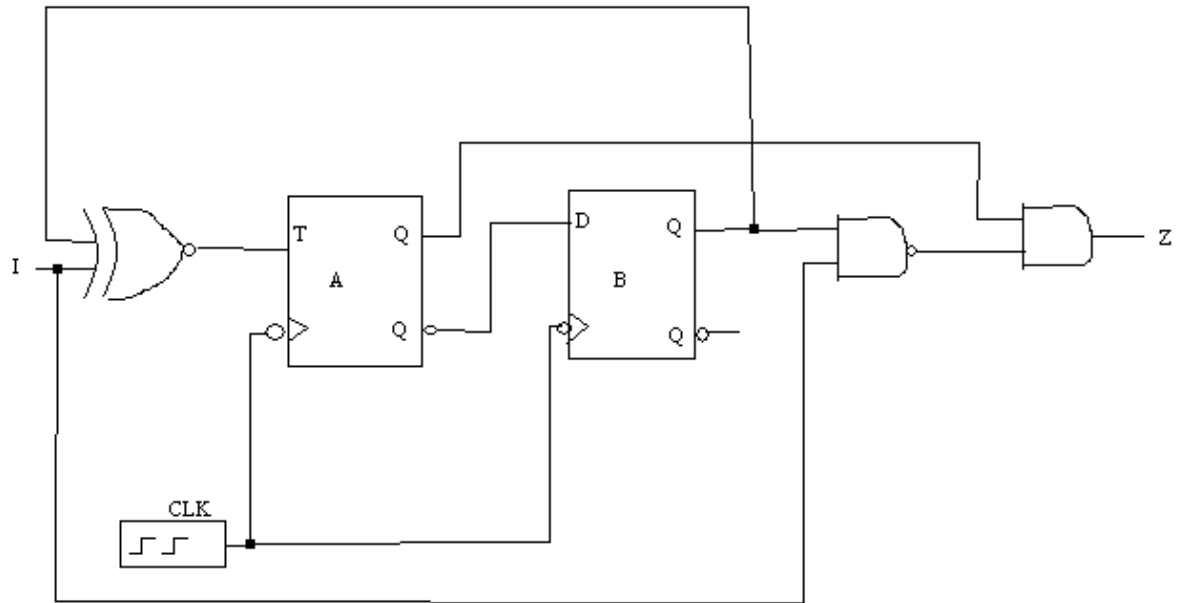


ECE451 Homework #12

1. (Reverse Engineering) Given the Mealy machine in the figure below, implemented with one toggle flip-flop and one D flip-flop, with single input I and single output Z, draw its complete state diagram.



2. (Word Problem) Implement a two-input Mealy machine that produces a 1 at its single output when the values of the two inputs differ *at the time of the previous clock pulse*. Show your state diagram or ASM chart. Describe what each of your states is supposed to represent.

7.19 (Moore Machines) Suppose you are told that a Moore machine has five flip-flops, three inputs, and nine outputs. Answer the following questions:

- a. What are the minimum and maximum numbers of states in the state diagram?
- b. What are the minimum and maximum numbers of transition arrows starting at a particular state?
- c. What are the minimum and maximum numbers of transition arrows that can end in a particular state?
- d. What are the minimum and maximum numbers of different binary patterns that can be displayed on the outputs?

7.22 (Word Problem) A finite state machine has one input and one output. The output becomes 1 and remains 1 thereafter when at least two 0s and at least two 1s have occurred as inputs, regardless of the order of occurrence. Assuming this is to be implemented as a Moore machine, draw a state diagram for the machine. (*Hint: You can do this in nine states.*)

7.23 (Word Problem) A finite state machine has one input (X) and two outputs (Z_1 and Z_2). An output $Z_1 = 1$ occurs every time the input sequence 101 is observed, provided the sequence 011 has never been seen. An output $Z_2 = 1$ occurs every time the input 011 is observed. Note that once $Z_2 = 1$, $Z_1 = 1$ can never occur. Assuming the machine is to be implemented in the Mealy design style, draw the corresponding state diagram. (*Hint*: The minimum number of states is eight.)