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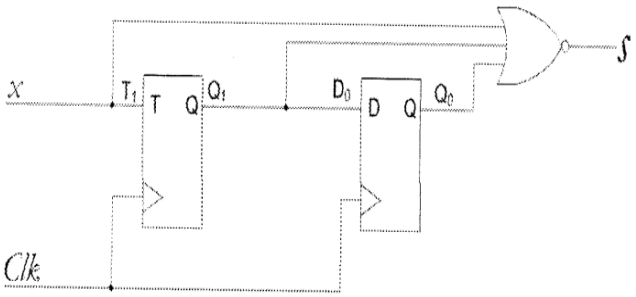
Faculty of Exact Sciences and Natural and Life Sciences
Department of: Mathematics / Computer science
Module : Machine Structure 2
Level / Year: L1 (2023/2024)

Assignment N° 4: Sequential circuits

Exercise 1:

Consider the following sequential circuit; its Bits of states are Q_1 et Q_0. We suppose that x does not change during the same clock cycle (synchronous input).



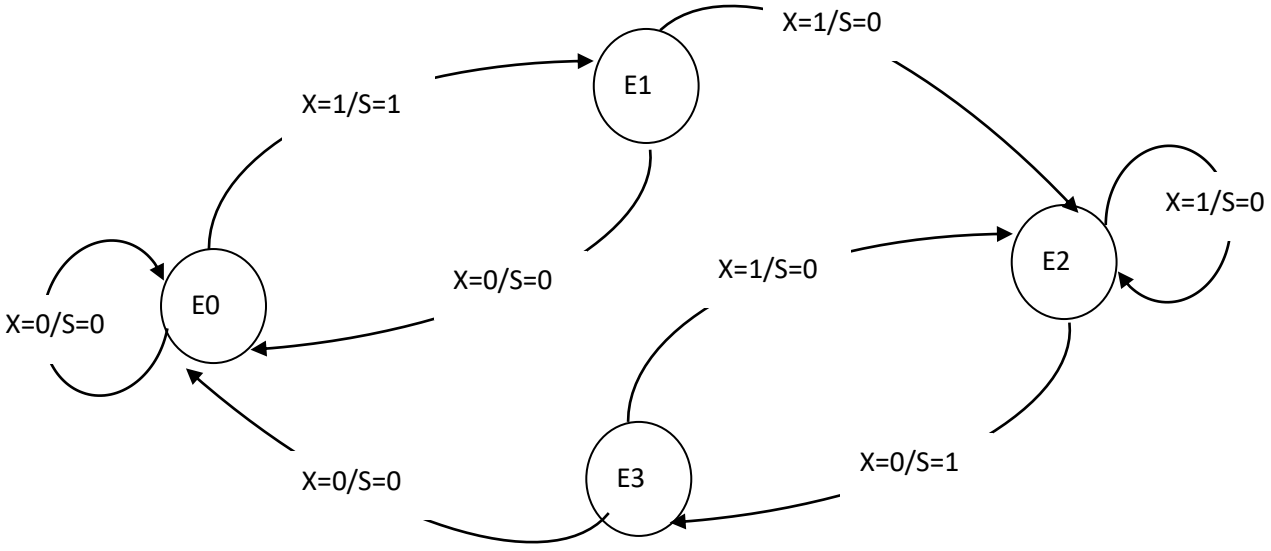
1) Give the logical expression of the input of the Flip-flop T (T_1) and the input of the Flip-flop D (D_0) using the input x and the Bits of the states Q_1 and Q_0
2) Give the Boolean expression of the output S according to the input x and the Bits of the states Q_1 and Q_0
3) Give the Boolean expression of the Bits of future states (Q_1^+ and Q_0^+) as function of the input x and the Bits of the states Q_1 and Q_0
4) Using the obtained results, fill the following state table:

Present state (Q_1Q_0)	Next state ($Q_1^+Q_0^+$)		Output (S)	
	x		x	
	0	1	0	1
E0=00				
E1=01				
E2=10				
E3=11				

5) Deduce the state diagram of this circuit?

Exercise 2 :

Consider the following state diagram:



1) Write its state table ?

Present state (Q_1Q_0)	Next state ($Q_1^+Q_0^+$)		Output (S)	
	x		x	
	0	1	0	1
E0=00				
E1=01				
E2=10				
E3=11				

2) Study the implementation of this circuit using the Flip-flops T and D ?

Q_1^+

Q_1Q_0	00	01	11	10
X=0				
X=1				

Q_0^+

Q_1Q_0	00	01	11	10
X=0				
X=1				

D1

Q_1Q_0	00	01	11	10
X=0				
X=1				

T0

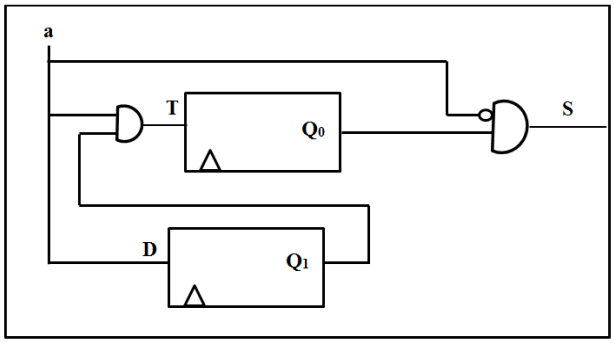
Q_1Q_0	00	01	11	10
X=0				
X=1				

3) Deduce the expression of the output S?

4) Draw the logic circuit for implementing this state machine?

Exercise 3: Consider the sequential circuit defined by its circuit diagram in the below figure; its Bits of states are Q_1 and Q_0. We suppose that x does not change during the same clock cycle (synchronous input).

1) Give the Boolean expression of the input of the flip-flop T and the input of the flip-flop D according to the input « a » and the bits of states Q_1 et Q_0
2) Give the logical expression of the output S according to the input « a » and the bits of states Q_1 et Q_0
3) Give the Boolean expression of the Bits of future states (Q_1^+ and Q_0^+) according to the input « a » and the bits of states Q_1 et Q_0



4) Using the obtained results, fill the following state table:

Present state (Q_1Q_0)	Next state ($Q_1^+Q_0^+$)		Output (S)	
	a		a	
	0	1	0	1
00				
01				
11				
10				

5) Deduce the state diagram of this circuit ?

Exercise 4: A new flip-flop is having behavior as described below:

It has two inputs "x" and "y", when both inputs are same and they are (1,1) the flip-flop is going to set else flip-flop resets. If both inputs are different and they are (0,1) the flip-flop complements itself else it is going to retain the last state.

1- What is a sequential circuit?
2- Find the characteristic expression for this new flip-flop?