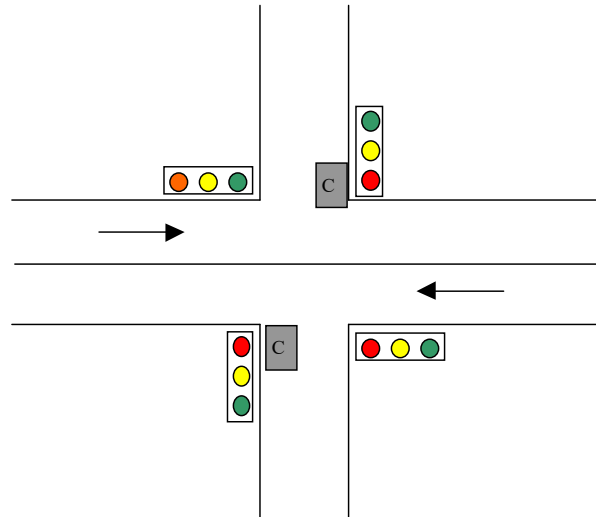


Sequential circuit design exercises for December 15, 2020

1. Traffic light controller for NITK

Model a traffic light controller for NITK using Verilog and implement on FPGA. The National highway NH66 is intersected by the NITK road as shown in Figure. Detectors are placed along the NITK road to raise the signal **C** as long as a vehicle is waiting to cross the highway. The traffic light controller should operate as follows: as long as no vehicle is detected on the NITK road the lights should remain green in the highway direction. If a vehicle is detected on the NITK road, the highway lights should change from green to yellow to red, allowing the NITK road lights to become green. The NITK road lights stay green only as long as a vehicle is detected on the NITK road and never



longer than a set interval to allow the traffic to flow on the highway. If these conditions are met the NITK road lights change from green to yellow to red, allowing the highway lights to return to green. Even if vehicles are waiting to cross the highway, the highway lights should remain green for a set interval. You may assume that there is an external timer that, once set via the control signal **ST** (set timer) will assert the signal **TS** after a short time interval has expired (used for timing yellow lights), **TLH** and **TLF** after a longer time interval (for green lights, highway and NITK road respectively). The timer is automatically reset when **ST** is asserted.

2. Vending Machine

A sequential network is to be used to control the operation of a vending machine which dispenses 200ml cup of water costing Rs 3. The network has 3 inputs FIVE, TWO, ONE and 2 outputs WATER and CHANGE. The coin detector mechanism in the vending machine is synchronized with the same clock as the sequential network you are to design. The coin detector inputs a signal 1 to the FIVE, TWO, ONE for every Five rupees, Two rupees or One rupee coin, respectively, that the customer inserts. Only one input will 1 at a time. When the customer has inserted the cost of the cup of water in any combination of Five, Two or Ones, the vending machine must give change and dispense the water. The coin return mechanism gives change by returning One Rupee coins to the customer. For every 1 output on CHANGE, the coin return mechanism will return One rupee to the customer. The water will be dispensed when the network outputs a signal 1 on output WATER. The network should reset after dispensing the product. Draw the minimal state diagram for the system and model in Verilog.