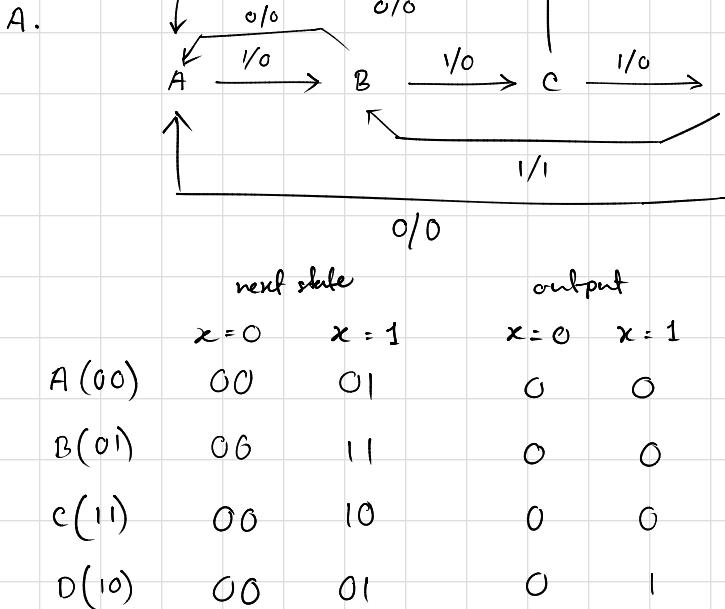


1. Design a clocked sequential circuit that recognizes the 4-bit input sequence 1111, including overlap. Design the circuit using D Flip-Flops. You have to show the following:  
A. The state diagram  
B. The flip-flop input table  
C. The simplified equation(s) for the flip-flop input(s) and the output(s)  
D. The final circuit diagram  
E. Suppose an input bit stream "01111010011111011" is given to this system. What will be the output stream?



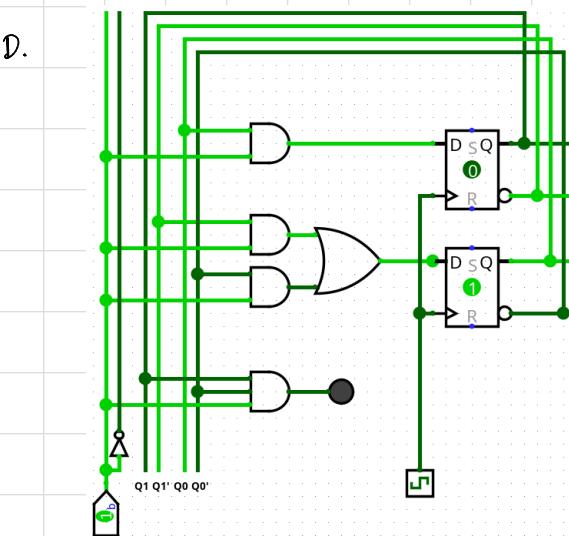
B.

	$Q_1$	$Q_0$	$x$	$Q_1$	$Q_0$	$y$
00	0	0	0	0	0	0
01	0	0	1	0	1	0
10	0	1	0	0	0	0
11	0	1	1	1	1	0
00	1	0	0	0	0	0
01	1	0	1	0	1	1
10	1	0	0	0	0	0
11	1	1	1	1	1	1

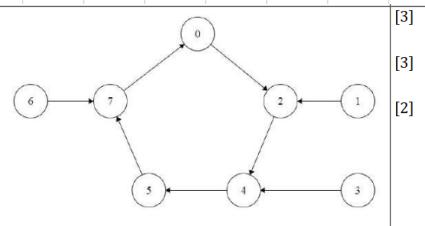
C.

$$D_1 = Q_0 x$$

$$D_0 = \bar{Q}_1 x + \bar{Q}_0 x$$

$$Y = Q_1 \bar{Q}_0 x$$


2. A. Find the state table with T/J/K flip flop inputs.  
B. Minimize the functions of flip flop inputs.  
C. Draw the circuit diagram using T/J/K flip flops and basic gates

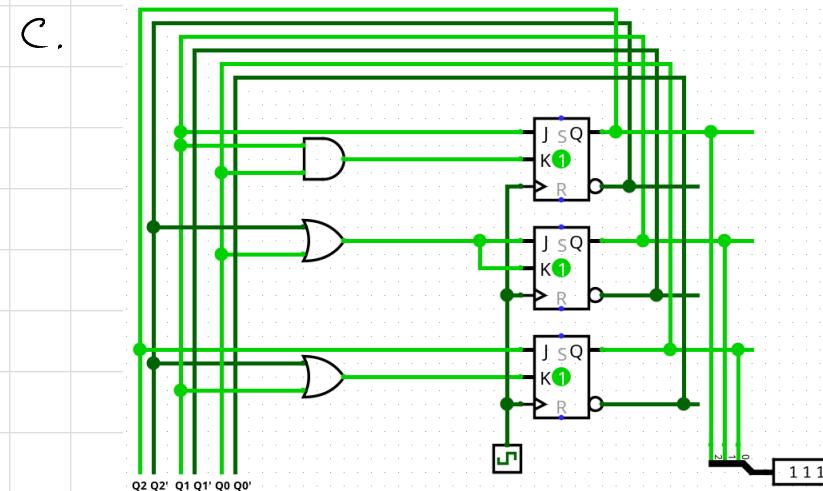


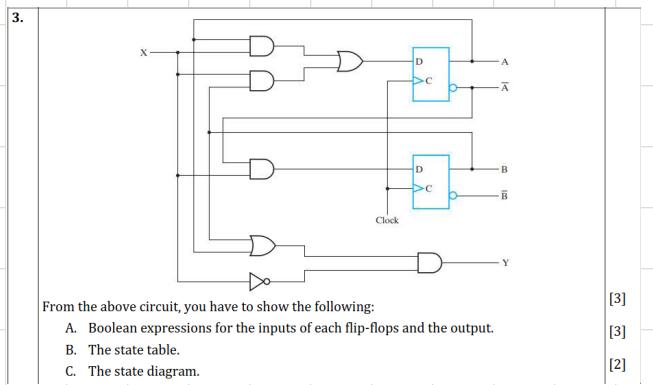
A.

