CS 221 – Scribes

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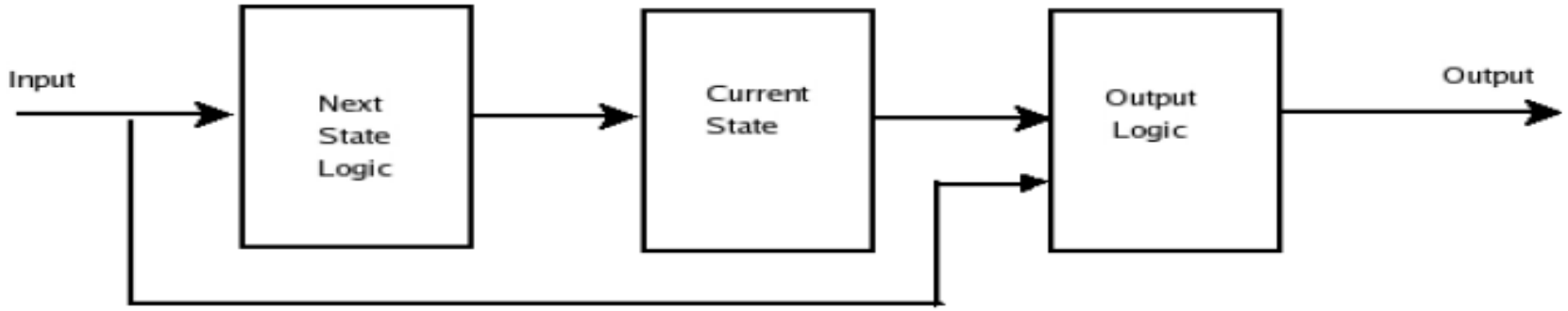
FSM (Finite State Machine)

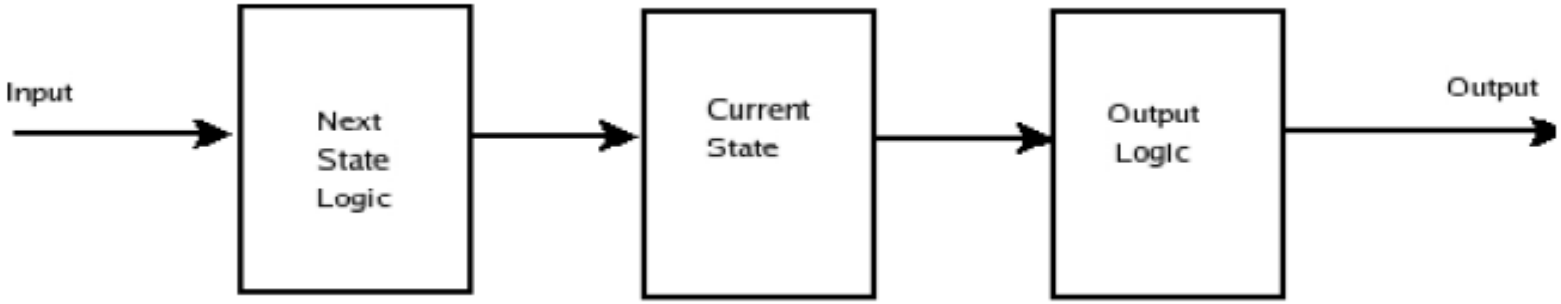
In a Finite State Machine the circuit's output is defined in a different set of states i.e. each output is a state. A State Register to hold the state of the machine and a next state logic to decode the next state. An output register defines the output of the machine. In FSM based machines the hardware gets reduced as in this the whole algorithm can be explained in one process.

