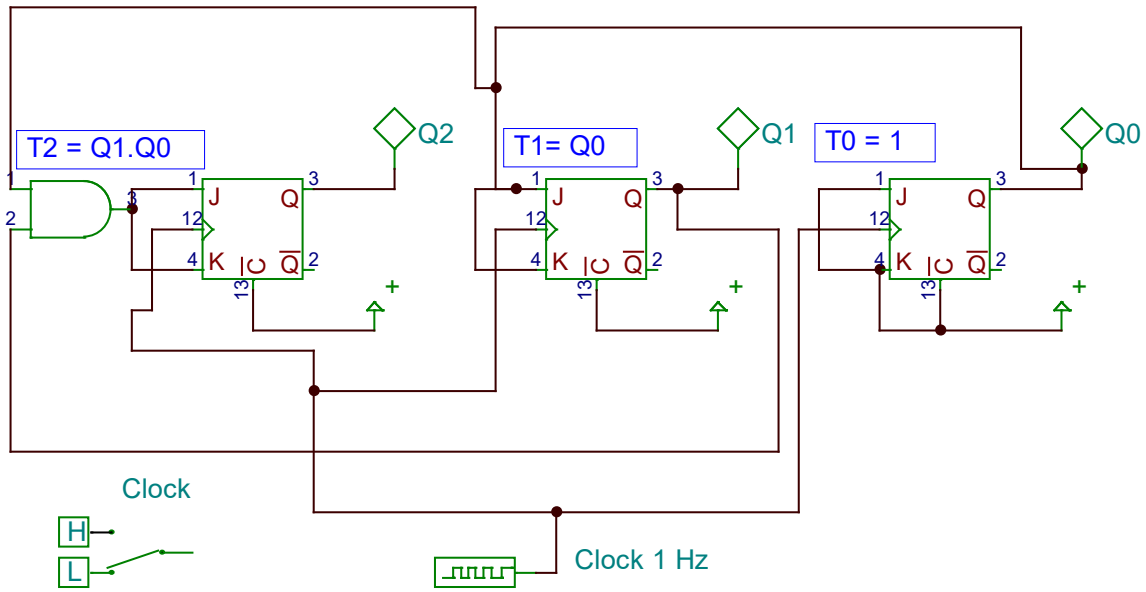
10-22-25 Lecture on: Flip Flop and Binary Counters.
Applications for FF: Static memory, Binary counters, Sequence detector
Electronic latch




| Count | Q2 | Q1 | Q0 |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 |
| 2 | 0 | 1 | 0 |
| 3 | 0 | 1 | 1 |
| 4 | 1 | 0 | 0 |
| 5 | 1 | 0 | 1 |
| 6 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 |

**T = f(Q0,Q1,Q2)**

| Q2<br>Q1Q0 | 0 | 1 |
|---|---|---|
| 00 | 1 | 1 |
| 01 | 1 | 1 |
| 11 | 1 | 1 |
| 10 | 1 | 1 |

| T | Qt+1 |
|---|---|
| 0 | NC |
| 1 | Toggle |

**T0 = 1**

| Count | Q2 | Q1 | Q0 |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 |
| 2 | 0 | 1 | 0 |
| 3 | 0 | 1 | 1 |
| 4 | 1 | 0 | 0 |
| 5 | 1 | 0 | 1 |
| 6 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 |

**T = f(Q0,Q1,Q2)**

| Q2<br>Q1Q0 | 0 | 1 |
|---|---|---|
| 00 | 0 | 0 |
| 01 | 1 | 1 |
| 11 | 1 | 1 |
| 10 | 0 | 0 |

**T1 = Q0**

| T | Qt+1 |
|---|---|
| 0 | NC |
| 1 | Toggle |

| Count | Q2 | Q1 | Q0 |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 |
| 2 | 0 | 1 | 0 |
| 3 | 0 | 1 | 1 |
| 4 | 1 | 0 | 0 |
| 5 | 1 | 0 | 1 |
| 6 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 |

**T = f(Q0,Q1,Q2)**

| Q2<br>Q1Q0 | 0 | 1 |
|---|---|---|
| 00 | 0 | 0 |
| 01 | 0 | 0 |
| 11 | 1 | 1 |
| 10 | 0 | 0 |

**T2 = Q1.Q0**

**T Qt+1**

**0 NC**

**1 Toggle**

## Design a binary counter that counts→ 0,5,2,3,4,7 and back to 0

| Count | Q2 | Q1 | Q0 |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 5 | 1 | 0 | 1 |
| 2 | 0 | 1 | 0 |
| 3 | 0 | 1 | 1 |
| 4 | 1 | 0 | 0 |
| 7 | 1 | 1 | 1 |

**T0 = 1** **2^#FF >= Counting states**

| Q2<br>Q1Q0 | 0 | 1 |
|---|---|---|
| 00 | 0 | 1 |
| 01 | d | 1 |
| 11 | 1 | 1 |
| 10 | 0 | d |

**T1 = Q0 + Q2**

| Count | Q2 | Q1 | Q0 |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 5 | 1 | 0 | 1 |
| 2 | 0 | 1 | 0 |
| 3 | 0 | 1 | 1 |
| 4 | 1 | 0 | 0 |
| 7 | 1 | 1 | 1 |

| Q2<br>Q1Q0 | 0 | 1 |
|---|---|---|
| 00 | 1 | 0 |
| 01 | d | 1 |
| 11 | 1 | 1 |
| 10 | 0 | d |

**T2 = Q0 + Q2'.Q1'**

# Schematic for the counter that counts 0,5,2,3,4,7 and back to 0