CMPUT 329 - Computer Organization and Architecture II
Quiz # 5 — Fall 2003

Prof. José Nelson Amaral
Computing Science Department
University of Alberta

Name: **SOLUTION**

CMPUT 329 Honor Code

By turning in the quiz solution for grading, I certify that I have worked all the solutions on my own, that I have not copied or transcribed solutions from a classmate, someone outside the class, or from any other source. I also certify that I have not facilitated or allowed any of my classmates to copy my own solutions. I am aware that the violation of this honor code constitutes a breach of the trust granted me by the teaching staff, compromises my reputation, and subjects me to the penalties prescribed in Section 26.1 of the University of Alberta 2003/2004 Calendar.

Edmonton, November, 2003.

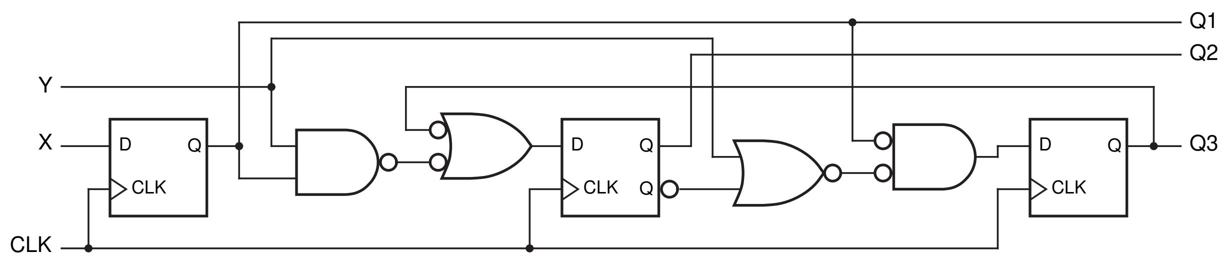

Figure 1: A sequential circuit using *D* Flip-flops.

Current State	Next State			
Q1 Q2 Q3	X=0 & Y=0	X=0 & Y=1	X=1 & Y=0	X=1 & Y=1
000	011	011	111	111
001	001	001	101	101
010	010	011	110	111
011	000	001	100	101
100	010	010	110	110
101	000	010	100	110
110	010	010	110	110
111	000	010	100	110

Table 1: State Transition Table for the sequential circuit of Figure 1.

Question 1 (50 points):

In this question you will analyse the sequential circuit shown in Figure 1.

a. (25 points) Write the excitation equations and the output equations for the circuit.

```
D1 = X
D2 = Q1.Y + Q3'
D3 = Q1'.(Q2' + Y) = Q1'.Q2' + Q1'.Y
```

b. (25 points) Complete the State Transition Table 1.

`It is easier to read the columns in the table.`

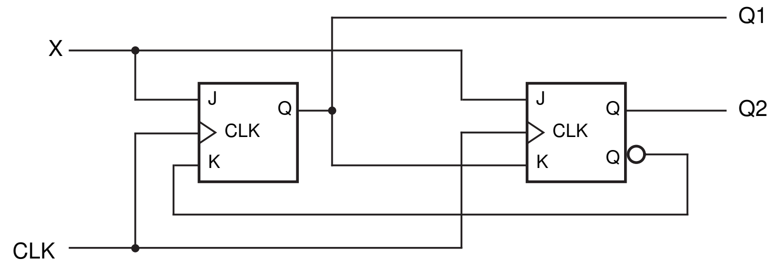

Figure 2: A sequential circuit using JK Flip-flops.

Question 2 (30 points):

For this question, it might be useful to recall the Application table for J-K flip-flops that is presented on page 577 of your textbook:

Q	Q+	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

This table provides the values that you have to have in the inputs J and K of the J-K flip-flop when you want to effect a transition from the current state Q to the next state Q+. An X in the table indicates a don't care.

You wil analyse the sequential circuit built with two J-K flip-flops shown in Figure 2. Assume that the four states in this machine are A, B, C, and D, and the following state assignment: (A:00), (B:01), (C:10), and (D:11). Assume also that 01 indicates that Q1=0 and Q2=1.

a. (25 points) Complete the following state transition table.

Current State	Next State		Outputs	
Q1 Q2	X=0	X=1	Q1	Q2
00	00	11	0	0
01	01	11	0	1
10	00	01	1	0
11	10	10	1	1

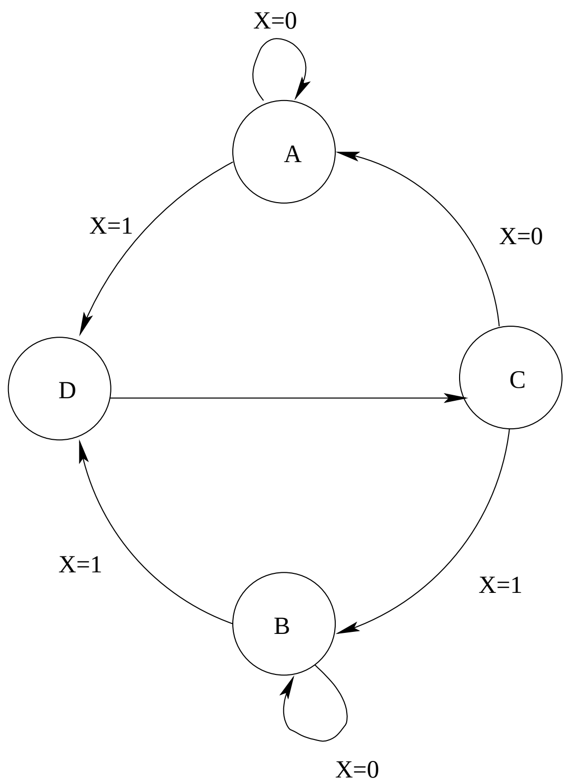

Figure 3: State Diagram for FSM implemented by circuit of Figure 2.

b. (25 points) Complete the drawing of the state diagram of Figure 3 for the finite state machine implemented by the circuit of Figure 2.