Types of state machines :

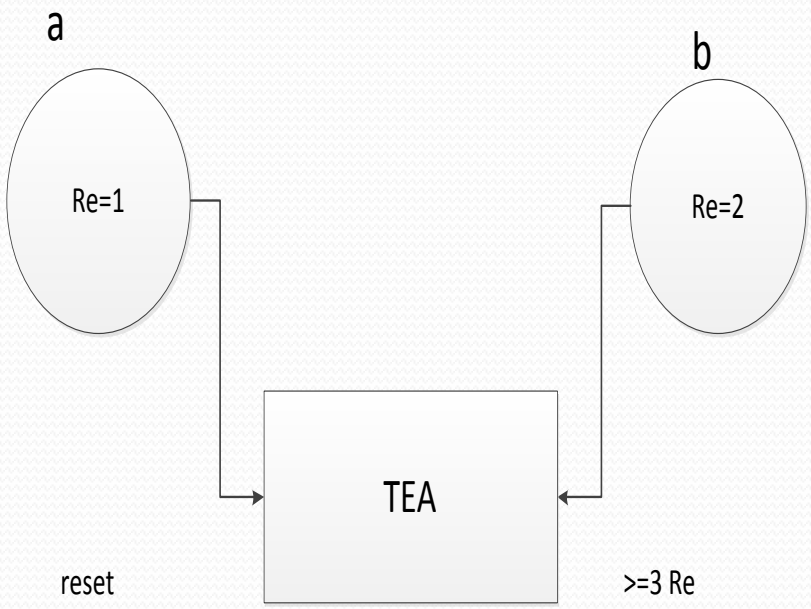
MEALY Machine: In this machine model, the output depends on the present state as well as on the input.



MOORE Machine: In Moore machine model the output only depends on the present state.

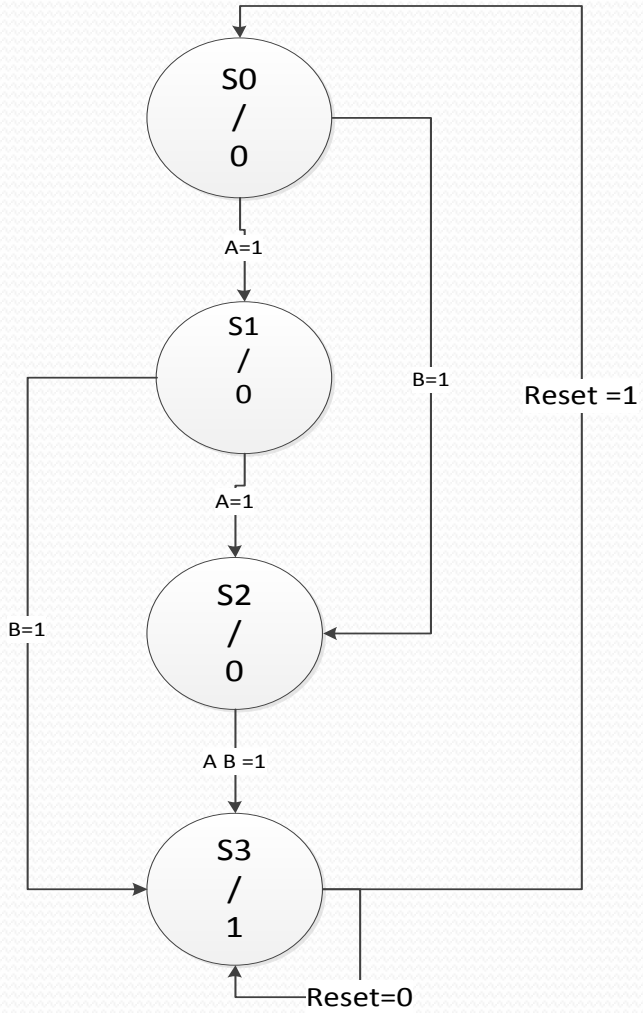


Tea Vending Machine :



a and b are the input states.
a = Re 1 b = Rs 2

When amount entered is greater than 3 , we get tea.



