Lab 9 - 4/25/22

4-Bit Asynchronous Counter

EGT 245 - Digital Electronics

Johnny Rivera & Mason Milburn

Northern Kentucky University
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Introduction

The purposes of this experiment are as follows: allow students to build a physical circuit using multiple different components, build familiarity with lab equipment and the mentioned components, and utilize the learned formulae to compute theoretical circuit values, then test those values against real-world models.

Required Equipment & Components

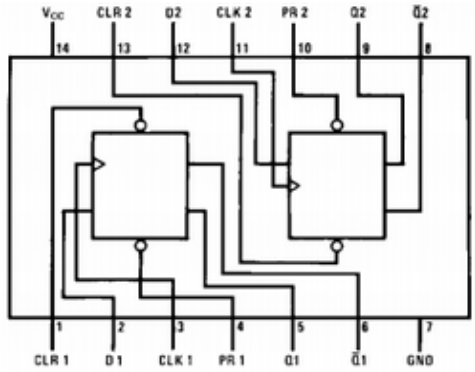
- 74LS74 (Dual D-Type Flip-Flops x2)
- XK-700 Digital/Analog Trainer
- Jumper Wires
- LEDs (x4)
- 5V Power Supply

Theory

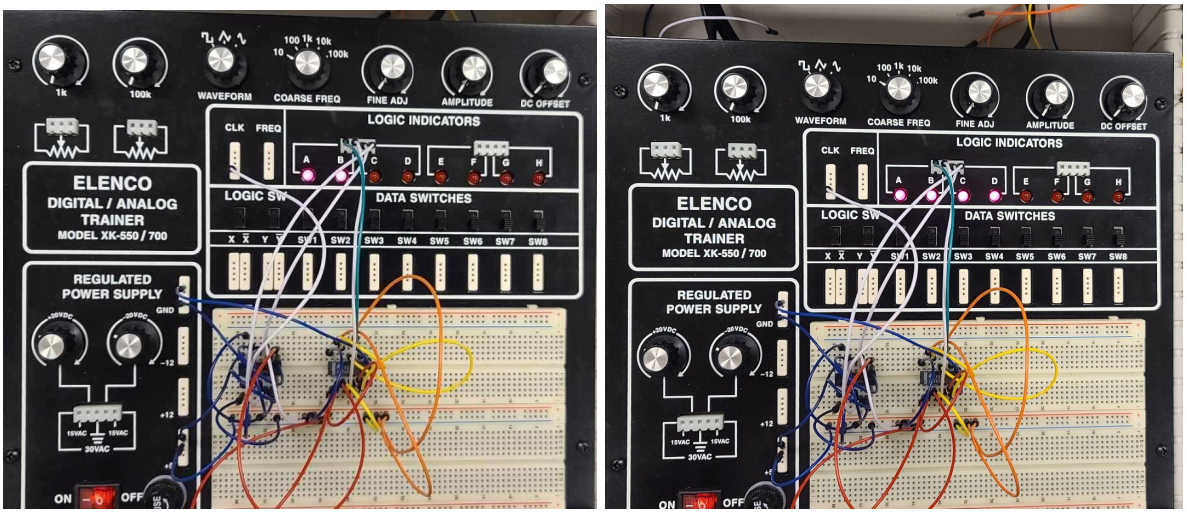
Two 74LS74 ICs were utilized to create a 4-bit counter. The clock input of the first flip-flop was connected to the clock output of the XK-700; a square wave at 10Hz. Each subsequent clock input was connected to the inverted output of the previous flip-flop. All flip-flops' data inputs were connected to their own inverted output. The LEDs were fed via the non-inverted output of each flip-flop. In this configuration, the circuit is capable of counting and displaying values from 0-15.

Component Layout

74LS74



Experimental Results



Conclusion

Through the use of asynchronous flip-flops in Integrated Circuits (IC) chips we were able to show the output of a counter circuit. In this lab we had to use two IC chips which each had two flip-flops inside them to form our 4-bit counter. The output was displayed using LEDs where the rightmost LED, labeled D, was our least significant digit and our leftmost LED, labeled A, would signify our most significant digit. The counter would display values from zero to 15. These counters would change by each sequential input from the clock pulse and the input D in the flip-flop. As in our previous lab where we used latches these flip-flops outputted two states, set and reset. In conclusion, we were able to simulate how we can build counters for a 4-bit number in our case as well as the logic behind the flip-flops we used.