HARDWARE EXERCISE 3: 2-Bit Binary Counter

Objective:
In this hardware exercise, we will implement a 2-bit binary counter—the least significant 2 bits of the 4-bit binary counter shown on page 157 of your text and repeated below.

Required Hardware:
- Your breadboard with the 555 timer circuit intact and able to generate a clock signal.
- 1 (one) Multimeter
- 1 (one) Arduino board to use as a 5V power source.
- 1 (one) USB cable to power the Arduino board.
- 1 (one) Dual JK flip-flop DIP (HEF4027BP)
- 1 (one) Quad 2-input AND DIP (74LS08N3)
- 2 (two) LEDs
- 2 (two) 320 Ohm resistors
- Wire as needed (~18 connections)
Pre-Laboratory:
You must draw the necessary connections on the mock-breadboard provided on the following page **prior to the start of class on Friday.** In other words, wire the components on the paper breadboard using a pencil or pen. There’s more wiring required in this design, so a few suggestions are provided below.

1. Start by connecting the ICs to power and ground.
2. Add reset and clear connections; notice that they are all active high. Although in real counters, one reset and one clear circuit would service all ICs, you can individually wire each reset and clear pin to ground.
3. Create the enable connections—-this should be one circuit that can optionally connect to power (or ground). No need for a switch, just move a wire.
4. Create the clock circuit using pin 3 of the 555 timer as the source of the clock signal.
5. Add the output LEDs and resistors and connect one to the output (Q) of each flip-flop.
6. Wire the remaining connections.

Grading:
To receive full credit (15 points) for this exercise you must:
1. Turn in your mock-breadboard with pencil wiring.
2. Demonstrate the functionality of your completed breadboard circuit in class on Friday.
Connect counter outputs here

Use pin 3 (the output) of the 555 timer as the clock signal

555 timer assembly---wiring
Not shown

Connect counter output here