

### Laboratory Session 5 – The Counter

Name: \_\_\_\_\_ Name: \_\_\_\_\_ Name: \_\_\_\_\_

**Materials:**

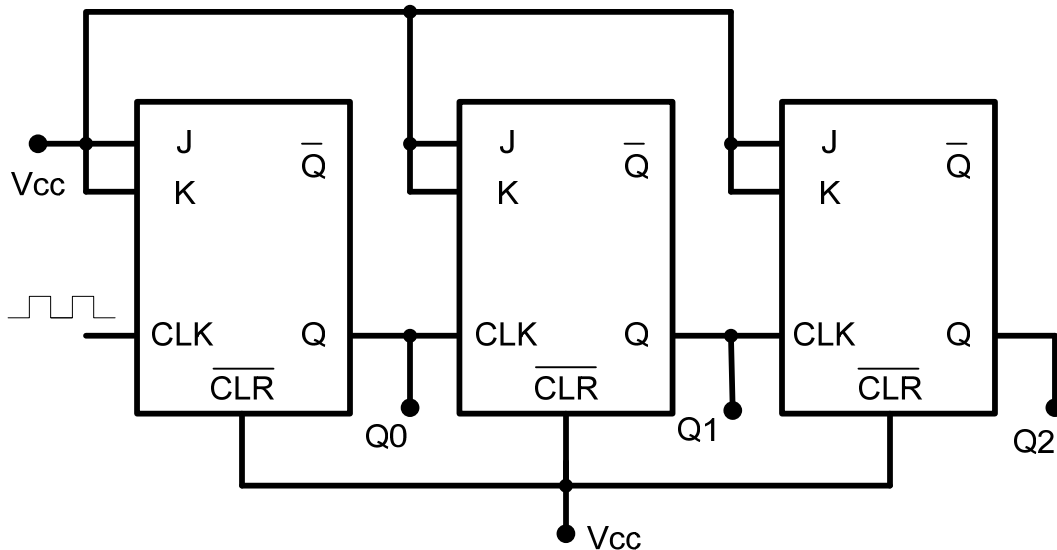
- 7-segment LED
- BCD to 7-segment decoder (7447 chip)
- 1 120 Ω resistors
- 3 J-K flip flops (two 7473 chips)

