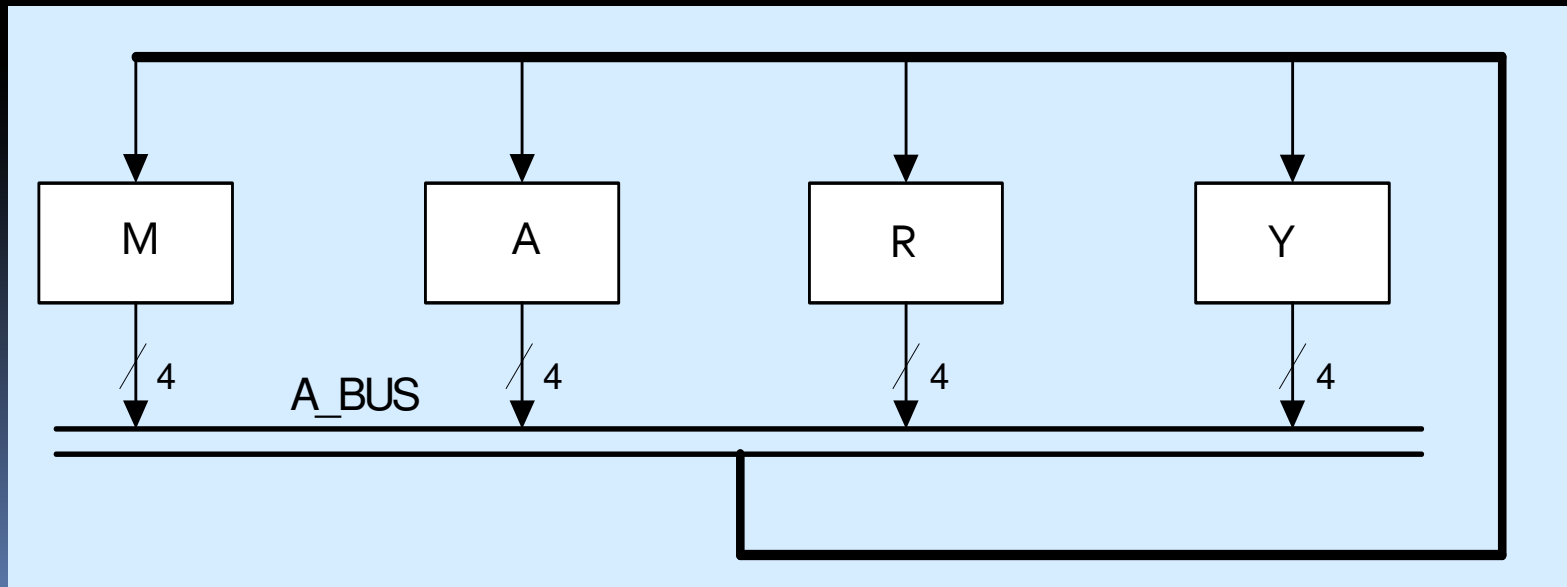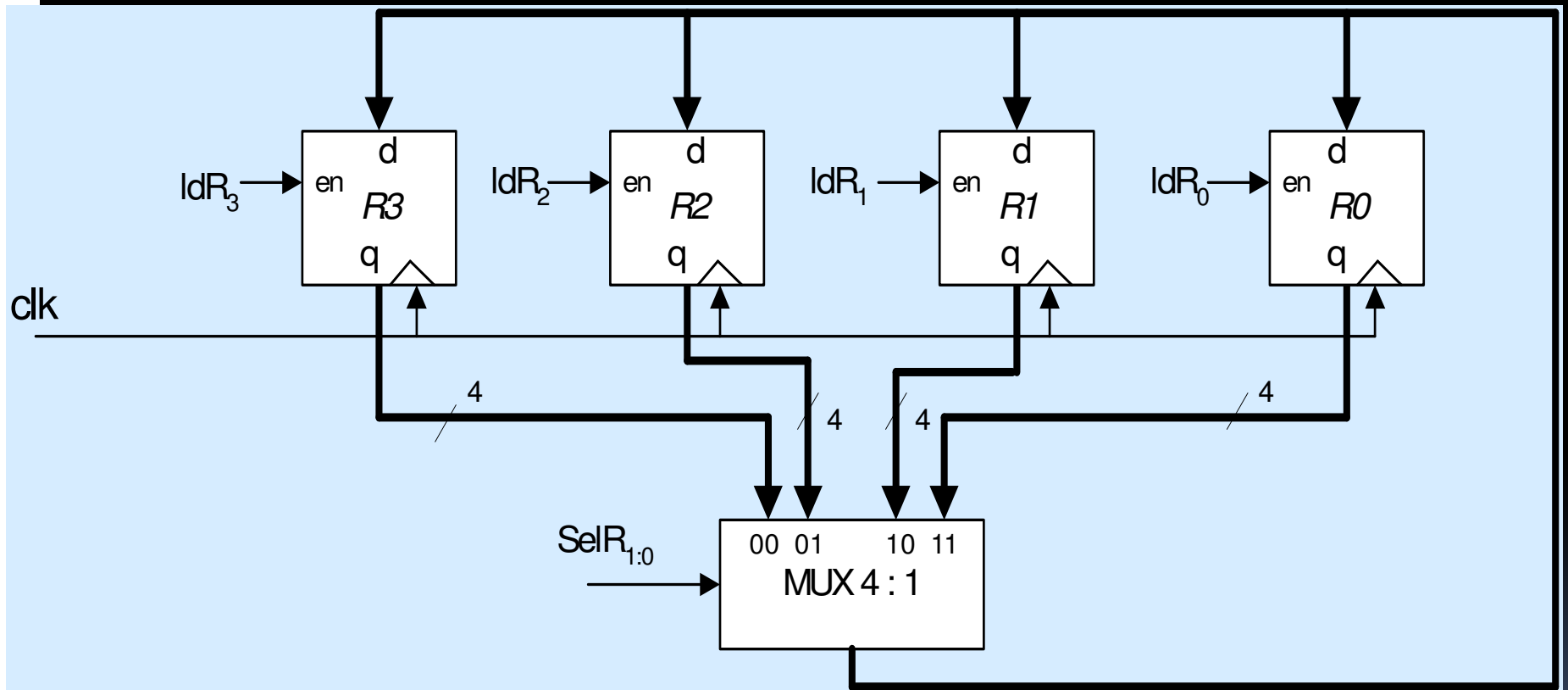# Week 6 Review