$Q_2$	$Q_1$	$Q_0$	$Q_1$	$Q_0$	$J_2$	$K_2$	$J_1$	$K_1$	$J_0$	$K_0$
0	0	0	0	1	0	0	1	x	0	x
0	0	1	0	1	0	0	1	x	x	1
0	1	0	1	0	0	1	x	1	x	1
0	1	1	1	0	0	1	x	1	x	1
1	0	0	1	0	1	0	x	0	x	1
1	0	1	1	1	x	0	1	x	x	0
1	1	0	1	1	x	0	x	0	1	x
1	1	1	0	0	x	1	x	1	x	1

B.

$Q_2$	$Q_1$	$Q_0$	$Q_1$	$Q_0$	$J_2$	$K_2$	$J_1$	$K_1$	$J_0$	$K_0$
0	0	0	0	1	1	1	1	x	0	x
0	0	1	0	1	x	x	x	x	x	x
0	1	0	1	0	x	x	x	x	x	x
0	1	1	0	0	x	x	x	x	x	x
1	0	0	1	0	x	x	x	x	x	x
1	0	1	1	1	x	x	x	x	x	x
1	1	0	1	1	x	x	x	x	x	x
1	1	1	0	0	x	x	x	x	x	x

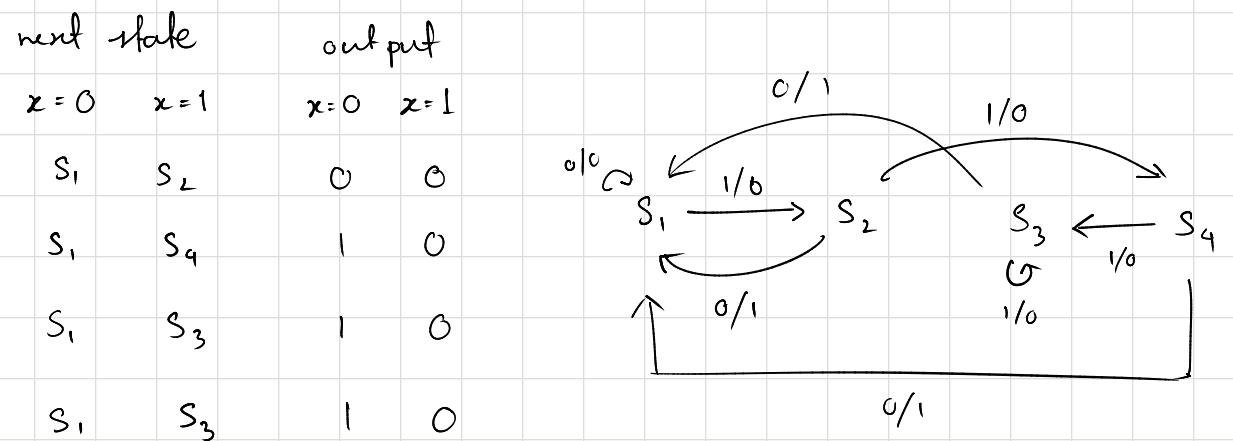




D<sub>1</sub>, D<sub>0</sub>

B.    A    B    x    A    B    Y    C.

0	0	0	0	0	0	0	S <sub>1</sub> (00)
0	0	1	0	0	1	0	S <sub>2</sub> (01)
0	1	0	0	0	0	1	S <sub>3</sub> (10)
0	1	1	0	1	1	0	S <sub>4</sub> (11)
1	0	0	0	0	0	1	S <sub>1</sub>
1	0	1	0	0	0	0	S <sub>2</sub>
1	1	0	0	0	1	0	S <sub>3</sub>
1	1	1	0	0	0	0	S <sub>4</sub>



6. A calling bell system is required to be developed for an IT office consisting of a manager, a project lead, a senior engineer, a junior engineer, and an intern. The priority of the calling bell system should be determined in the following order: manager (highest priority), project lead, senior engineer, junior engineer, and intern (lowest priority).

Your task is to design a priority encoder for the calling bell system, ensuring the correct prioritization of the five individuals mentioned, based on their respective input signals. The corresponding input pin labels and output signals for each individual are as follows: Manager (M-101), Project Lead (L-111), Senior engineer (S-000), Junior Engineer (J-100), and Intern (I-110).

- A. Construct the truth table for the given priority encoder including valid bit.  
 B. Derive the Boolean expressions for each output signal along the valid bit.  
 C. Draw the implementation diagram.

M	L	S	J	I	$y_2$	$y_1$	$y_0$	V
0	0	0	0	0	X	X	X	0
0	0	0	0	1	1	1	0	1
0	0	0	1	x	1	0	0	1
0	0	1	x	x	0	0	0	1
0	1	x	x	x	1	1	1	1
1	x	x	x	x	1	0	1	1

