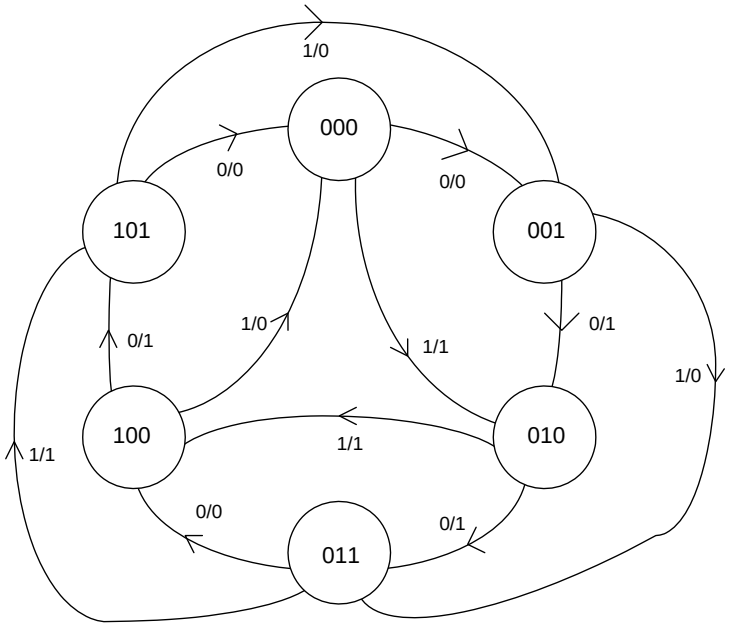
EGR 270 Due date: Monday, 4-14-08, 4:20 pm
Fundamentals of Computer Engineering
Spring 2008
File: N270T3E

Test #3
Take-home Test

Instructions:

1. The test is open-book, open-notes. Any books are allowable.
2. The test must be your own work. You may neither give nor receive help of any kind from any person.
3. Work the test on separate paper.
4. Problems should be presented neatly with clear solutions.
5. In general it is not necessary to show feedback connections from flip-flops to gates when drawing logic diagrams.
5. Staple the solution sheets together or place them in a folder.
6. Include a final page with a signed pledge stating the following:
   "I pledge that I have neither given help to any other person nor received help from any other person on this test."
7. The test will not be accepted late except in case of emergency (and timely notification).

1. (14 points) Design a synchronous sequential circuit using SR flip-flops to implement the following state diagram using the **excitation table method**. Treat all unused states as "don't cares". Draw the final logic diagram.

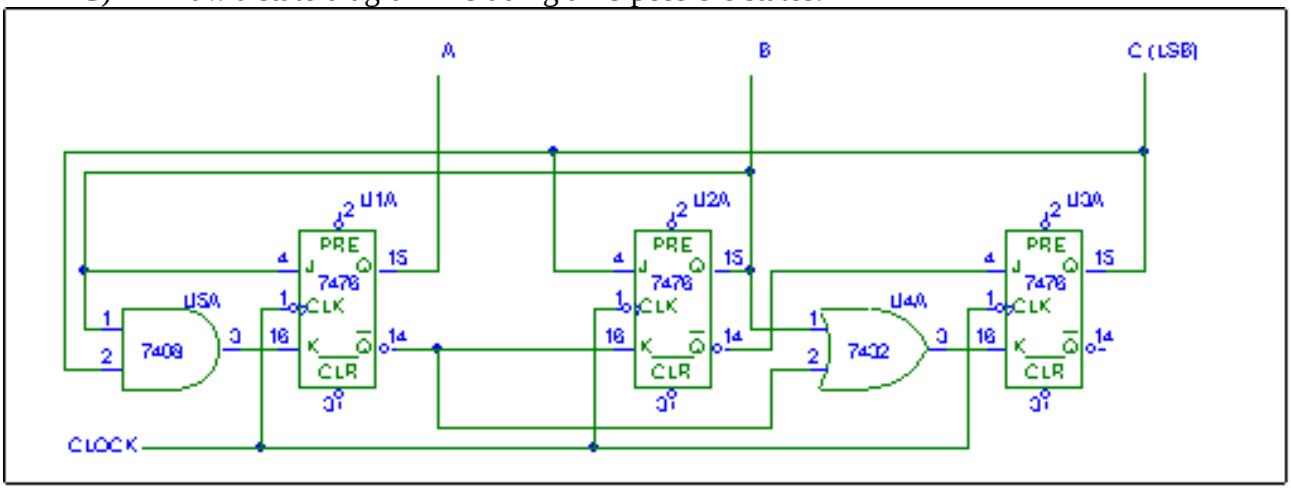


2 (14 points) Consider the counter shown below.

A) Use a timing diagram to determine the counting sequence for the counter below if the counter begins with count 000. The timing diagram should include CK, JA, KA, JB, KB, JC, KC, A, B, and C.

B) Is the counter self-starting?