FSM Example
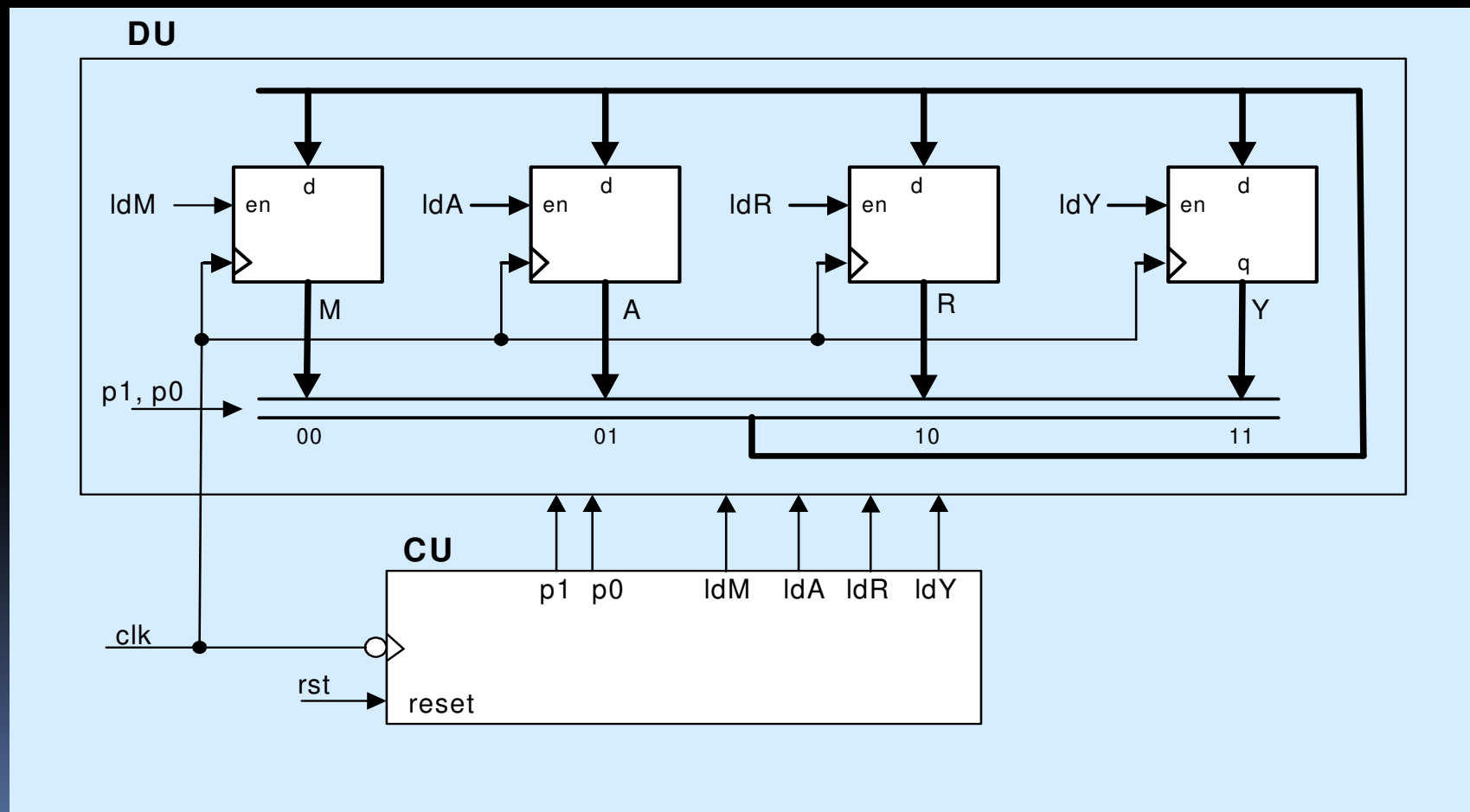
- A data bus, labeled A_BUS, is used to create a shared data routing path between four 4-bit registers, M, A, R and Y.

