

# Finite State Machines

$$M = (S, \underline{I}, O, f, g, S_0)$$

↑        ↑        ↑        ↓        ↑        ↑  
set of states    set of inputs    set of outputs    transition function    output function    initial state

Picobot ex:  $S = \{0, 1, \dots, n\} \Leftarrow$  not infinite

$$\underline{I} = \{xxxx, xxxs, \dots, NEWS\}$$

$$O = \{N, E, W, S, X\}$$

$$f: S \times \underline{I} \rightarrow S$$

(new state given state and input)

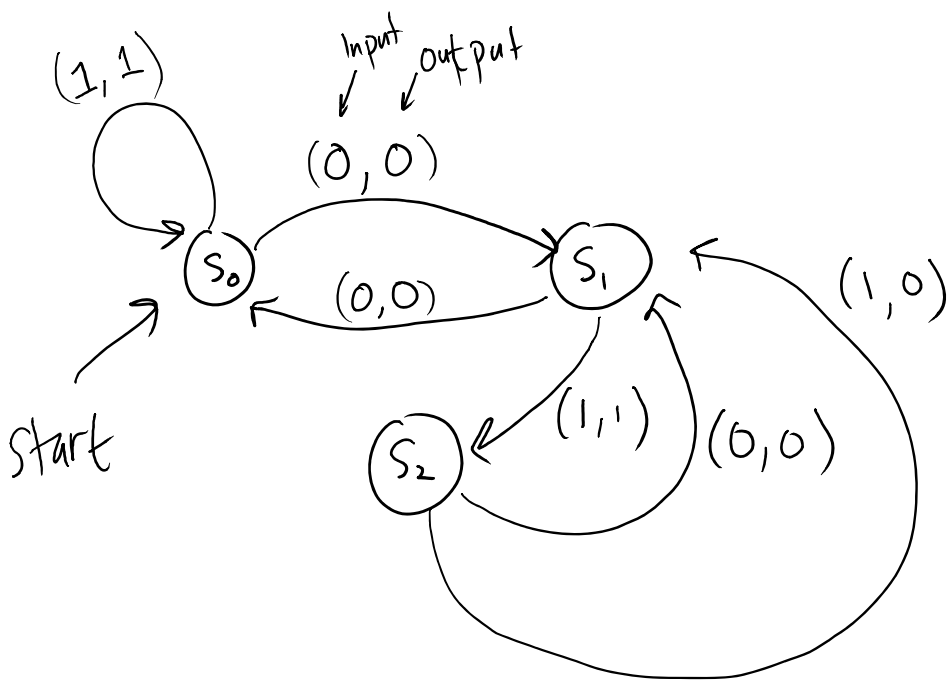
$$g: S \times \underline{I} \rightarrow O$$

(output given state and input)

$$S_0 = 0 \in S$$

Cartesian product

$$(0, xxws) \in S \times \underline{I}$$

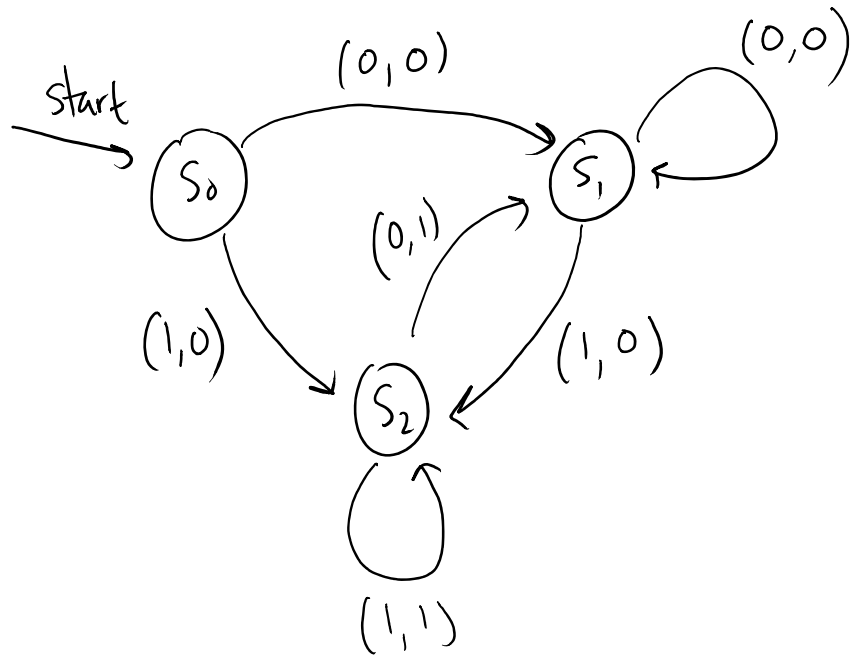


Is graph for FSM

| State          | f<br>Input     |                | g<br>Output |   |
|----------------|----------------|----------------|-------------|---|
|                | 0              | 1              | 0           | 1 |
| s <sub>0</sub> | s <sub>1</sub> | s <sub>0</sub> | 0           | 1 |
| s <sub>1</sub> | s <sub>0</sub> | s <sub>2</sub> | 0           | 1 |
| s <sub>2</sub> | s <sub>1</sub> | s <sub>1</sub> | 0           | 0 |

Input 1101106110

Output 1101060100



Q: Construct a FSM that is a delay machine:

Input: 10110001  
Output: 010110001