

State Diagram

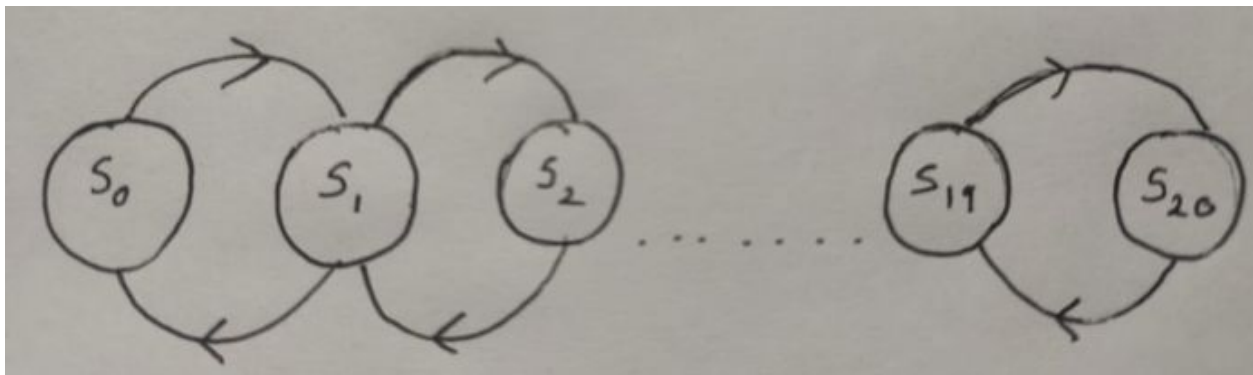
State Diagrams:

The states of the 2 registers are thought of as 2 Moore machines.

Setter Register:

It stores the present value. It's summed with either +1 or -1, which is the parallel input from the adder.

It has a load which is asserted when the piston is inactive when either one of increase or decrease is pressed but not both. In all other cases since the load is low, no state change occurs. Since all the transitions are determined by the increase or decrease button, they act as the only inputs.



Explanation :

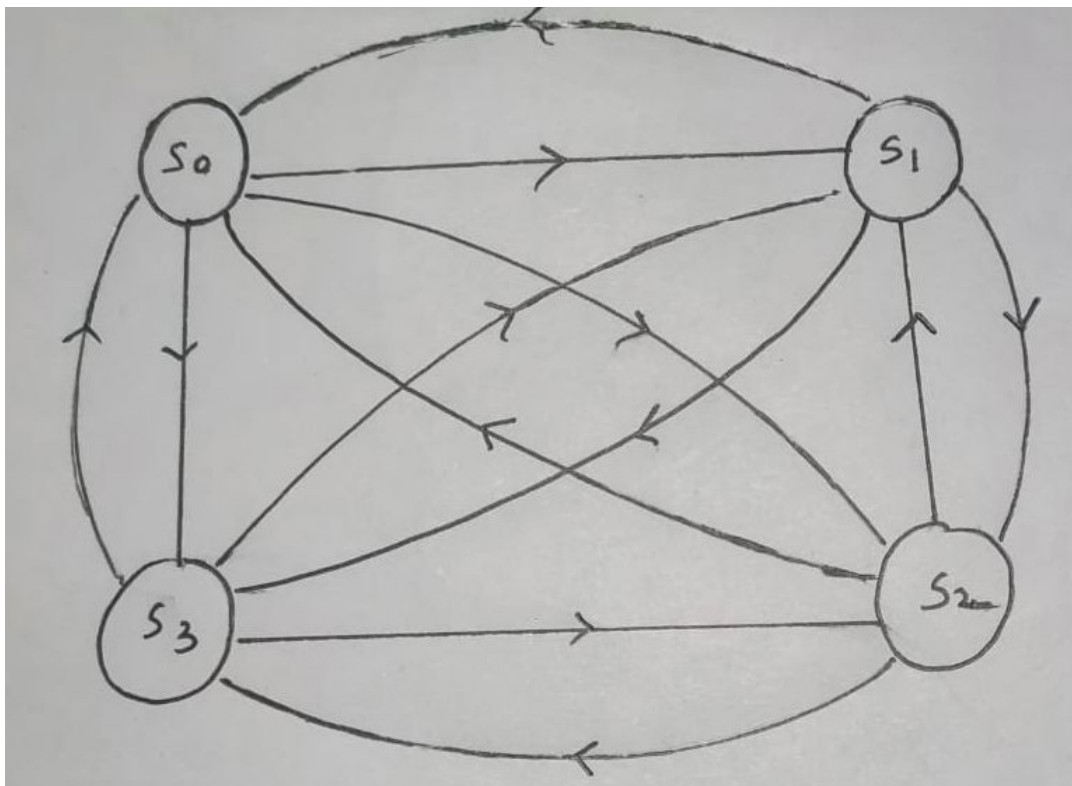
- Each S_i denotes that the amount of liquid present in the pipette is $(10 \cdot i)$
- Valid increase: When the 'increase' button is pushed and the current state is S_i , $\forall i \in [0,19]$
- Valid decrease: When the 'decrease' button is pushed and the current state is S_i , $\forall i \in [1,20]$
- For any valid increase, the state of the pipette changes from S_i to S_{i+1}
- For any valid decrease, the state of the pipette changes from S_i to S_{i-1}
- The value does not increase after it has reached S_{20} .
- The value does not decrease after it has reached S_0 .
- For any invalid increase/decrease, the state of the pipette remains the same.