  1) How would you implement this data bus using the combinational/sequential devices that you have learned so far?

  2) What control signals are needed in your design (i.e. clock)?
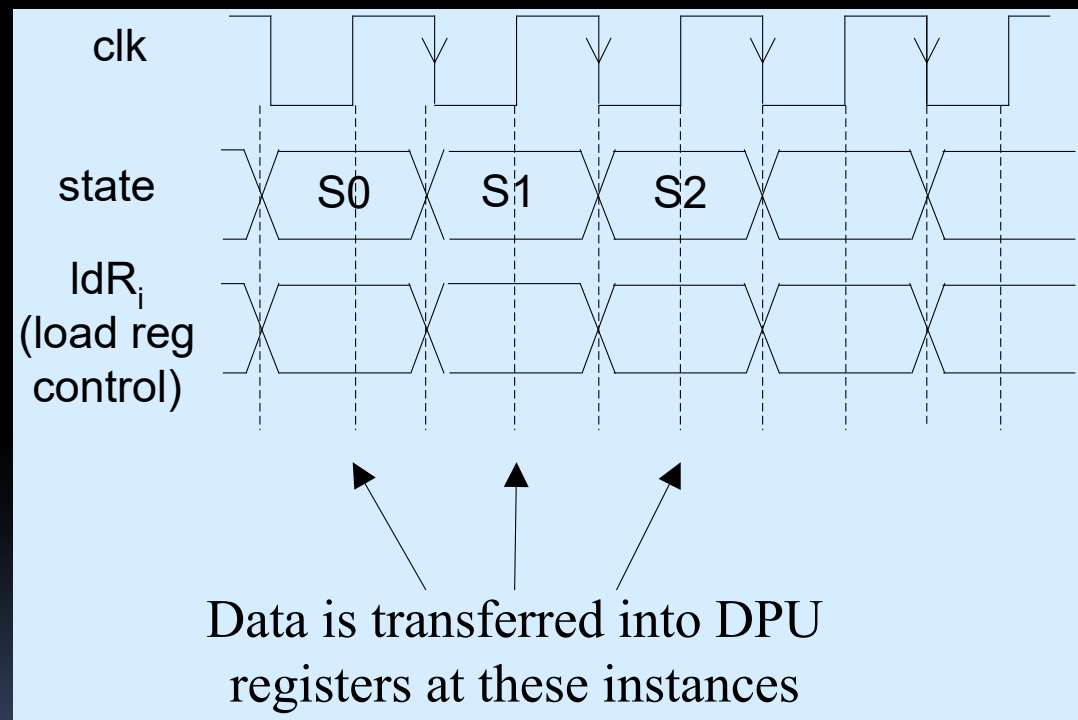
Using multiplexors

