CSEE 3827: Fundamentals of Computer Systems

Lecture 11

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A state machine model of a system’s behavior in terms of states and transitions between those states that are triggered by actions.
State diagrams represent state machines

- **one or more states, indicated by nodes**

- **edges between states**

- **input value that triggers transition on edge**

- **machine output at transition**
Finite state machine (FSM)

A state machine that has a finite number of states

* Any finite state machine can be implemented with sequential logic

* All sequential circuits implement finite state machines
Implementing a finite state machine

1. describe operation

2. convert to truth table

3. choose type of flip-flop

4. annotate table with flip-flop inputs for next state

5. derive “next state” and “output” logic

6. wire circuit and flip-flops together together
In class exercise: design a 3-bit counter
Moore machine

A circuit in which the output depends only on the current state
(+ outputs are synchronous)
Mealy machine

A circuit in which the outputs depend on the inputs as well as the current state

(+ typically fewer states than a Moore machine)
A Mealy or Moore circuit?
An example Moore circuit

(a) Circuit diagram

<table>
<thead>
<tr>
<th>Present state</th>
<th>Inputs</th>
<th>Next state</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>X</td>
<td>Y</td>
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</table>

(b) State table
In class exercise

• Design a Mealy machine to identify when the sequence “3827” has occurred in a serial numerical input.

• Now design a Moore machine to do the same thing.
In class exercise: design a vending machine

• This vending machine will dispense a soda after the user has entered $.15

• Inputs: N, D (nickel, dime, quarter inserted)

• Output: R (release soda)