S0:00 S1:01 S2:10 S3:11

Moore FSM of the Vending Machine :

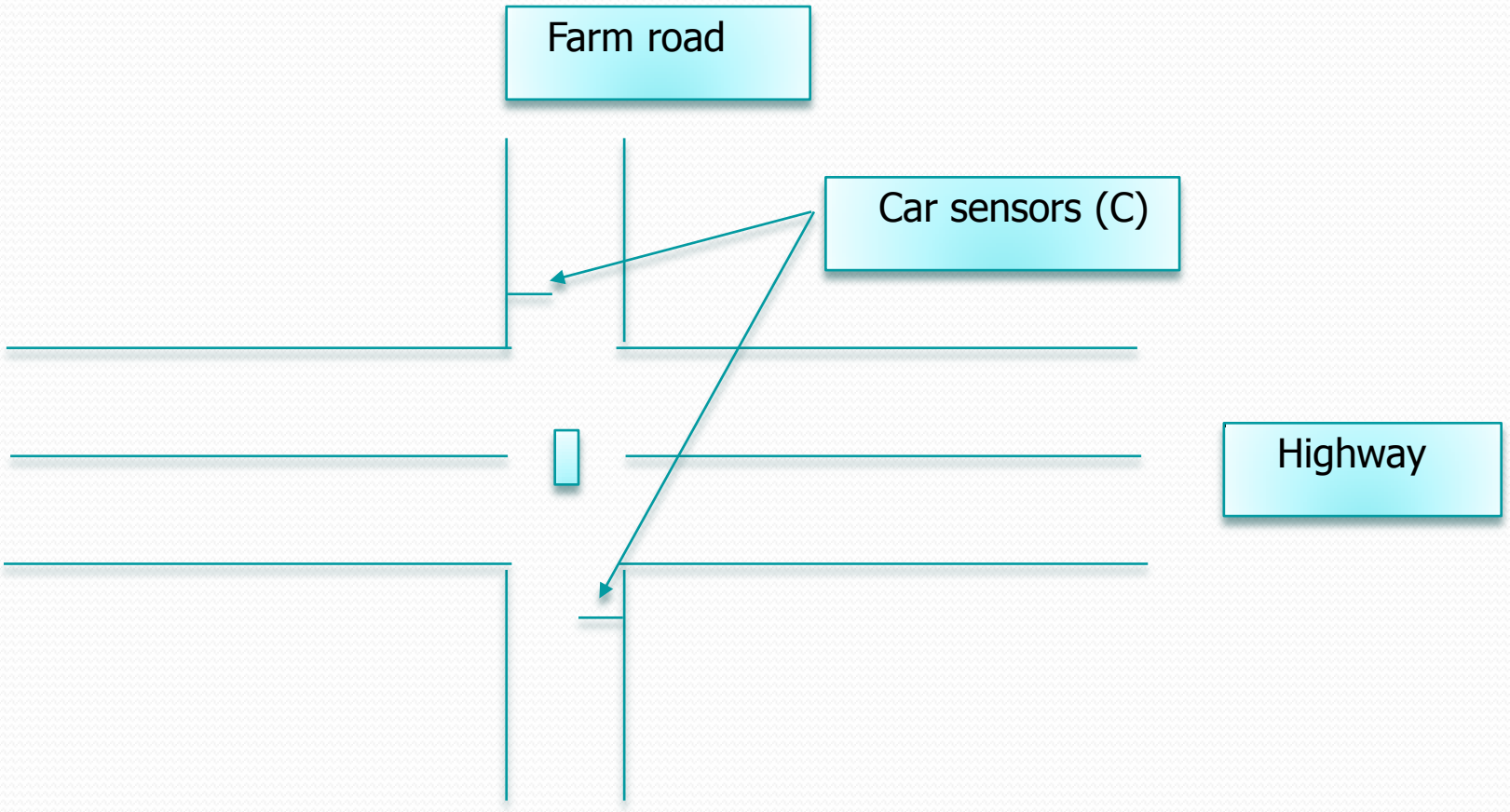
The reset button takes the control back to state 0. But here, we have the problem of infinite tea; i.e. , if we input coins after reaching state 3, output will remain high and we'll keep getting tea.

To avoid this, we include an additional state S4 after S3, where the control goes directly from S3 . From here , to go back to state 0, give reset = 1.

