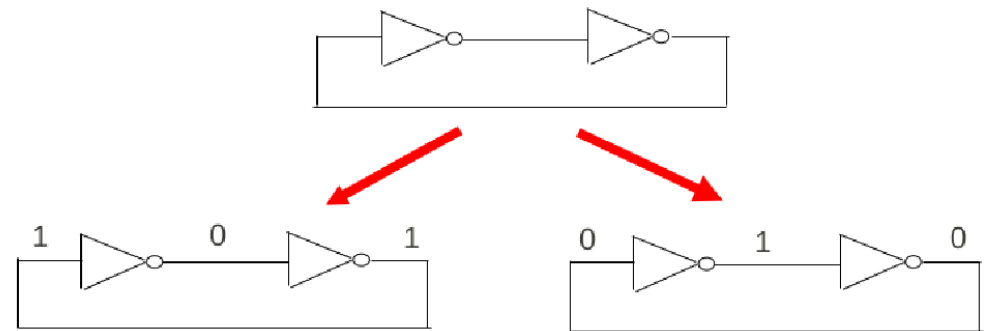


Registers and Finite State Machines

Eric McCreath

- State information can be maintained by connecting the output back into the input.



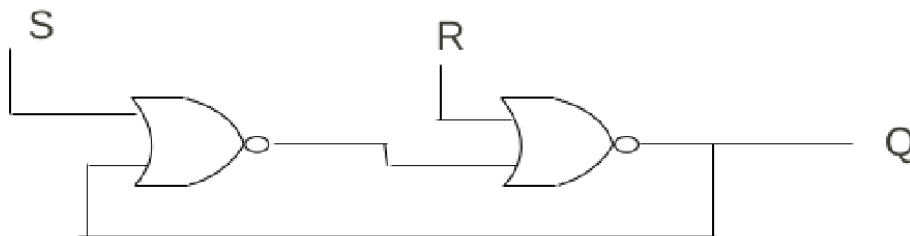
- This circuit can store one bit of information.
- However, there is no way of changing the state of memory within this circuit.



2

State

- By using two 'nor' gates, in much the same way as the two 'not' gates, we can set and reset the one bit of memory. This is known as a flip-flop.

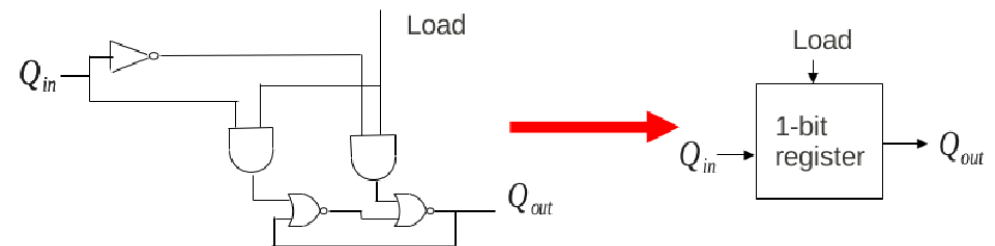


- If $S=0$ and $R=0$ then whatever is in memory will be maintained. If $S=1$ then $Q=1$. If $R=1$ then $Q=0$.

3

Registers

- Usually some more gates are added to the flip-flop to make it easier to control.

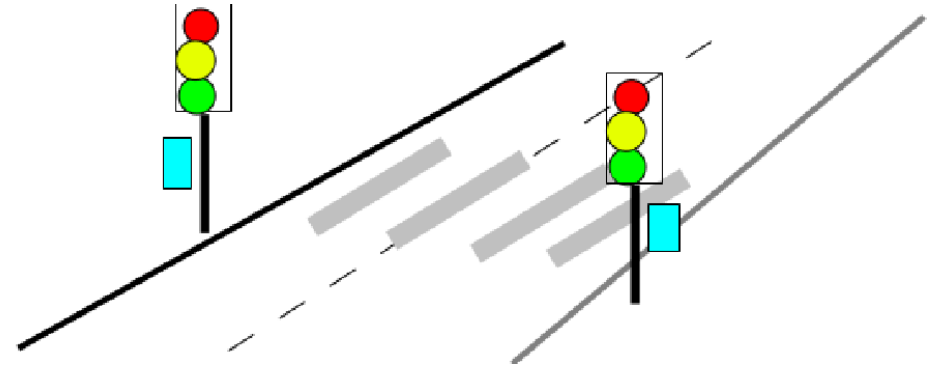


- We can also combine k of these 1 bit registers together to form a k -bit register.

