	0	0	0	0
13	1	1	0	1	0	0	0	0	0
14	1	1	1	0	0	0	0	0	0
15	1	1	1	1	0	0	0	0	0

Step 5: Draw the finite state machine by using the truth table.



Step 6: How many unreachable states does the finite state machine contain? (No explanation, only short answer)

# of Unreachable States: 3 (111) (110)(101)

Step 7: Briefly explain the relation between the input and the output.

Explanation: It counts 1's between 0's. If the 1's between 0's is 1 -> output 01; If the 1's between 0's is 2 -> output 10; If the 1's between 0's is more then or equal to 3 -> output 11. Else the output is 00.