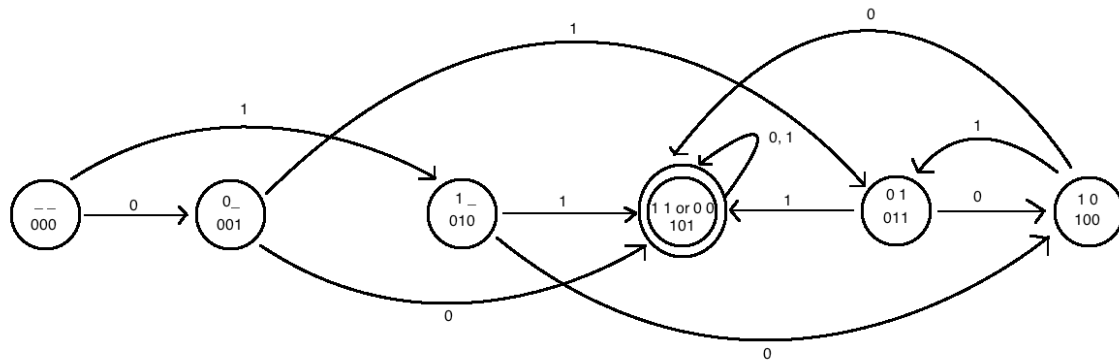State Diagram:

For each state, the numbers on top are the past two clocked inputs, and the bottom number represents the current state. The 3 bits of this state are represented by S2, S1, and S0. The double circle means the output is 1, and that output cannot be changed. For all other states, the output is 0.

Truth Table:

IN	S2	S1	S0	S2_next	S1_next	S0_next	OUT
0	0	0	0	0	0	1	0
0	0	0	1	1	0	1	1
0	0	1	0	1	0	0	0
0	0	1	1	1	0	0	0
0	1	0	0	1	0	1	1
0	1	0	1	1	0	1	1
1	0	0	0	0	1	0	0
1	0	0	1	0	1	1	0
1	0	1	0	1	0	1	1
1	0	1	1	1	0	1	1
1	1	0	0	0	1	1	0
1	1	0	1	1	0	1	1

Equations:
OUT = IN' S2' S1' S0 + IN' S2 S1' S0' + IN' S2 S1' S0 + IN S2' S1 S0' + IN S2' S1 S0 + IN S2 S1' S0
= IN' S1' + (S2' S0 + S2 S0' + S2 S0) + IN S1 + (S2' S0' + S2' S0) + IN S2 S1' S0
= IN' S1' + S2' S0' + IN S1 + S2' + IN S2 S1' S0

S2_next = (IN S2 S1 S0)' + (IN S2' S1' S0')' + (IN S2' S1' S0)' + (IN S2 S1' S0')'
=(IN S2 S1 S0 + IN S2' S1' S0' + IN S2' S1' S0 + IN S2 S1' S0')'
=(IN S2' + (S1' S0' + S1' S0) + IN S2 + (S1 S0 + S1' S0'))'
=(IN S2' + S1' + IN S2 + (S1 ⊕ S0)')'

S1_next = IN S2' S1' S0' + IN S2' S1' S0 + IN S2 S1' S0'
= IN S2' S1' + (S0' + S0) + IN S2 S1' S0'
= IN S2' S1' + IN S2 S1' S0'

S0_next = (IN' S2' S1 S0' + IN' S2' S1 S0 + IN S2' S1' S0')'

=(IN' S2' + (S1 S0' + S1 S0) + IN S2' S1' S0')'

=(IN' S2' + S1 + IN S2' S1' S0')'