- Datapath Unit (DPU or DU)
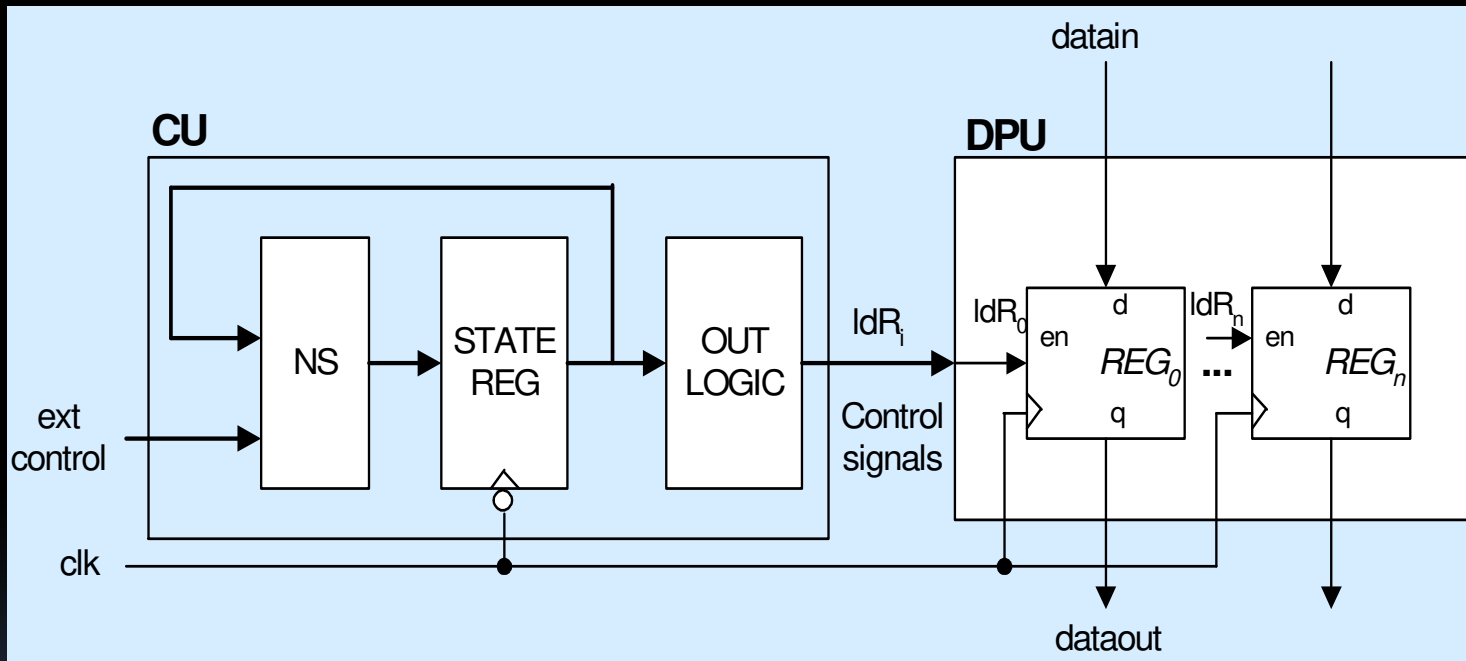- Control Unit

