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CPE 301 – 1104
Assignment # 2
9/23/2016

Assignment Description:

This lab involved creating and testing breadboard circuits using LEDs, a 3-8 decoder, and an 8-bit shift register. First we hooked up the LED, the D latch, and the 3-8 decoder. We wired a circuit to test the truth table of the decoder using the LED (attached below). Then we removed the decoder, attached the shift register, and tested for correctness of the circuit.

Problems Encountered:

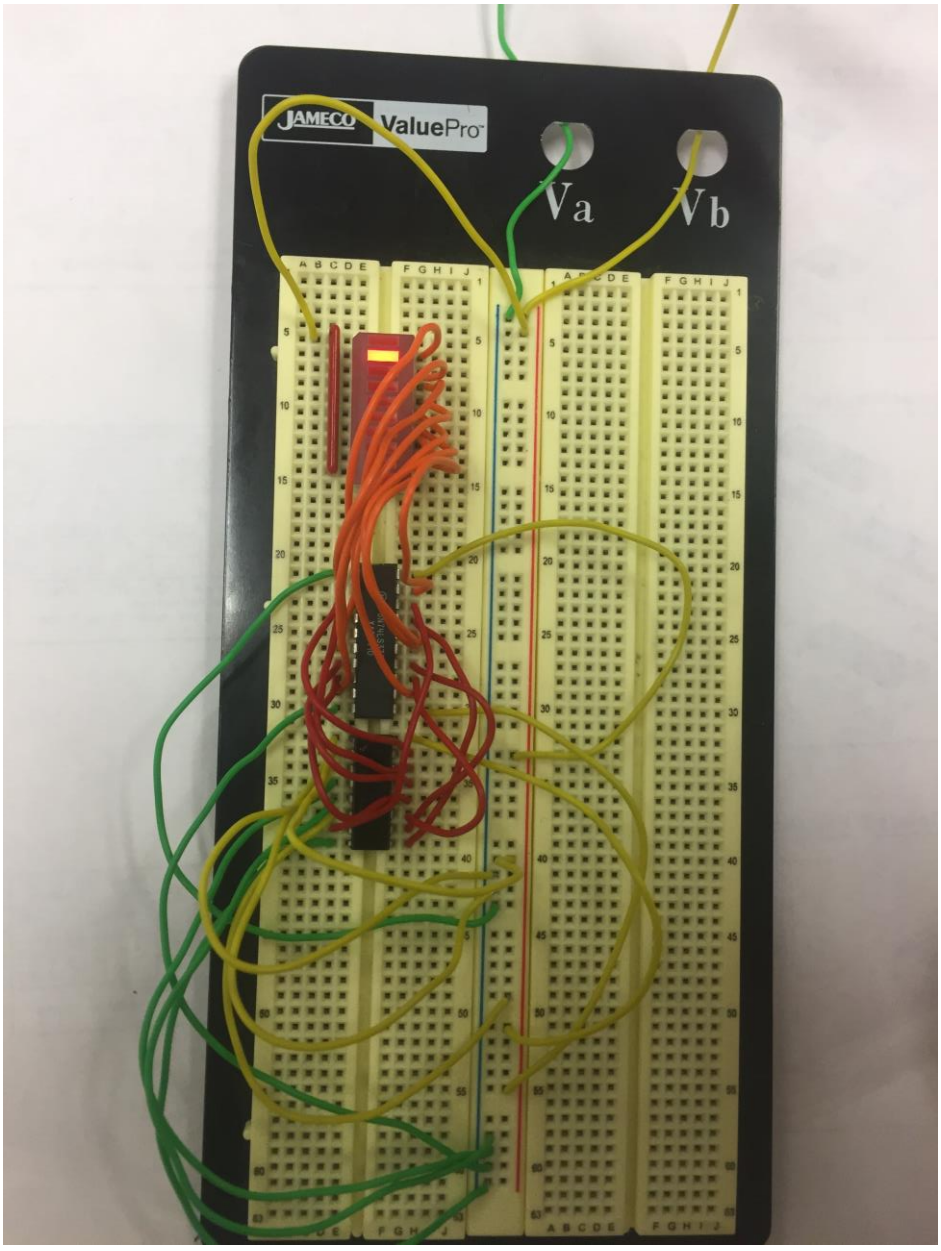
Before lab I had to do a fair bit of wrangling on datasheet websites to find a version of the chip datasheets that I liked best for simply presenting the needed information. Once in lab there was a fair amount of getting the rust off to be done, having taken CPE 201 several semesters ago, but this passed quickly. While we had worked with the other chips before and had our heads around them without much issue, operating the LED and its accompanying resistor was new to us and took a little grappling with the datasheet to understand. After that things proceeded more or less smoothly, and our circuits worked as expected when tested.

