Review Problem 24

- Given the light display shown, build the FSM for a "move left" arrow traffic sign. It should animate an arrow moving left.

- Hint: Can any of the bulbs be connected to the same signal?

```plaintext
S1 = \{E, O, P\}  S3 = \{B, F, S, X\}
S2 = \{C, H, U, Y\}  S4 = \{L, M\}
S5 = \{A, D, T, K, Q, V\}
```
State Table

- "Truth table" for sequential circuits

<table>
<thead>
<tr>
<th>Present State</th>
<th>Input</th>
<th>Output</th>
<th>Next State</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
State Table Example

- State Table for 4th cycle circuit

<table>
<thead>
<tr>
<th>P5</th>
<th>PS1</th>
<th>PS0</th>
<th>Out</th>
<th>NS1</th>
<th>NS0</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>00</td>
<td></td>
<td>00</td>
<td>0</td>
<td>01</td>
</tr>
<tr>
<td>#2</td>
<td>01</td>
<td></td>
<td>01</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>#3</td>
<td>10</td>
<td></td>
<td>10</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>#4</td>
<td>11</td>
<td></td>
<td>11</td>
<td>1</td>
<td>00</td>
</tr>
</tbody>
</table>

Out = PS1 * PS0
NS1 = PS1 \oplus PS0
NS0 = \overline{PS0}
FSM Design Process

1. Understand the problem

2. Draw the state diagram

3. Use state diagram to produce state table

4. Implement the combinational control logic
Vending Machine Example

- Vending Machine:
  - Deliver package of gum after >= 10 cents deposited
  - Single coin slot for dimes, nickels
  - No change returned

- State Diagram:

  [State Diagram Image]

  Hauck's FSM Rules
  
  For each state and legal input pattern
  
  A.) There must be a matching edge
  B.) There cannot be 2+ edges that match