4

- Most of the components that we have looked at so far are purely functional. However, in the design of a computer we require a component that can control and sequence events in time. These components are known as finite state machines.
- A finite state machine maintains its current states. Also it is given a number of inputs and returns a number of outputs.
- A clock, which is a signal that regularly changes between 1 and 0, is used to move the finite state machine from state to state.

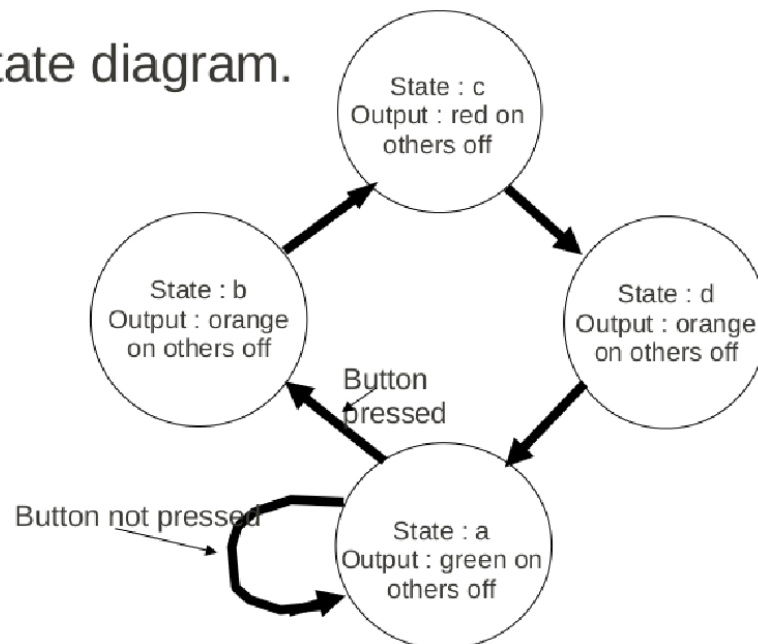
- Suppose we wish to construct a device that will control a traffic light at a pedestrian crossing.
- The device will have three outputs. The first turns the red light on, the second turns the orange light on, and the third turns the green light on.
- It will also have an input from the pedestrian's button.



5

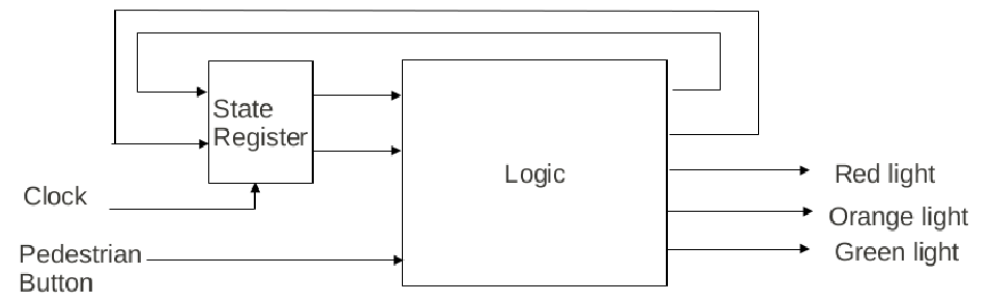
6

- The state diagram.



7

- The current state can be stored in a two bit register.
- This can be used in conjunction with the input to work out the next state and the outputs.



8