Data Bus Example

- The following process needs to be implemented:

  - S_0 : $M \leftarrow A$
  - S_1 : $A \leftarrow Y$
  - S_2 : $R \leftarrow M$
  - S_3 : $Y \leftarrow R$,

        $M \leftarrow R$

clk

state   S0   S1   S2

ldR_i
(load reg
control)

Data is transferred into DPU
registers at these instances

Control Unit (CU) and Datapath Unit (DU)

Data Bus Example

RTL operations	Control Vector $[p_1\ p_0\ ldM\ ldA\ ldR\ ldY]$
$S_0{:}M \leftarrow A$	
$S_1{:}A \leftarrow Y$	
$S_2{:}R \leftarrow M$	
$S_3{:}Y \leftarrow R, M \leftarrow R$ ()/goto S_0.	

Data Bus Example

RTL operations	Control Vector $[p_1\ p_0\ \text{ldM}\ \text{ldA}\ \text{ldR}\ \text{ldY}]$						
S0:M ← A	0	1	1	0	0	0	(18Hex)
S1:A ← Y	1	1	0	1	0	0	(34Hex)
S2:R ← M	0	0	0	0	1	0	(02Hex)
S3:Y ← R, M ← R ()/goto So.	1	0	1	0	0	1	(29Hex)

Quiz 5

Question 1: Traffic Light

Complete the state table for the FSM represented by the following state diagram:
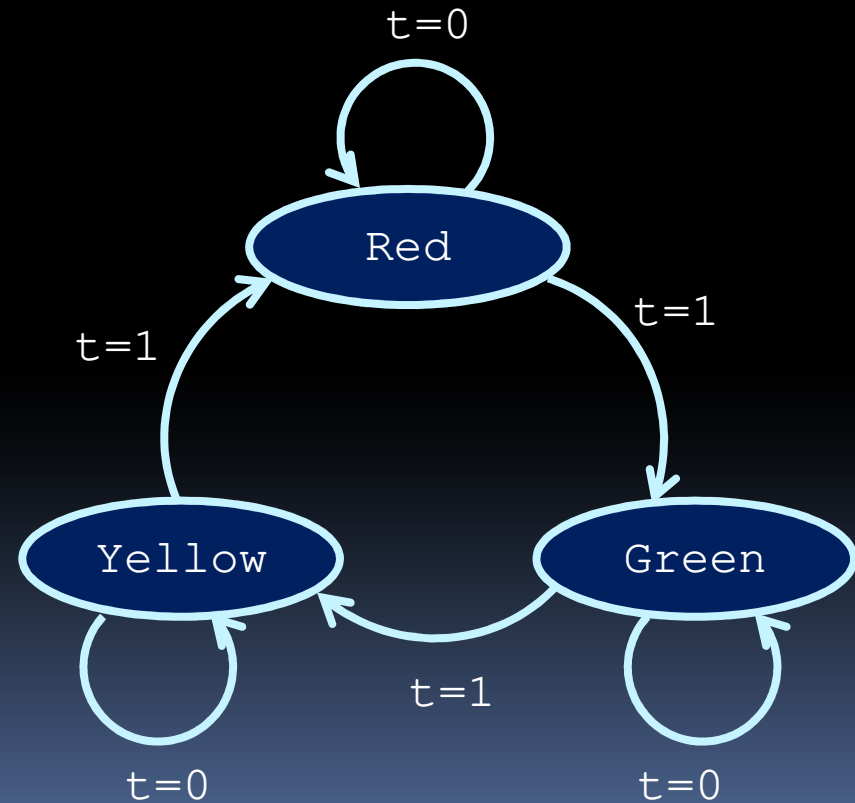
Question 1

Output, Color changer (CC):

- 00 => Red color,
- 01 => Green color,
- 10 => Yellow color

Current state	t	Next State	CC
Red	0	Red	00
Red	1	Green	01
Green	0	Green	01
Green	1	Yellow	10
Yellow	0	Yellow	10
Yellow	1	Red	00

Question 2:

- What is the equation for F1*?
- Hint: use CC as your state variable.

