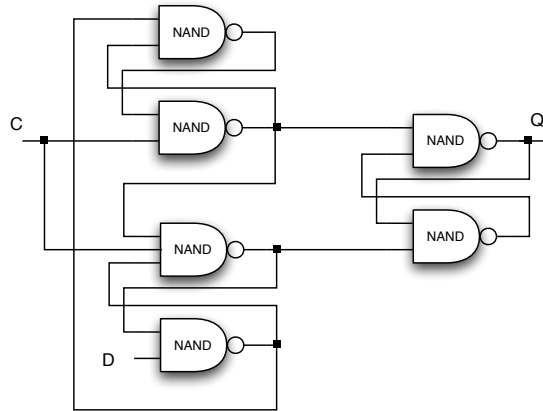


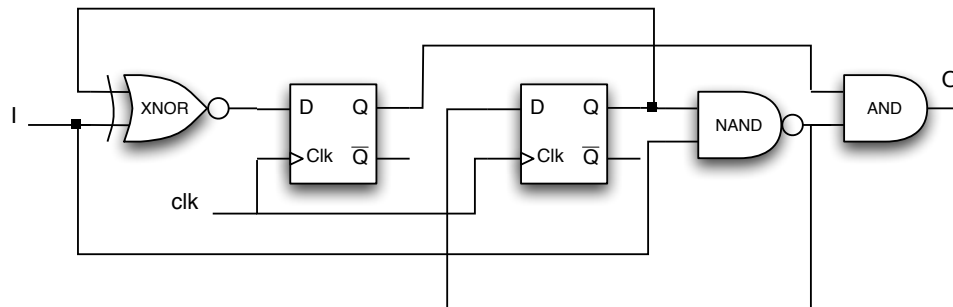
## Homework 2

You may discuss the assignments with your classmates but need to write down your solutions independently. Be careful with your handwriting. Unclear solutions will be assumed wrong.

- (20 pts) How would you implement a positive edge-triggered D flip-flop using NOR gates only? What changes are necessary to make this a negative edge-triggered device?
- (20 pts) Draw the state transition graph of the following circuit and give its function table.



- (20 pts) Is the following sequential circuit a Mealy machine or Moore machine? Why? Please give its state graph. Assume each gate or Flip-Flop has 10ps delay and the setup time for each FF is 5ps, what is the minimal clock period for the circuit to work correctly?



- (20 pts) A sequential circuit has two JK flip-flops  $A$  and  $B$ , two inputs  $x$  and  $y$ , and one output  $z$ . The flip-flop input equations and circuit output equations are

$$J_A = Bx + \bar{B}\bar{y} \quad K_A = \bar{B}x\bar{y}$$

$$J_B = \bar{A}x \quad K_B = A + x\bar{y}$$
$$z = A\bar{x}\bar{y} + B\bar{x}\bar{y}$$

Draw the logic diagram and state graph of the circuit.

5. (20 pts) A sequential circuit has one input ( $x$ ) and one output ( $z$ ). Give a design for each of the following requests. You need to have state graph, encoding, state and output functions, and logic diagram for each design.
- The output is 1 if and only if the total number of 1's received is divisible by 3 (e.g. 0, 3, 6).
  - The output is 1 if and only if the total number of 1's received is divisible by 3 and the total number of 0's received is an even number greater than zero.