

Complete the truth table for the following sequential circuit:

Present State		Input X	Next State	
A	B		A	B
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

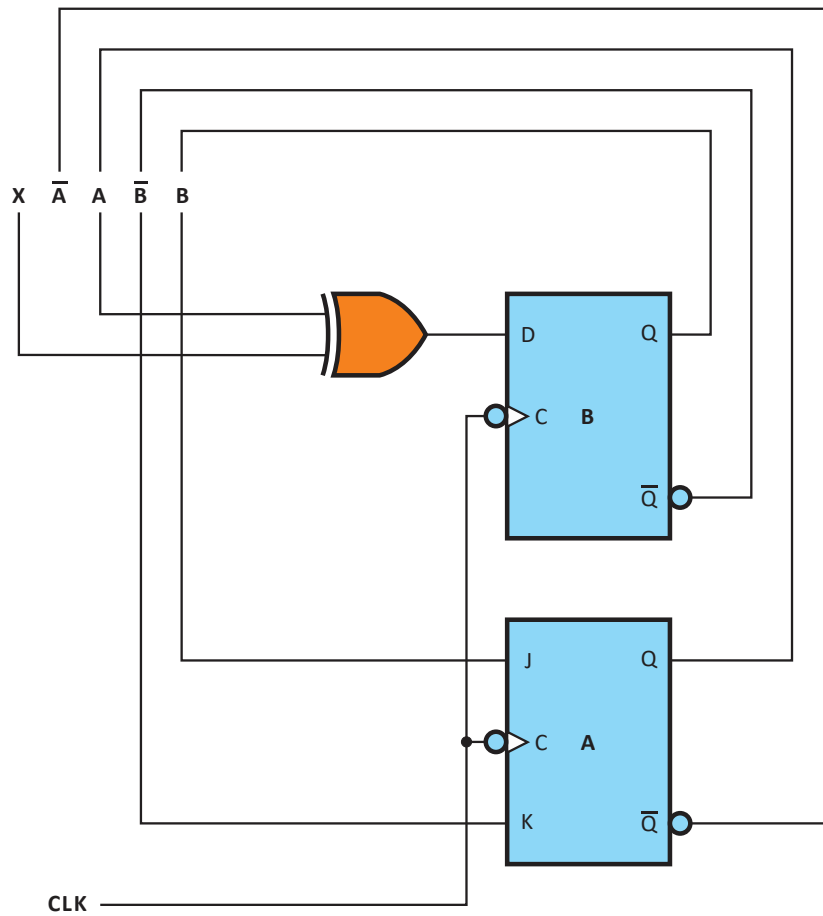


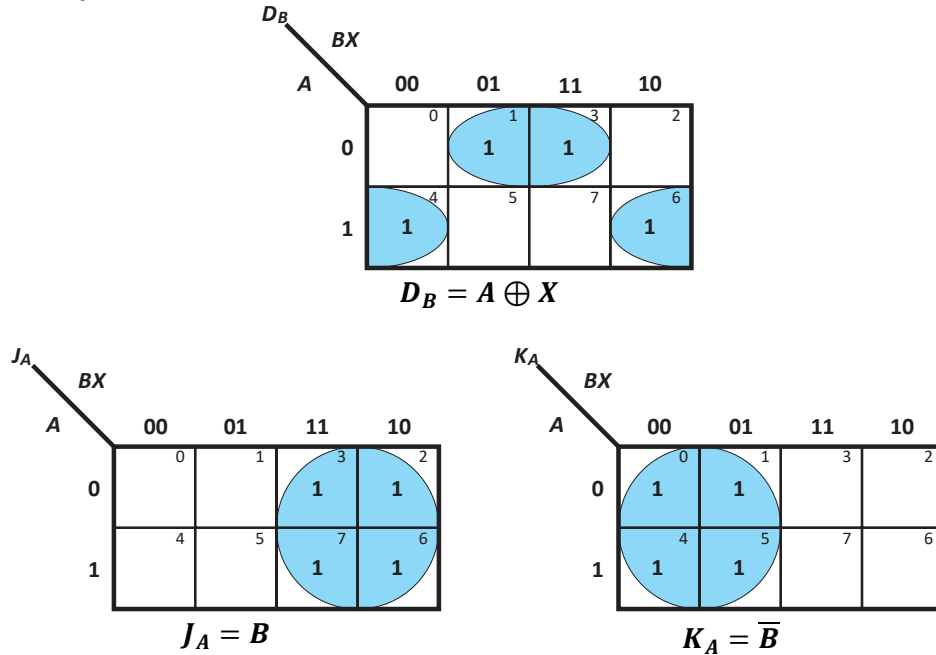
Figure 1. Logic Diagram Similar to Exercise 55.

Solution:

1. Write the equations for the next state decoder.

$$D_B = A \oplus X, J_A = B, K_A = \bar{B}$$

2. Create K-Maps for the next state decoder.



3. Augment the truth table to include columns for the next state decoder.

Present State		Input X	Next State Decoder			Next State	
A	B		J_A	K_A	D_B	A	B
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

4. Enter the values of the next state decoder from the appropriate K-Map.

Present State		Input X	Next State Decoder			Next State	
A	B		J_A	K_A	D_B	A	B
0	0	0	0	1	0		
0	0	1	0	1	1		
0	1	0	1	0	0		
0	1	1	1	0	1		
1	0	0	0	1	1		
1	0	1	0	1	0		
1	1	0	1	0	1		
1	1	1	1	0	0		

5. Compute the next state values for the JK-flip-flop designated as A with the aid of the JK Characteristic Table shown below.

Present State		Input X	Next State Decoder			Next State	
A	B		J_A	K_A	D_B	A	B
0	0	0	0	1	0	0	
0	0	1	0	1	1	0	
0	1	0	1	0	0	1	
0	1	1	1	0	1	1	
1	0	0	0	1	1	0	
1	0	1	0	1	0	0	
1	1	0	1	0	1	1	
1	1	1	1	0	0	1	

Present State				Next State	
J	K	$Q(t)$		$Q(t + 1)$	
0	0	0	0	0	Retains state
1	0	0	1	1	
2	0	1	0	0	RESET
3	0	1	1	0	
4	1	0	0	1	SET
5	1	0	1	1	
6	1	1	0	1	Toggle
7	1	1	1	0	

JK Flip-Flop Characteristic Table

6. Compute the next state for the D-Flip-Flop labeled B by copying the values in the D_B -column to the Next State B -column since the state follows the input value for a D -flip-flop.

Present State		Input X	Next State Decoder			Next State	
A	B		J_A	K_A	D_B	A	B
0	0	0	0	1	0	0	0
0	0	1	0	1	1	0	1
0	1	0	1	0	0	1	0
0	1	1	1	0	1	1	1
1	0	0	0	1	1	0	1
1	0	1	0	1	0	0	0
1	1	0	1	0	1	1	1
1	1	1	1	0	0	1	0

7. Now, we can present the solution to the problem by copying the Next State values in our Present-State-Next-State Table shown in step 6 above to the Present-State-Next-State Table given in the original problem.

Present State		Input X	Next State	
A	B		A	B
0	0	0	0	0
0	0	1	0	1
0	1	0	1	0
0	1	1	1	1
1	0	0	0	1
1	0	1	0	0
1	1	0	1	1
1	1	1	1	0