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CS 250

CS 250 Homework 3

1.

(a)

Truth Table
Formula: out = !B*C + (A+B) * !C

A	B	C	!B	!B*C	!C	A+B	(A+B)*!C	Out
0	0	0	1	0	1	0	0	0
0	0	1	1	1	0	0	0	1
0	1	0	0	0	1	1	1	1
0	1	1	0	0	0	1	0	0
1	0	0	1	0	1	1	1	1
1	0	1	1	1	0	1	0	1
1	1	0	0	0	1	1	1	1
1	1	1	0	0	0	1	0	0

(b) Please see circuit1.circ.

(c)

The sum-of-product Boolean functions for out1 and out2 are, respectively:

Out1 = (!A&!B&!C)|(!A&B&C)|(A&!B&C), or, alternatively expressed,
Out1 = !A*!B*!C+!A*B*C+A*!B*C

Out2 = (!A&!B&!C)|(!A&!B&C)|(!A&B&!C), or, alternatively expressed,
Out2 = !A*!B*!C+!A*!B*C+!A*B*!C

(d) Please see circuit2.circ.

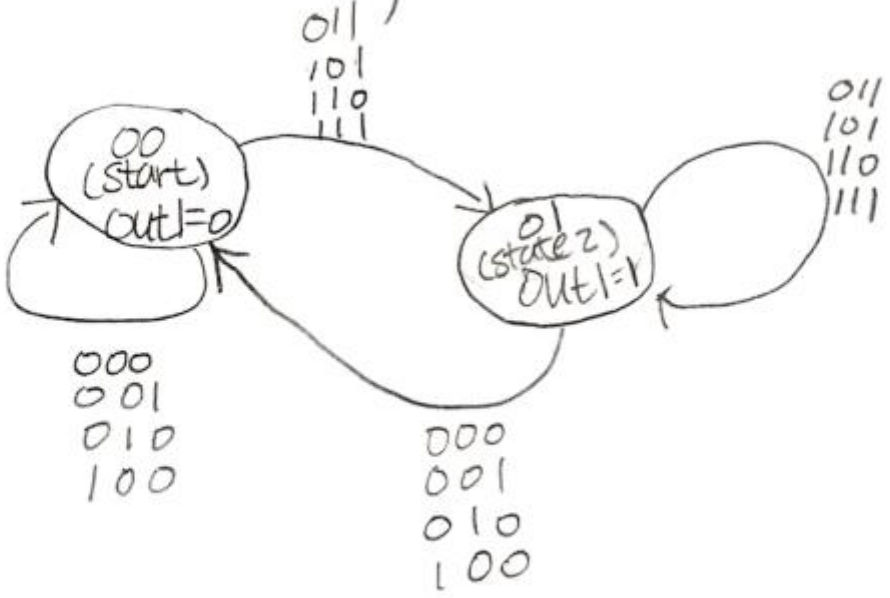
2. Please see adder.circ.

3.

(a)

Here are the state transition diagrams for out 1 and out2, respectively.

State Transition Diagram for out 1



State Transition Diagram for out 2

(b)

Truth Table for Out1

(Since there are only two states for out1, I employed 1 D flip-flop, but I included both D0 and D1, and Q1 and Q0 here just in case.)

Current State (Q1)	Current State (Q0)	Output	In1	In2	In3	Next State (D0)	Next State (D1)
0	0 (start)	0 (closed)	0	0	0	0 (start)	0
0	0 (start)	0	0	0	1	0 (start)	0
0	0 (start)	0	0	1	0	0 (start)	0
0	0 (start)	0	0	1	1	1 (state2)	0
0	0 (start)	0	1	0	0	0 (start)	0
0	0 (start)	0	1	0	1	1 (state2)	0
0	0 (start)	0	1	1	0	1 (state2)	0
0	0(start)	0	1	1	1	1 (state2)	0
0	1 (state2)	1	0	0	0	0 (start)	0
0	1 (state2)	1	0	0	1	0 (start)	0
0	1 (state2)	1	0	1	0	0 (start)	0
0	1 (state2)	1	0	1	1	1 (state2)	0
0	1 (state2)	1	1	0	0	0 (start)	0
0	1 (state2)	1	1	0	1	1 (state2)	0
0	1 (state2)	1	1	1	0	1 (state2)	0
0	1 (state2)	1	1	1	1	1 (state2)	0

Truth Table for Out2

Current State (Q1)	Current State (Q2)	Output	In1	In2	In3	Next State (D1)	Next State (D0)
0(start)	0(start)	0(closed)	0	0	0	0	0
0	0	0	0	0	1	0	1
0	0	0	0	1	0	0	1
0	0	0	0	1	1	0	0
0	0	0	1	0	0	0	1
0	0	0	1	0	1	0	0
0	0	0	1	1	0	0	0
0	0	0	1	1	1	0	0
0	1	0	0	0	0	1	1
0	1	0	0	0	1	1	0
0	1	0	0	1	0	1	0
0	1	0	0	1	1	1	1
0	1	0	1	0	0	1	0
0	1	0	1	0	1	1	1
0	1	0	1	1	0	1	1
0	1	0	1	1	1	1	1
1	0	1	0	0	0	1	1
1	0	1	0	0	1	1	0
1	0	1	0	1	0	1	0
1	0	1	0	1	1	1	1
1	0	1	1	0	0	1	0
1	0	1	1	0	1	1	1
1	0	1	1	1	0	1	1
1	0	1	1	1	1	1	1
1	1	1	0	0	0	0	0
1	1	1	0	0	1	0	1
1	1	1	0	1	0	0	1
1	1	1	0	1	1	0	0
1	1	1	1	0	0	0	1
1	1	1	1	0	1	0	0
1	1	1	1	1	0	0	0
1	1	1	1	1	1	0	0

(c) Please see fsm.circ.

For out1, the sum-of-products formula I used is:

(!Q0&in1&in2&in3)|(!Q0&in1&in2&!in3)|(!Q0&in1&!in2&in3)|(!Q0&!in1&in2&in3)|(Q0&in1&in2&in3)|(Q0&in1&in2&!in3)|(Q0&in1&!in2&in3)|(Q0&!in1&in2&in3)

For out 2, the sum-of-products formula I used for D1 and D0 are respectively:

If common =
(!Q1&Q0&!in1&!in2&!in3)|(!Q1&Q0&!in1&in2&in3)|(!Q1&Q0&in1&in2&!in3)|(!Q1&Q0&in1&in2&in3)|(!Q1&Q0&in1&!in2&in3)|(Q1&!Q0&!in1&!in2&!in3)|(Q1&!Q0&!in1&in2&in3)
|(Q1&!Q0&in1&in2&!in3)|(Q1&!Q0&in1&in2&in3)|(Q1&!Q0&in1&!in2&in3),

This is the common part that I calculated separately and then computed with the rest of the formula for D1 and that for D0 respectively in order to get out2 in the end.

Then D1 =
Common|(!Q1&Q0&in1&!in2&!in3)|(!Q1&Q0&!in1&!in2&in3)|(!Q1&Q0&!in1&in2&!in3)|(Q1&!Q0&in1&!in2&!in3)|(Q1&!Q0&!in1&!in2&in3)|(Q1&!Q0&!in1&in2&!in3).

And D0 =
Common|(!Q1&!Q0&in1&!in2&!in3)|(!Q1&!Q0&!in1&!in2&in3)|(!Q1&!Q0&!in1&in2&!in3)|(Q1&Q0&in1&!in2&!in3)|(Q1&Q0&!in1&!in2&in3)|(Q1&Q0&!in1&in2&!in3).