

# ECE 204 - STATE MACHINES - INVESTIGATION 25

## INTRODUCTION TO STATE MACHINES - PART III

FALL 2003

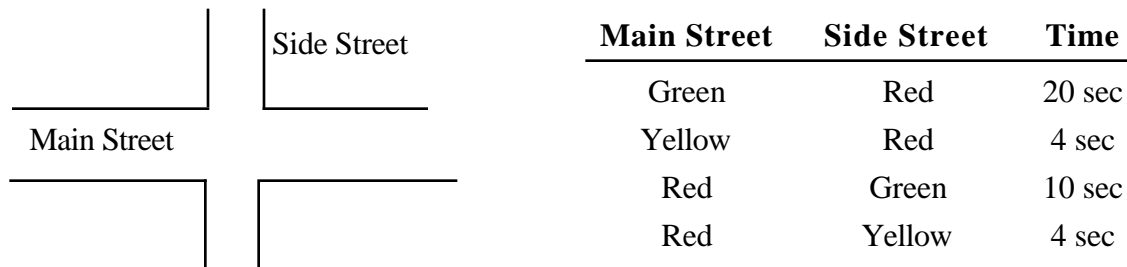
A.P. FELZER

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.

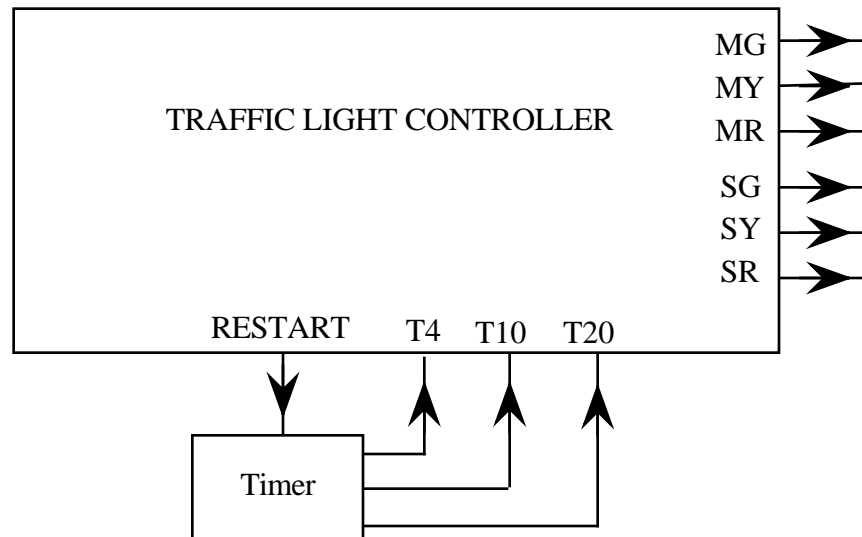
From the last two Investigations we've seen how to realize a state machine with D flip-flops from its state diagram. A major part of the design of real systems of course is to decide exactly what you want to control and how you want to control it - what inputs are available, what outputs are needed, what are good choices for the states and so on.

The objective of this Investigation is to design some state machines for the control of traffic lights.

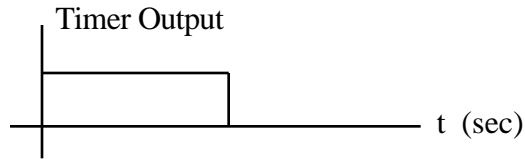
1. Suppose we have an intersection as follows



that we wish to control with a state machine having the following inputs and outputs



where T4, T10 and T20 are pulses of length 4 seconds, 10 seconds and 20 seconds like the following



- a. What are the states of the traffic light controller
- b. What's the minimum number of D flip-flops needed to realize this traffic light controller
- c. Find the next state table for the following assignment of states

Main Street	Side Street	Q1	Q0
Green	Red	0	0
Yellow	Red	0	1
Red	Green	1	0
Red	Yellow	1	1

- d. Draw a block diagram of your controller assuming the combinational circuitry is realized by a ROM
  - e. What are the dimensions and size of your ROM in part (c)
2. Design another traffic light like the one in Problem (1) but this time the light is to stay green on Main Street until a sensor S sends a pulse of a car on Side Street. Side Street is to then get a green light - but only when Main Street has had a green light for a total of at least 20 seconds. As always begin by clearly defining your states.