Store Register:

It stores the present state summed with the present state of the setter register . The sign of the present state register is determined by the operation to perform. Thus the state can transition from any state to any other state. State varies from S_0 to S_{20}

Note :

- In the setter register , while changing its state the present state of the store register is used to determine whether such transitions can take place or not, thus ruling out undesirable cases.
- '0' in operations corresponds to pulling in and '1' corresponds to pushing out.
- Since the state diagram for S_0 to S_{20} would have been messy, a sub graph for S_0 to S_3 has been shown below



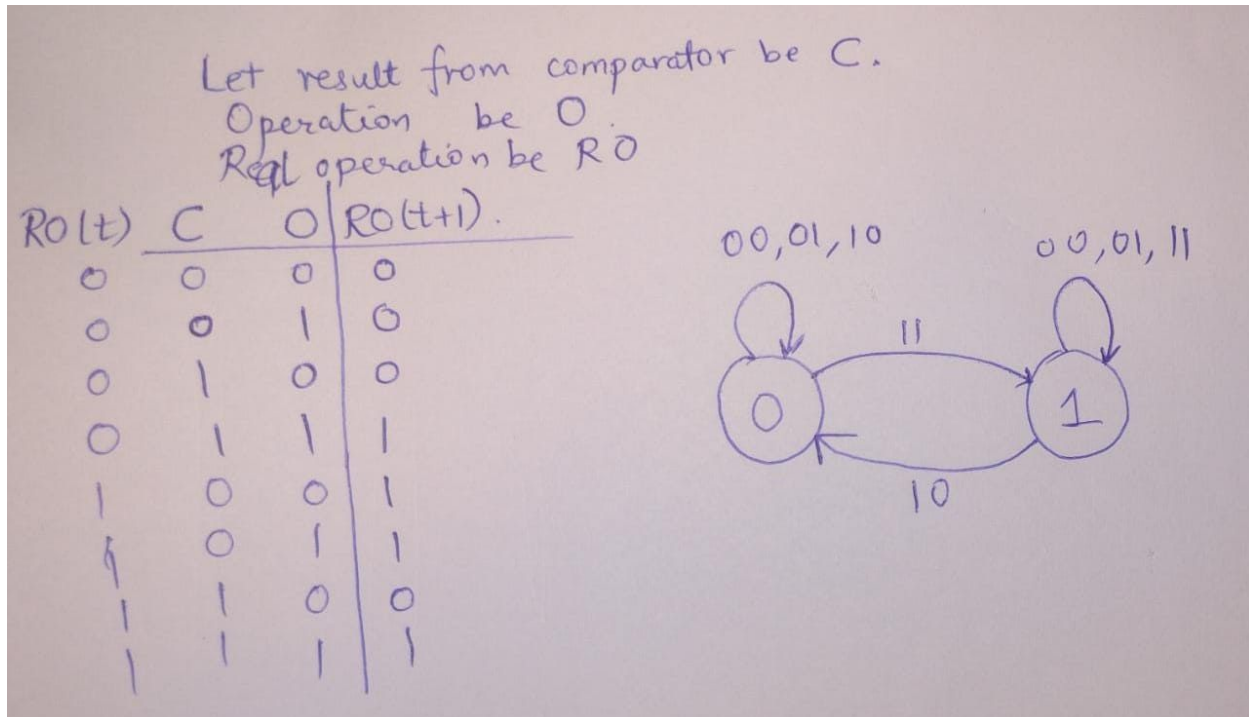
Explanation:

- Each S_i denotes that the amount of liquid present in the pipette is $(10 \cdot i)$

- Valid piston : When the 'piston' button is pushed and the current state is S_i , $\forall i \in [0,20]$
- For any valid increase, the state of the pipette changes from S_i to S_{i+k} o $\forall k \in [i+1,20]$
- For any valid decrease , the state of the pipette changes from S_i to S_{i-1} $\forall k \in [0,i-1]$
- The value does not increase after it has reached S_{20} .
- The value does not decrease after it has reached S_0 .

Note the values of current value and set value are used to determine whether a particular operation is possible. The sum of both of these values must remain between 0 and 200.

Keep operation constant:



Explanation:

- The value of real operation can be changed only when the set value is 0.