

CS2810 Homework 4 - 46 points - Due by midnight September 28. Submit this homework through Eagle.

For this homework assignment you may work individually or in a group of up to 3 students. If working in a group, be sure that when you turn in your homework through Eagle you include the names of everyone in the group.

Questions 1-2 5 points each

- 1.) What is the next state equation for a D flip-flop?
- 2.) What is the next state equation for a T (toggle) flip-flop?

(8 points each part)

- 3.) I am building a sequence detector for the sequence 1011101.
 - a. Give the finite state (Mealy) machine diagram for this machine, assuming that whenever a sequence is detected, the machine outputs a 1 and then starts over, i.e. overlapping sequences are not allowed.
 - b. Give the finite state (Moore) machine diagram for this machine, assuming that overlapping sequences are allowed.

(10 points)

- 4.) Consider a 4-bit shift register, made up of 4 clocked D flip-flops. The flip-flops are labeled (left to right) as $A_3A_2A_1A_0$. In addition to the clock, there is a one-bit control input I. When $I=0$, each bit in the register shifts to the right, with the right most bit in the register being lost, and the left most bit coming in as a 0. When $I=1$, each bit in the register shifts to the left, with the left most bit in the register being lost and the right most bit coming in as a 0. Give the truth table for the next value of flip-flop A_i , $0 < i < 3$ for an input I. (Hint: The left side of the truth table will have 8 rows – what are they?)

(10 points)

- 5.) Give the FSM (Mealy) for a machine which outputs a 1 whenever a legal integer is input, and a 0 whenever a non-integer is input. Samples of the expected out sequence(s) are shown. You may assume that the possible input characters are:
<digit> | + | - | <whitespace> | <anything else>
<whitespace> is a space, tab, or a newline character

Input 123-745<whitespace>
Output 00010001

Note: <whitespace> is really a single character
Note: The designation that an integer has been input comes with the first character after the end of the integer.

Input +75-86<tab>
Output 0001001

Input 67.23<newline>
Output 001001

Input xyz123.456+9 9<newline>
Output 000000100010101

(8 points each part)

- 7.) Consider a combinational logic circuit which accepts as input two positive 2-bit binary integers ($A=a_1a_0$, $B=b_1b_0$) and produces as output their sum as a 3-bit value $S=s_2s_1s_0$.
- a.) Give the full truth table for this machine
 - c.) Give the canonical sum of products for S