

ECE 311

Introduction to Digital Systems

Homework Assignment 7

1. (Finite State Machine Design) Consider the following state table for a Finite State Machine. Given the state assignment, Y_1Y_0 : A = 00, B=01, C=10, D=11:

Input	PS X	NS	Output Z
0	A	A	0
1	A	B	0
0	B	C	0
1	B	B	0
0	C	D	0
1	C	B	0
0	D	A	1
1	D	B	0

- a. Implement the FSM using D flip-flops.
- b. Implement the FSM using R-S flip-flops.
- c. Implement the FSM using J-K flip-flops.
- d. Implement the FSM using T flip-flops.

For each implementation, show the required logic equations and sketch the logic diagram.

2. (Finite State Machine Design) Repeat Problem 1 using the state assignment Y_1Y_0 : A = 00, B=11, C=01, D=10.
3. (Finite State Machine Design) Compare the complexity of the logic equations for the two state assignments. Be sure to compare 1a to 2a, 1b to 2b, 1c to 2c, and 1d to 2d. Also tell which implementation require the fewest gates out of the 8 different Configurations.
4. (*Finite State Machine/Counter Design*) Use the principals of Finite State Machine Design to complete the following questions.
- a. A particular counter counts through the decimal sequence (7,3,1,4,2,5,6) and repeats. Draw the state diagram for the counter implemented as a Moore machine. The state S0 should have a binary output equivalent to

decimal 7, state S1 should have a binary output equivalent to decimal 3, and so on (7 states total, S0 - S6).

- b.** Fill in the encoded state table for the counter encoded for using D flip-flops. The state assignment must be such that the output of each state is equivalent to the present state. For example, S0 must be assigned the code 111.

PS			NS			Output		
Q_C	Q_B	Q_A	D_C	D_B	D_A	Z_2	Z_1	Z_0
1	1	1	0	1	1	1	1	1

- c. Draw the schematic for the counter. Use the smallest number of gates possible to implement the counter and use the TTL 7474 D-flip-flop component. The circuit must have an active high Reset signal that resets the circuit to state S0. In other words, add circuitry to the preset and clr lines to initialize the circuit to S0. Be sure to show your KMAPS for partial credit!