Lessons Learned:

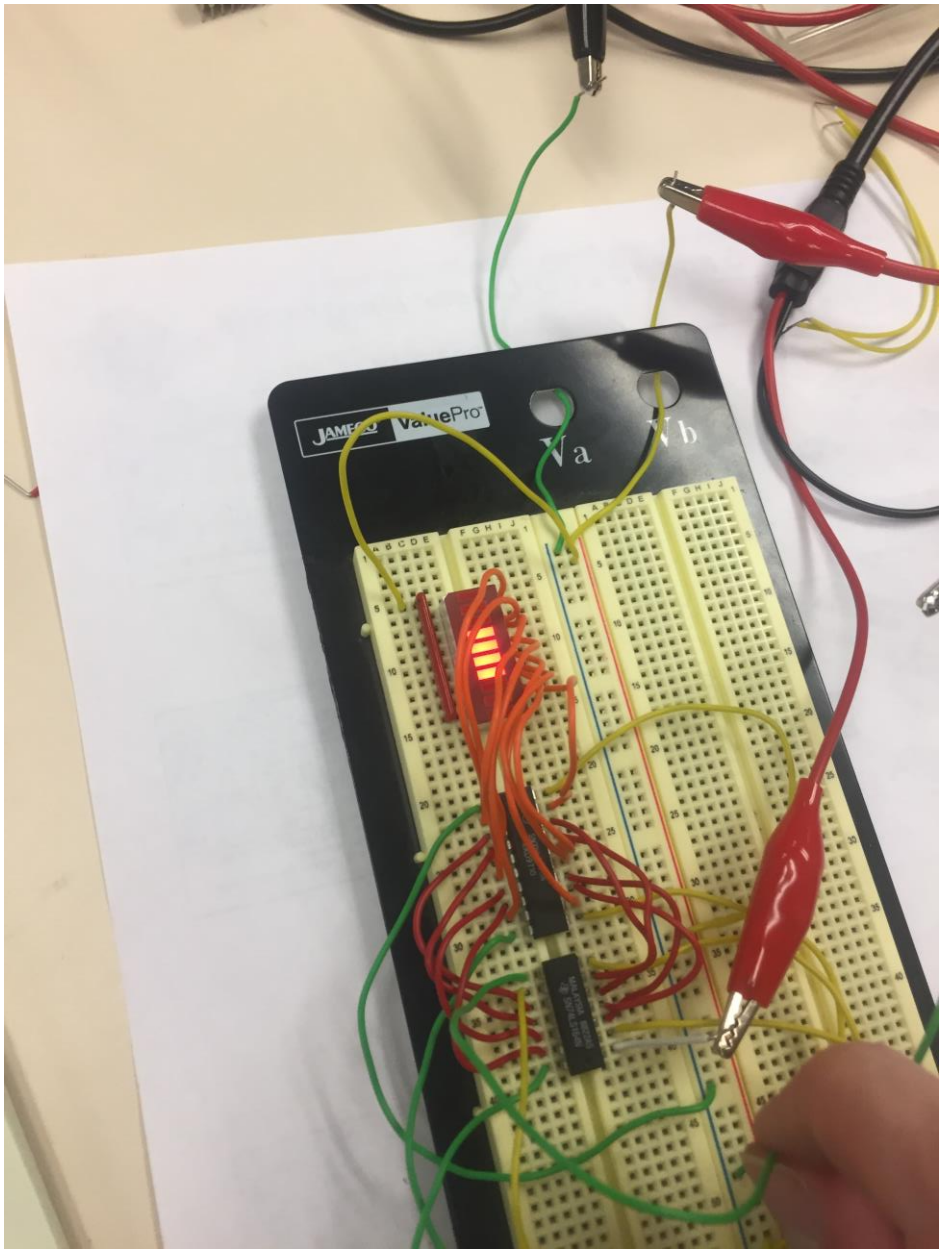
A whole lot of lessons about basic breadboarding were recalled from 201. As mentioned above, operating the LED chip was a new experience. Using the function generator to work as a clock for the shift register was also a new setup compared to the 201 labs. Another new thing I was exposed to was the color coding of wires recommended by the TA, which actually helped quite a bit in keeping organized and is definitely something I will maintain going forward. Other than that much of the work with the actual chips was 201 review: 3x8 decoder and shift registers were not new to me, though review can't hurt. Also got experience finding and comparing datasheets.

Description of Completed Lab:

Decoder breadboard lit one of 8 LEDs corresponding to the low/high combination of the 3 input bits. Decoder breadboard, mid-test:



Shift register breadboard shifted input bits “down” the LEDs by one with each cycle of the clock.
Shift register breadboard, mid-test (lights streamed down with the clock):



Board 1 questions:

Truth table:

E1	E2	E3	A0	A1	A2	O0	O1	O2	O3	O4	O5	O6	O7
1	X	X	X	X	X	1	1	1	1	1	1	1	1
X	1	X	X	X	X	1	1	1	1	1	1	1	1
X	X	0	X	X	X	1	1	1	1	1	1	1	1
0	0	1	1	1	1	1	1	1	1	1	1	1	0
0	0	1	0	1	1	1	1	1	1	1	1	0	1
0	0	1	1	0	1	1	1	1	1	1	0	1	1
0	0	1	0	0	1	1	1	1	1	0	1	1	1
0	0	1	1	1	0	1	1	1	0	1	1	1	1
0	0	1	0	1	0	1	1	0	1	1	1	1	1
0	0	1	1	0	0	1	0	1	1	1	1	1	1
0	0	1	0	0	0	0	1	1	1	1	1	1	1

Setting the latch enable to low and changing the input combination led to no change in the LED. This is because the decoder input was routed through the D-latches, and if the latches were not enabled they would not receive a new value but instead store the old one. So changing the input to the decoder would then have no effect on the LED.

Board 2 questions:

The clear pin had to be tied high in order to enable the chip- with clear pin low, all outputs are low and the inputs and clock are don't cares.

Our result was that the top bit, which was based on our input, would "stream" down to the next light with each clock cycle, and then shift down to the next light with the next clock cycle, and so on. That is, each clock cycle shifted each bit in the 8 bit register over by one bit. This can be used to transmit data serially, ie one bit at a time, via the last output on the register.