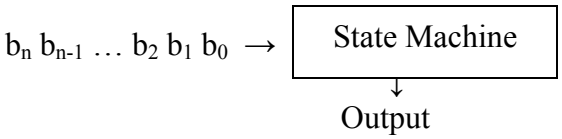
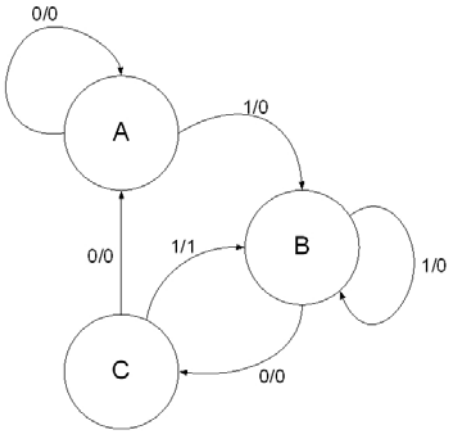
**ECE/CS 314 Spring 2004** **Section 6**

State Machines

Problem:
Implement a 3-bit sequence recognizer that produces a high on its output bit when the bit sequence 101 is recognized. Assume that the input is a bit sequence entering from the left one bit at a time:




Mealy Machine: outputs depend on both state and inputs (asynchronous output)




| | S1 | S0 |
|---|---|---|
| A | 0 | 0 |
| B | 0 | 1 |
| C | 1 | 0 |

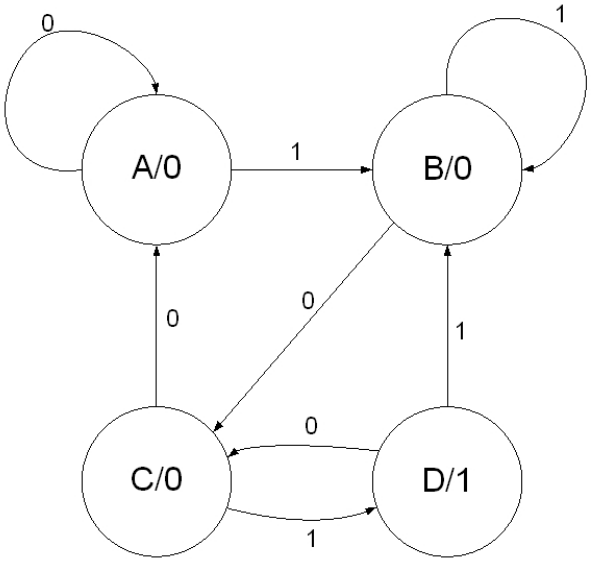
On each arc, the label x/y means the input is x and the output is y.

| Current State | | Input | Next State | | Output |
|---|---|---|---|---|---|
| S1 | S0 | I | S1’ | S0’ | Out |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | X | X | X |
| 1 | 1 | 1 | X | X | X |

Using Espresso, the following reduced equations can be obtained:

S1’ = S0·I
S0’ = I
Out = S1·I

Moore Machine: outputs depend only on states




| | S1 | S0 |
|---|---|---|
| A | 0 | 0 |
| B | 0 | 1 |
| C | 1 | 0 |
| D | 1 | 1 |

Note that in a Moore machine, the outputs are attached to the states, rather than the arcs.

| Current State | | Input | Next State | | Output |
|---|---|---|---|---|---|
| S1 | S0 | I | S1’ | S0’ | Out |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 | 1 |

Using Espresso, the following reduced equations can be obtained:

S1’ = S1·$\underline{S0}$·I + S0·$\underline{I}$
S0’ = I
Out = S1·S0