	$\overline{F_0} \cdot \overline{t}$	$\overline{F_0} \cdot t$	$F_0 \cdot t$	$F_0 \cdot \overline{t}$
$\overline{F_1}$	0	0	1	0
F_1	1	0	X	X

F1* = Fo.t + F1.t'

Question 3:

- What is the equation for Fo*?

|	$\overline{F_0} \cdot \overline{t}$	$\overline{F_0} \cdot t$	$F_0 \cdot t$	$F_0 \cdot \overline{t}$
$\overline{F_1}$	0	1	0	1
F_1	0	0	X	X

Fo* = Fo.t' + F1'.Fo'.t

Question 4:

- Draw your FSM circuit diagram?
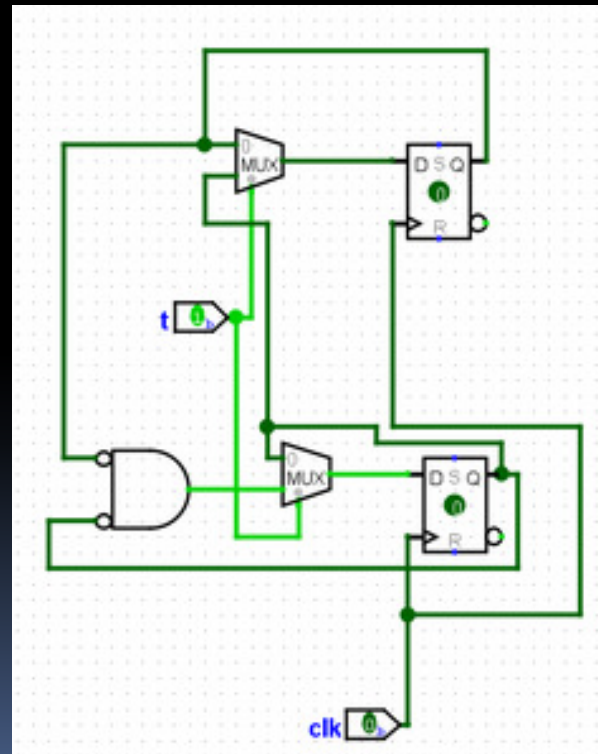
Question 5:Pedestrian Crossing

The pedestrian crossing is a Mealy machine and is an add-on to the traffic light. Other than the first input timer (t), it has a secondary input, p which is the signal generated when a pedestrian presses the button indicating they would like to cross the road. This produces an output Z which will be used to speed-up the timer that will cause the traffic light to turn Red for cars and allow the pedestrians to 'Go'.

1X/?

Stop   Go

1X/?

00/?   01/?

0x/?
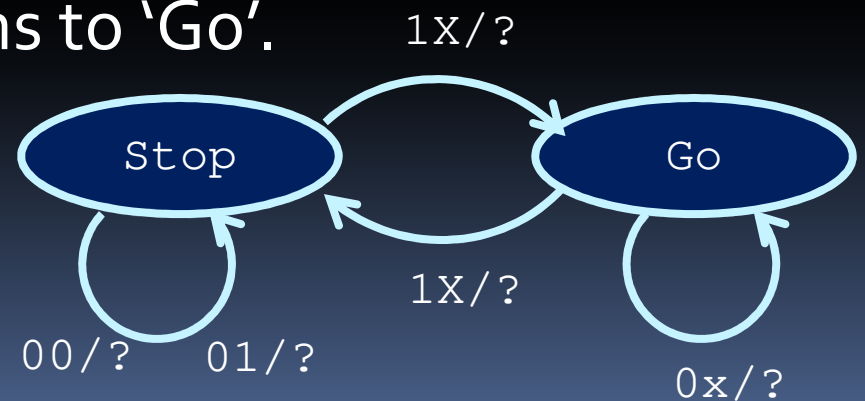
Question 6:

- What is the equation for Fo* for the pedestrian signal?

	$\overline{t} \cdot \overline{p}$	$\overline{t} \cdot p$	$t \cdot p$	$t \cdot \overline{p}$
$\overline{F}_0$	0	0	1	1
F_0	1	1	0	0

$$Fo* = Fo't + Fot'$$

Question 7:

- Draw your FSM circuit diagram?