- Protoboard
- Wires
- Wire Stripper

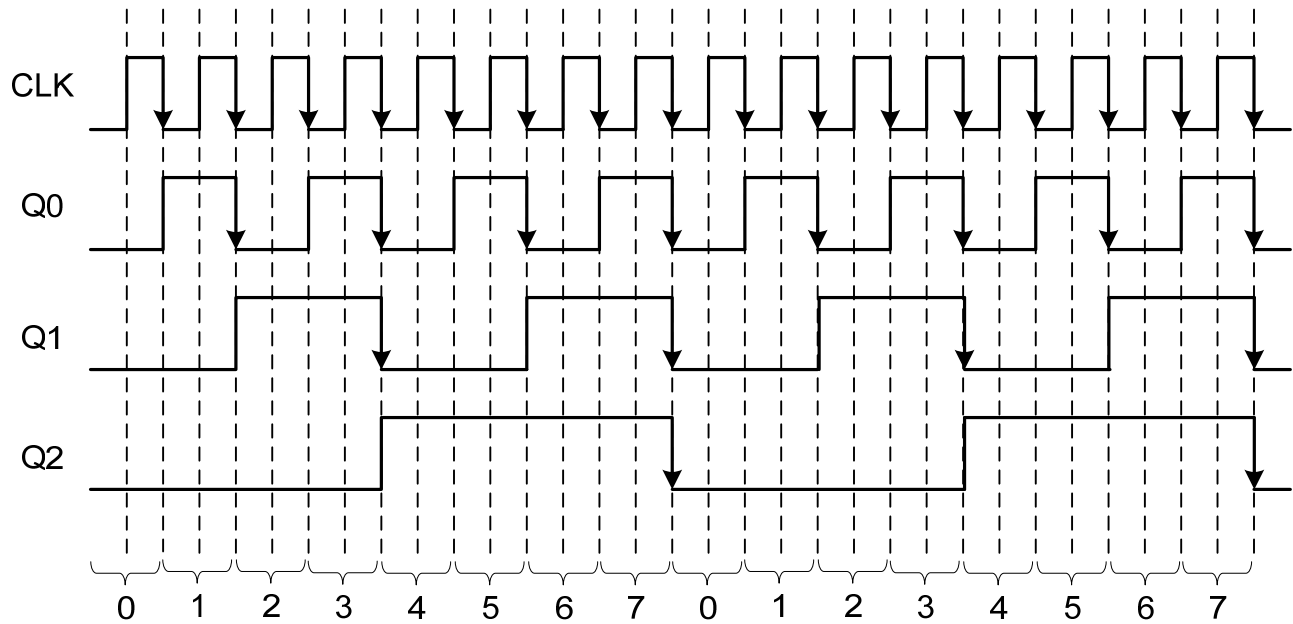
**Introduction:**

Ever notice how important time is to everyone nowadays? Time has evolved into one of the most valuable resources in modern culture. How many times you do glance at the clock to see what time it is in the day? In this lab, we will recreate from scratch, a primitive part of the digital clock, a device that has proved its usefulness in the world today by keeping track of time. You will build a counter that counts from 0→7.

3 bit, 0→7 counter

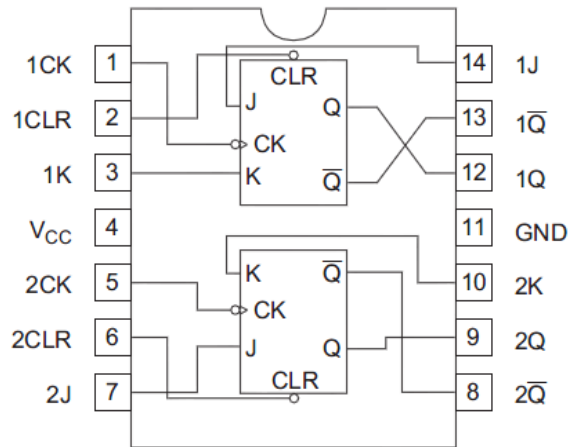
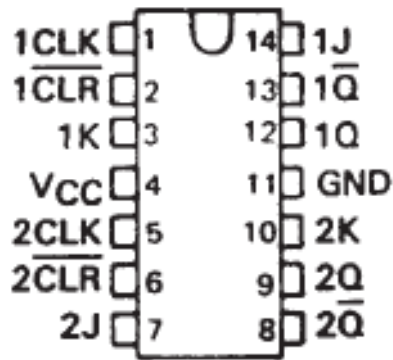


Timing Diagram



1. Create the circuit shown above using J-K flip flops provided. Note that a T flip flop is simply the J-K flip flop with the J and K connected to  $V_{cc}$ . Make sure all the chips that are in use have  $V^+$  and ground connected. If you need more information on schematics for the chips, go to [www.ti.com](http://www.ti.com) and type in the part number.

**7473 JK flip flop**



(Top view)

2. Connect all clock pins (CLK) as the diagram in the next page. Then connect one of the clock pins to the pulse switch mounted on the board. If one is not available, connect the pin to  $V^+$  through a pushbutton. All the clear pins (CLR) should be connected to  $V_{cc}$ . All the inputs K and J also need to be connected to  $V_{cc}$ .
3. Now connect the 3 outputs  $Q_0$ ,  $Q_1$  and  $Q_2$  to the corresponding inputs A, B and C of the 7447 BCD decoder chip from the previous 7-segment LED lab (and disconnecting the old wires that were connected to the switches). Input D of the decoder should be connected to ground. Now as you press the pulse switch or pushbutton that's connected to the clock, you should see the decimal values appear on the 7-segment display.

Figure 1: 0 to 7 Counter Schematic

