**LAB 6: Digital Electronics: Shift Registers**

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**3. 74HC595 Shift Register in Action**

d.

i) The LED corresponds to the binary representation of our number. For instance, when we put in 85, then pins 15, 2, 4, and 6 light up, corresponding to 010101012.

ii) There are 8 clock pulses, and 3 data pulses. We see that the data pulses occur in the same form as the LEDs are lit up. The LED signals are divided evenly among the clock signals. The clock signal always contains 8 pulses; the data signal has as many pulses as there are LEDs lit up.

iii) The LEDs represent the last 8 bits in any number. When the number is >255, there are more than 8 bits, so the most significant digits get cut off. This is because the MSB will get shifted away when the number is >255.

iv) Every 500 ms, the next light turns on and the previous one turns off. When it reaches the end, it loops back to the starting LED.

v) When we were taking MSBFIRST, pins 15 and 1 were lit. Once we switched it, pins 6 and 7 turned on. Basically, the sequence was “reversed” in the LEDs.

e. The code cycles through the numbers 1 to 255 in their LED binary representations.

f.

i) We linked up the pins corresponding to 11 and 12 to the same pins in the first board. Then, we connected the 14 pin to the 9 pin on the first board, so it would take the serial out pin and continue the 8 bit number to more bits. The largest number we can produce is then 216-1 = 65535.

ii) If the delay is 100ms, then it will take 65535 \* 100 ms = 6553.5 s = 109.225 minutes. Because we are committed ES50 students, we will wait this long.

iii) The price that we pay is that the signal takes longer to propagate along the LEDs. With more LEDs, this signal becomes greater and greater and thus results in more delayed signals.