ESE 566A: Modern System-on-Chip Design

Homework 1

Due: Jan 23, 2:30 pm

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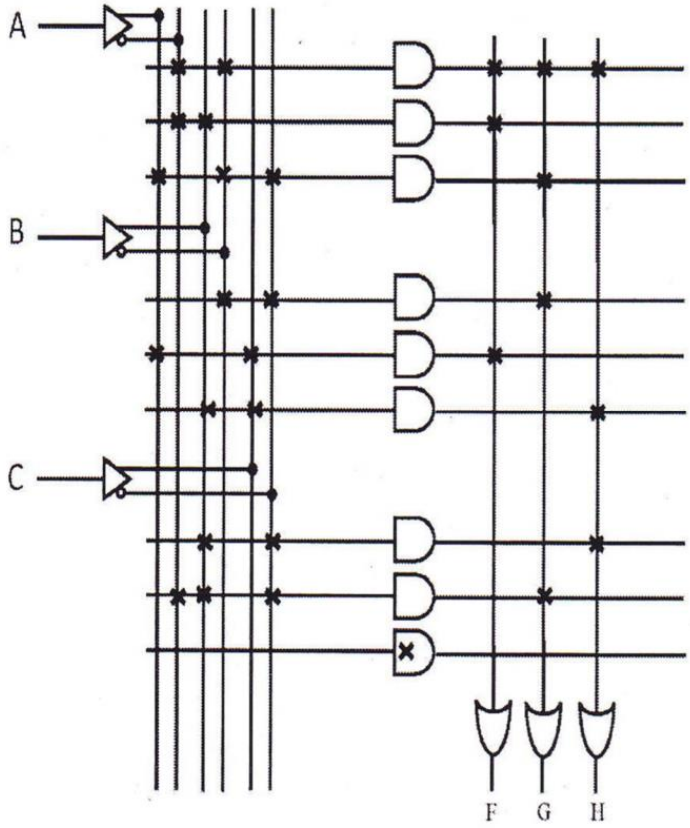
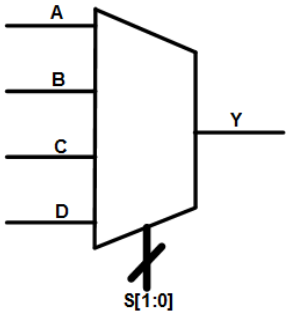
1. Write a Boolean SOP expression for this truth table and then simplify it.

Input				Output
A	**B**	**C**	**D**	**F**
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

2. For the following programmable Logic Array (PLA), find the function expressions for all outputs and draw the Karnaugh-Maps for function "F".



3. Draw a circuit diagram for a 4-input multiplexer using NOT, AND, and OR.

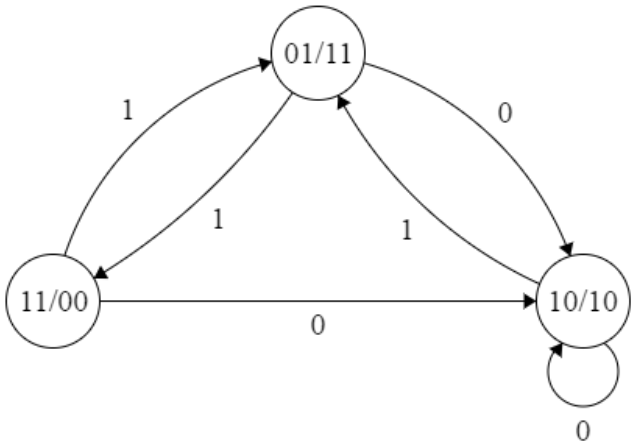


4-input multiplexer

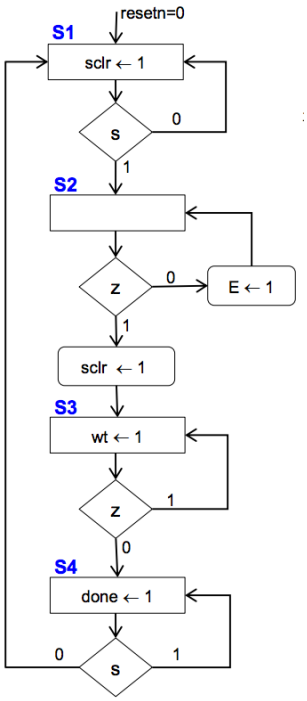
4. Design a 3 FlipFlop counter which transitions through states Q2Q1Q0 = 000, 100, 110, 111, 011, 001 and then repeats.

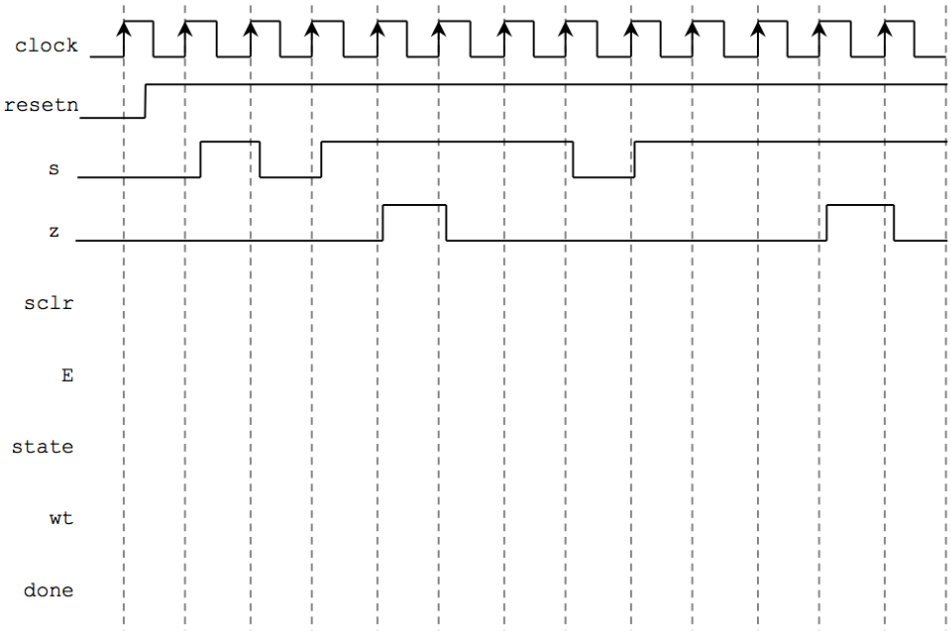
a. Draw the state diagram and state transition table.
b. Draw the Karnaugh maps, clearly indicating the implicants that you use in your covers of the next-state functions.
c. Implement the counter using D flip flops and whatever gates you like.

5. Construct a circuit for this FSM



6 Complete the timing diagram of the following FSM (represented as an ASM chart).





7. Design a finite state machine that recognizes the particular pattern "111". The input to a finite state machine (FSM) is a sequence of binary bits in series. When the FSM sees three 1's in a row, it it should output "1" - otherwise it should output a "0".

8. Finite state machine design:

A vending machine sells candy for 30 cents. It accepts nickels, dimes and quarters and provides no change if more than 30 cents is deposited. Design a finite state machine to control the vending machine. The inputs to the machine are two signals indicating which coin has been deposited or that a coin release is requested. The 4 possible inputs are encoded by the two signals as:

00: nickel deposited
01: dime deposited
10: quarter deposited
11: coin release

Assume that your machine will receive a clock only when there is an input (a coin has been deposited or the coin release has been pulled). These two signals are synchronized with a clock. The outputs of your machine are two signals: one releasing the candy and the other releasing the coins.