

CS 207 Digital Logic - Spring 2019

Quiz 2

Monday, Apr. 15, 2019

Write down your answer to the questions with detailed procedures. Feel free to refer to the lecture notes. Discussion is allowed as long as not disturbing to others.

SUSTech SID: _____

- Using a decoder and external gates, design one combinational circuit defined by the following three Boolean functions: $F_1 = x'y'z' + xz$, $F_2 = xy'z' + x'y$, $F_3 = x'y'z' + xy$.

Solution:

$$F_1 = x(y + y')z + x'y'z' = xyx + xy'z + x'y'z' = \Sigma(2, 5, 7)$$

$$F_2 = xy'z' + x'y = xy'z' + x'y'z + x'yz' = \Sigma(2, 3, 4)$$

$$F_3 = x'y'z' + xy(z + z') = x'y'z' + xyz + xyz' = \Sigma(0, 6, 7)$$

- Derive the state table and the state diagram of the sequential circuit shown in Fig. 1. Explain the function that the circuit performs.

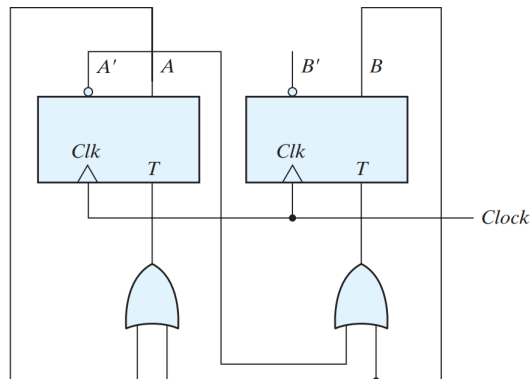


Figure 1: Sequential circuit for Question 2.

Solution:

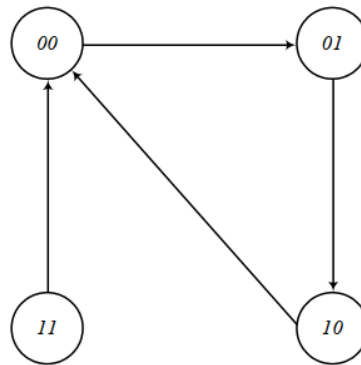
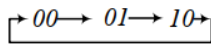
A counter with a repeated sequence of 00, 01, 10.

Present state		Next state		FF Inputs	
A	B	A	B	T_A	T_B
0	0	0	0	0	1
0	1	1	0	1	1
1	0	0	0	1	0
1	1	0	0	1	1

$$T_A = A + B$$

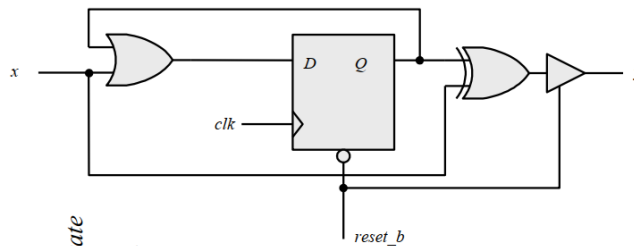
$$T_B = A' + B$$

Repeated sequence:

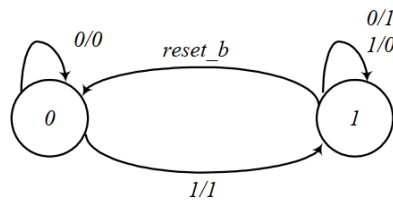


3. Design a one-input, one-output serial 2's complemter. The circuit accepts a string of bits from the input and generates the 2's complement at the output. The circuit can be reset asynchronously to start and end the operation.

Solution: The output is 0 for all 0 inputs until the first 1 occurs, at which time the output is 1. Thereafter, the output is the complement of the input. The state diagram has two states. In state 0: output = input; in state 1: output = input'.



Present state	Input	Next state	Output
A	x	A	y
0	0	0	0
0	1	1	1
1	0	1	1
1	1	1	0



$$D_A = A + x$$

$$y = Ax' + A'x$$