EE111 - TEST III

NAME _____

Show all your work in the space provided. Answers with a simple "yes", "no", or a single number are incomplete and will not be given full credit. Answers in the form: ans = $\frac{a+sqrt(b)}{c}$ are fine where appropriate. Good English is required on essays.

Problem 1. (5 points) Compute the frequency and duty cycle of a clock signal with a width of $0.25\mu S$ and period of $1\mu S$.

Problem 2. (10 points) Truth tables and Karnough maps for a bit-slice subtractor are shown below. Implement the subtractor in the given 4x8x4 PLA. Show equations for each output as well as the appropriate connections within the PLA.

a_i	b_i	c_i	$c_{(i+1)}$	f_i
0	0	0	0	1
0	0	1	1	0
0	1	0	0	0
0	1	1	0	1
1	0	0	1	0
1	0	1	1	1
1	1	0	0	1
1	1	1	1	0

$c_{(i+1)}$:

a_i \ b_ic_i	00	01	11	10
0	0	1	0	0
1	1	1	1	0

f_i:

a_i \ b_ic_i	00	01	11	10
0	1	0	1	0
1	0	1	0	1

Problem 3. (10 points) Draw the state-diagram for the following state/output table:

Present State	Next State A=0	Next State A=1
s_0	$s_1/0$	$s_2/0$
s_1	$s_3/0$	$s_4/0$
s_2	$s_0/0$	$s_4/0$
s_3	$s_0/1$	$s_1/1$
s_4	$s_2/0$	$s_3/0$

Problem 4. (10 points) Following is the characteristic table and circuit diagram for a flip-flop we have not studied, which I will call the MU or "Made-Up" flip-flop.

M	U	$Q_{(next)}$
0	0	0
0	1	Q
1	0	Q'
1	1	1

a) (5 points) Find the characteristic equation for this flip-flop.

b) (5 points) Complete the following timing diagram.

Problem 5. (15 points) For the FSM represented by the following state-diagram, find an optimal state encoding using the minimum bit-change heuristic.

Problem 6. (10 points) Derive a state/output-table for the following circuit.

Problem 7. (15 points) Find which, if any, states are equivalent in the following state/output table. (Use either state-partitioning or an implication table).

Present State	Next State A=0	Next State A=1
s_0	$s_0/0$	$s_2/1$
s_1	$s_4/1$	$s_2/1$
s_2	$s_2/0$	$s_1/1$
s_3	$s_0/1$	$s_2/1$
s_4	$s_0/0$	$s_2/1$

Problem 8. (10 points) Following is a slightly-modified version of a combinatorial component we studied in Chapter 5.

a) (5 points) If $S_1S_0 = 10$ and $d_3d_2d_1d_0 = 1100$, what is the value of $y_3y_2y_1y_0$?

b) (5 points) What type of combinatorial component does this circuit represent (i.e. what is its function)?

Problem 9. (15 points) Draw a circuit which implements the following next-state/output table using D flip-flops.

Present State Q_1Q_0	Next State x=0	Next State x=1	Output Y
00	00	10	1
01	01	11	0
10	00	00	1
11	01	01	1