Assignment 5

Schoelen EET122, Spring 2020 Remote

revA: 05/12/2020

Contents

Week: Start 05/14/20 - End 05/21/20

Objectives:

1. Continue to gain familiarity with KiCad schematic capture by doing more KiCad tasks
2. Continue to gain knowledge of circuits by building and debugging.
3. More exposure to synchronous circuits: More Shift Register
4. Exposure to Linear Feedback Shift registers and pseudo random numbers
5. Exposure to Digital to Analog Conversion

This lab uses a parallel load, parallel out shift register (74LS194) to generate a pseudo-random binary count. In action it is a four-bit counter that sequences through the binary count in "random" order. It produces fifteen possible count values. A zero count is not allowed (why?). Our "random" count needs an initialization value, this is referred to as a seed. The seed value in this lab is: 0001b. The seed is parallel loaded and then the shift register is set to shift-right mode.

The counter drives both LEDs and a homemade Digital to Analog (DAC) convert.

Read / Watch:

(This isn't the greatest video, but it talks about exactly what we are building)
Watch: LFSR https://www.youtube.com/watch?v=CkklqF13F98
Watch: R2R DAC https://www.youtube.com/watch?v=bXUfDLF4MVc

Do:

Use the Lab5 Discussion board if you need help.

1. Read the following PCC lab exercise: http://spot.pcc.edu/~dgoldman/labs/eetdig-2-5.pdf.
2. Complete a KiCad schematic of the design. A reference schematic is loaded on D2L. Please note that our design has more components than the department lab, so please use the reference schematic provided on D2L.
3. Use Arduino for +5V, GND and Clock (clock is pin D8 on the Arduino, use week1 Arduino sketch).
4. Do a simple sketch of your breadboard layout before you build. I want all students to have the LEDs in the same order for the build. The order shall be (from left to right on the breadboard):
    a. Q3 – Q2 – Q1 – Q0
5. Build the circuit on a breadboard.
6. Review the datasheet for the 74194. You will need to understand the modes of the 74194 (S1,S0).
    a. S1 S0: 1 1 is parallel load
    b. S1 S0: 0 1 is shift right
7. Procedures in the next section
8. Derivables are to be uploaded to D2L for grading.

For the deliverable use this this naming convention please: LastNameFirstName_L5

***** This is a one week Lab *****

Procedures

1. Document the complete count sequence of the counter before testing. This way the expected sequence is known and we can therefore determine if the circuit is operating correctly. There will be fifteen unique count values

2. Use Arduino sketch form first lab. Be sure MY_CLOCK_RATE is defined as 500 at the top of the sketch

3. Once the circuit is debugged and presenting the correct LED count sequence, make a video of a complete sequence.

4. Change MY_CLOCK_RATE to 1 (this changes the clock rate to 1ms high / 1 ms low => 2ms period OR f = 1/T = 1/2ms = 500Hz). Shoot a video with sound so that we can hear the speaker output. It should sound like noise with random volume changes.

Deliverables to be uploaded to D2L for grading

1. Upload the completed KiCad schematic: both the .pro and the .sch
2. Scan or shoot a picture of your pre-layout sketch
3. The documented count sequence
4. Video of the LEDs displaying the full count sequence
    MY_CLOCK_RATE 500
5. Video with sound
    MY_CLOCK_RATE 1