ECE 204 - STATE MACHINES - INVESTIGATION 24
INTRODUCTION TO STATE MACHINES - PART II

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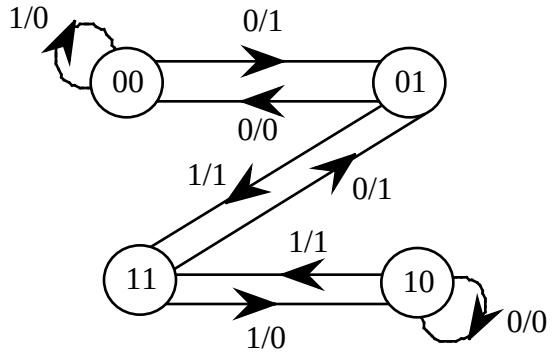
To do "well" on this investigation you must not only get the right answers but must also do neat, complete and concise writeups that make obvious what each problem is, how you're solving the problem and what your answer is. You also need to include drawings of all circuits as well as appropriate graphs and tables.

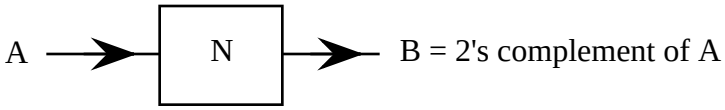
From the last Investigation we know how to realize a state machine with D flip-flops from its state diagram. The objective of this Investigation is to get more practice with such circuits.

1. We begin with a review problem. Given a sequential circuit with the following state diagram



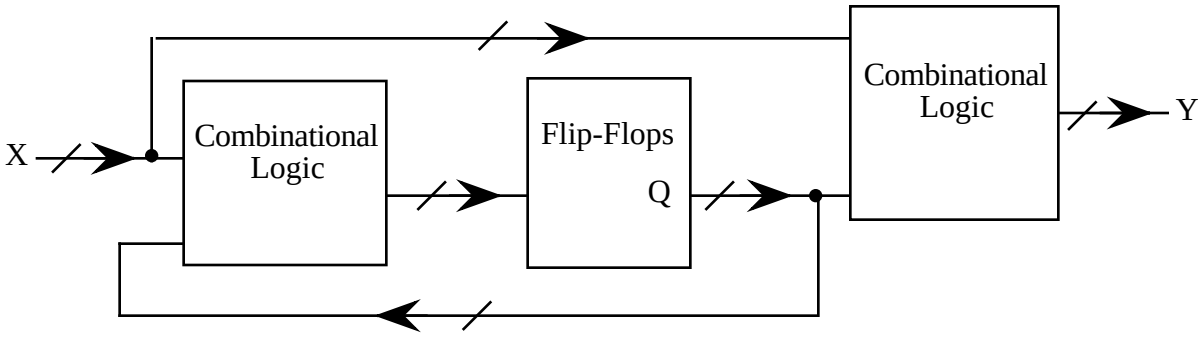
   a. Find the next state table
   b. Draw a timing diagram for the circuit for the input X = 01101 assuming that the circuit starts out in the zero state
   c. Realize the circuit with D flip-flops

2. Design a sequential circuit as follows



   for calculating the 2's complement of A. Design the circuit so that as each bit of the 2's complement number A is clocked into N the next bit of its 2's complement appears at the output.

3. When we analyze state machines we find that there are two basic kinds. The first kind is as follows

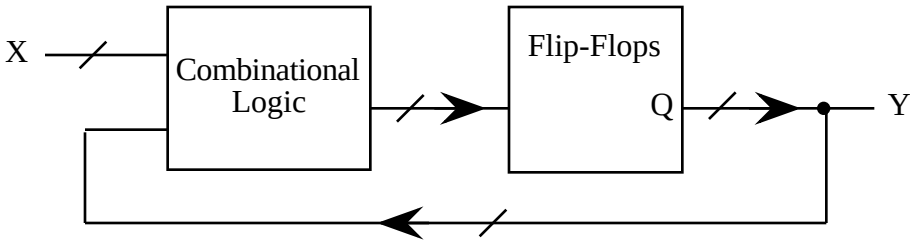


with the next state Q* and present output Y both equal to functions of the present state Q and inputs X as follows

$$Q^* = F(X, Q) \qquad Y = G(X, Q)$$

We call this form of state machine a **Mealy machine**. Note that the slashes represent the fact that in general there's more than one wire connecting the blocks.

If we had chosen our states in such a way that the present output is only a function of the present state as follows



with

$$Q^* = F(X, Q) \qquad Y = G(Q)$$

then we call the the state machine a **Moore machine**. **Memorize** the difference between Mealy and Moore machines.

a. Can Y in a Mealy machine change at the same time X does
b. Can Y in a Moore machine change at the same time X does
c. Is the following a state diagram for a Mealy or a Moore machine. How can you tell