Problem 1

Given the circuit below find the following. Note that the binary number is represented by the output of the flip-flops with $Q_1$ being the LSB and $Q_2$ being the MSB.

1. Derive a state transition table
2. Make a timing diagram starting from the state $Q_1=1$ and $Q_2=1$ and complete at least 5 transition cycles. (Graph provided on next page)
3. Make a state diagram.

### State Transition Table

<table>
<thead>
<tr>
<th>$Q_1$</th>
<th>$Q_2$</th>
<th>$Q_{new}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>01</td>
<td>00</td>
<td>01</td>
</tr>
<tr>
<td>10</td>
<td>00</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>00</td>
<td>11</td>
</tr>
</tbody>
</table>

### Timing Diagram

- $Q_1 \rightarrow J_1 = K_1 = 1$ so
  - Toggle on each count
- $Q_2 \rightarrow$ Toggle on $5$ of $Q_1$, so look where $Q_1$ transitions from $0 \rightarrow 1$
  - $K = 1$ so $1$
    - $Q_1 = 1$, $J_2 = 1$
      - Toggle
      - $Q_1 = 0$, $J_2 = 0$
      - Clear (reset)

### State Diagram

- From 00 to 01
- From 11 to 10