ENGN2219/COMP6719
Computer Systems & Organization
Problem Set 3

Note: This problem set is optional for your practice only and not part of the assessment scheme.

Question 1:

For the input waveforms shown below, sketch the output, Q, of an SR latch.

Question 2:

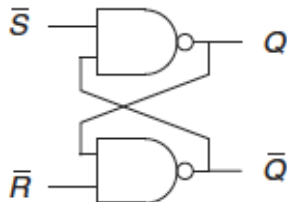For the input waveforms shown below, sketch the output, Q, of a D latch and a D flip-flop.

Is the circuit in the figure below combinational or sequential? Explain the relationship between the inputs and outputs. What should we call this circuit?

The controller for a specific electronic component has a 1-bit input and a 1-bit output. The controller outputs a 1 exactly when the input is 1 for the last three clock cycles. The initial state (upon reset) is called *Zero*. Whenever the input transitions from 1 to 0, the controller enters the *Zero* state. Design the finite state machine controller including the state transition diagram, binary state encodings, state transition table, output table, Boolean equations for the next state and output, and sketch a schematic of the finite state machine.

Design the finite state machine controller for a coffee vending machine with the following specifications. A cup of coffee costs 25 cents. The machine accepts either a nickel (5 cents) or a dime (10 cents). When enough coins are inserted, the machine dispenses coffee. The machine returns no change. The controller has two inputs, N and D, one for each coin type. For example, if the user inserts a nickel, the controller inputs are (N, D) = (1, 0). The controller output is 1 (dispense coffee) when enough coins are inserted. Design the finite state machine controller including the state transition diagram, binary state encodings, state transition table, output table, Boolean equations for the next state and output, and sketch a schematic of the finite state machine.

Describe in words what the state machine does in the figure below. Using binary state encodings, complete a state transition table and output table for the FSM. Write Boolean equations for the next state and output and sketch a schematic of the FSM.