PS	NS	A	B	Reset	Output
00	01	1	0	X	0
00	10	0	1	X	0
00	00	0	0	X	0
01	10	1	0	X	0
01	11	0	1	X	0
01	01	0	0	X	0
10	11	1	0	X	0
10	11	0	1	X	0
10	10	0	0	X	0
11	11	X	X	0	1
11	00	X	X	1	1

Traffic Light Controller

Highway/farm road intersection :



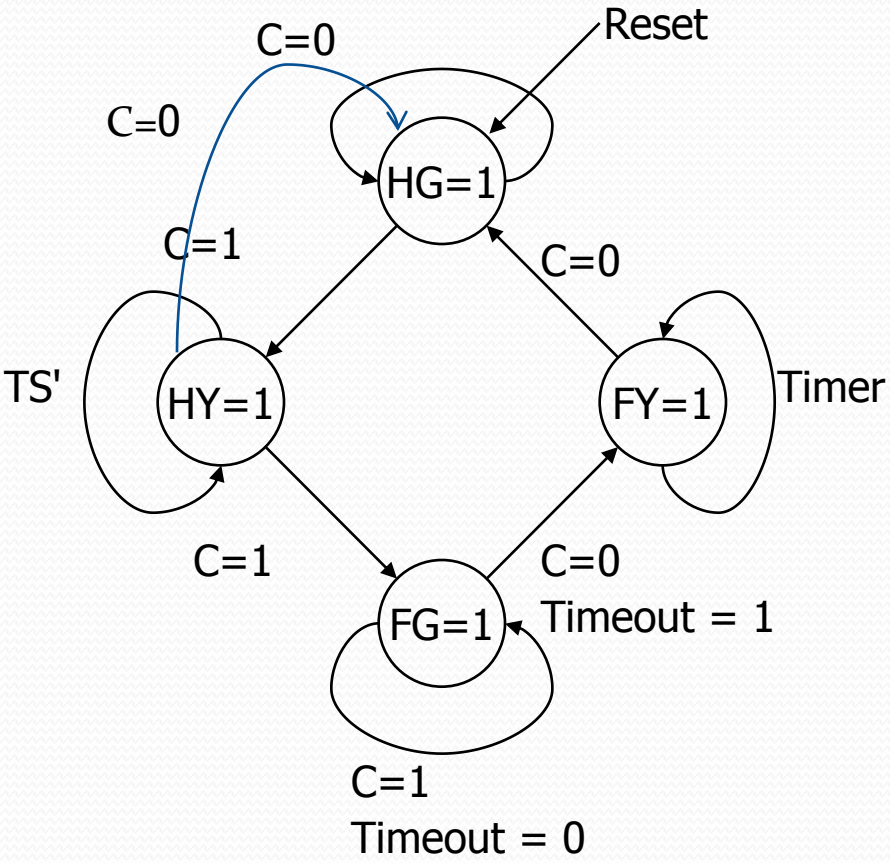
- A busy highway is intersected by a little used farm road
- Detectors C sense the presence of cars on the farm road
  - With no car on farm road, lights remain Green in highway direction
  - If vehicle on farm road, highway lights go from Green to Yellow to Red, allowing the farm road lights to become Green
  - These stay Green only as long as a farm road car is detected but never longer than a set interval (say, 20 time units)
  - When these are met, farm lights transition from Green to Yellow to Red, allowing highway to return to Green
  - Even if farm road vehicles are waiting, highway gets at least a set interval as Green (say, 20 time units)

- Inputs
  - Reset
  - C (farm road car detector)
- Outputs
  - HG (highway green)
  - HY (highway yellow)
  - HR (highway red)
  - FG (farm road green)
  - FY (farm road yellow)
  - FR (farm road red)

•If the highway light is green or yellow, the farm road light must be red.

•States

HG (highway green)
HY (highway yellow)
FG (farm road green)
FY (farm road yellow)


Reset
C=0
C=0
HG=1
C=1
C=0
TS'
HY=1
FY=1
Timer
C=1
C=0
Timeout = 1
FG=1
C=1
Timeout = 0

Mealy FSM of a Traffic Light Controller:

We make a timer which turns the farm road light to yellow and when C=0 , the farmroad light turns to Red.

This ensures that any vehicle going on farm road doesn't meet an accident.

Reset turns the HG=1, i.e, sets highway road light to green and farm road light to red.