C) Draw a state diagram including all 8 possible states.



3. (14 points) Design a sequential circuit to implement the state table shown below using JK flip-flops and using the **state equation method**. (No credit will be given if the excitation table method is used.) Draw the final logic diagram.

	Next State		Output	
Present State	x = 0	x = 1	x = 0	x = 1
A B	A B	A B	y	y
0 0	0 0	1 1	0	0
0 1	0 0	1 0	0	1
1 0	0 1	1 1	1	0
1 1	1 0	0 1	1	1

4. (10 points) Draw the state diagram for a synchronous **sequence detector** that will detect every occurrence of the sequence 001001 in a serially transmitted message of any length. The sequence detector should detect overlapping sequences as well as individual occurrences of the sequence.

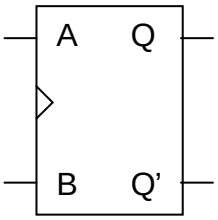
5. (14 points) A certain sequential circuit has the following state equations and output equation.

$$A(t+1) = x + AB$$
$$B(t+1) = A'B' + (x \oplus A)$$
$$y = A' + (x \oplus B)$$

where x is an input and y is an output. Draw the state diagram.

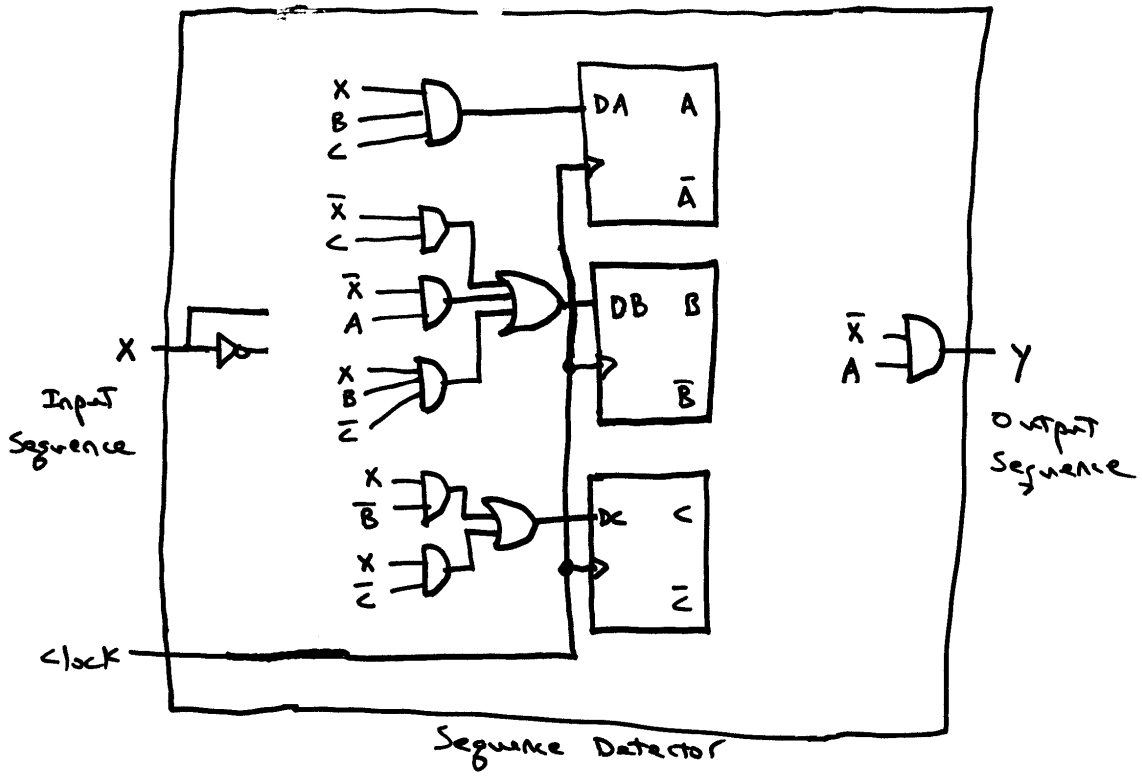
6. (6 points) Suppose that an AB flip-flop is defined with the following truth table. The block diagram for the AB flip-flop is also shown below.

A	**B**	**Q(t + 1)**
0	0	0
0	1	Q'(t)
1	0	Q(t)
1	1	1



A) Draw the **excitation table** for the AB flip-flop.
B) Determine the **characteristic equation** (minimized) for the AB flip-flop.

7. (14 points) The circuit below is a **sequence detector**.
   A) Determine the state diagram for the sequence detector assuming that the sequence detector begins in state 000. It is not necessary to include unused states.
   B) What sequence does it detect?
   C) Does it detect overlapping sequences?



8. (14 points) Design a circuit using D flip-flops and the "one-hot method" to implement the state diagram shown below. Draw the final logic diagram. Label the input as X.