CE100 Lab Report 1

Oscilloscope descriptions and figures

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Lab Sec: TTH 2:00pm-4:00pm

Date: January 15th, 2016

Description:

The purpose for this lab was to get familiar with the tools us, CE100 students, will be dealing with for future labs. One of the tools being used in lab 1 was an oscilloscope, which displays the voltage of a time-varying signal, in this lab our time varying signal was analog. Other tools used were oscilloscope probes, which is just an extension of the oscilloscope and used these to measure the voltage in parts of the Basys2 board. Lastly, us, students, were to familiarize ourselves with the ISE Project Navigator which allows for simple schematics and then transferred on to the Basys2 Board. The lab consisted of the following two parts.

Part A – Oscilloscope

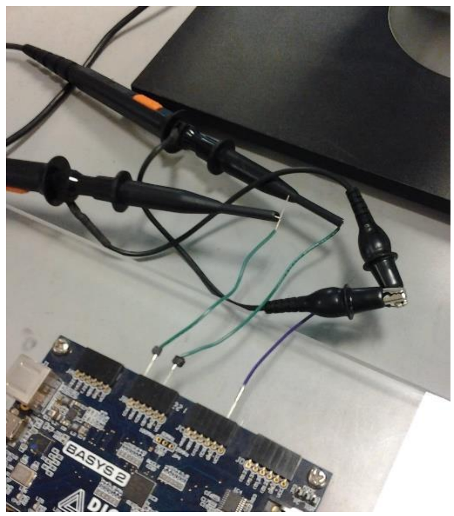


Figure 1 (taken from cmpe100/Winter16/lab1/lab1)

As we familiarized ourselves with the oscilloscope probes, we hooked them up using sockets and wires to the Basys2 board in such a way:

Using an alligator clip, connect that to the ground of the board (gnd) pin. Then, connect a socket into Pin JB-1 of the JB connector and another to PinJB-4. When we connect them following these steps, we will have it like Figure 1. Then after fetching the bit file and running the file onto Adept we use the controls of the oscilloscope to display waveforms, Figure 2.

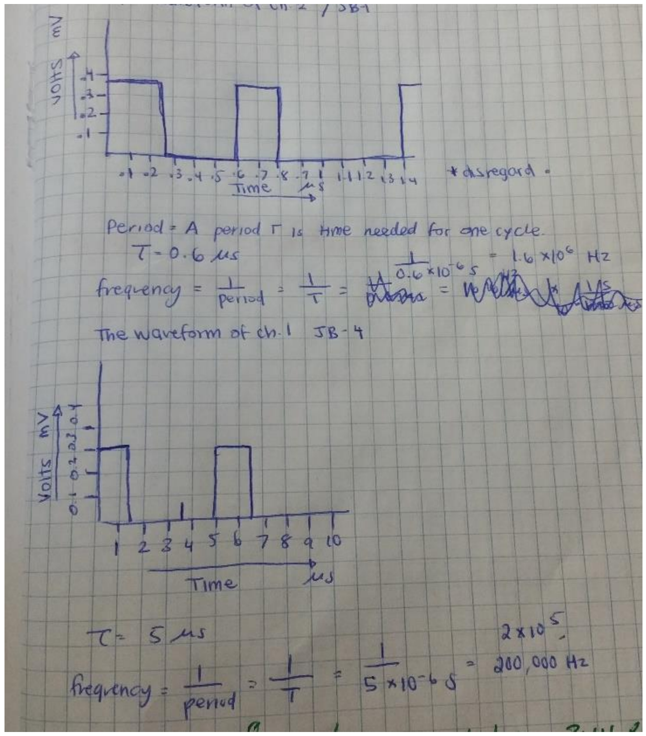


Figure 2

Results:

A more through explanation of the waves, in Figure 2, are that the voltage was measured in mV and the time was µs. From this we can equate what the horizontal sweep and the vertical graduations were. A horizontal sweep is how fast electron guns run across the screen; therefore, understanding that we were using time in micro seconds per division and each cell grid on my notebook was .1 microseconds per division allows us to obtain the information. As for the vertical graduations, we are able to notice the same pattern, where the cell grid represents in micro volts per division. Furthermore, using the period of the wave we were able to obtain frequency using the formula, f = 1 / T (period). For the waveform of channel two (JB-1), which was the one above the other waveform, we obtained 1.6 * 10^6 Hz and for channel one (JB-4) we obtained 2*10^5 Hz.

Part B- Entering a simple schematic:

This part of the lab helped us familiarize ourselves with the ISE Project Navigator to enter simple schematics and download them to the Basys2 Board. We were to create a design with a single schematic which had the following four outputs: NOT of BTN0 should be to LED LD0, the AND of pushbuttons BTN0 and BTN1 should be the output to LED LD1, the OR of pushbuttons BTN0 and BTN1 should be the output to LED LD2, and the XOR of switches SW0, SW1 and SW22 should be the output to LED LD3. In order to have the inputs and outputs of our schematics we must first read the Basys2 Board Reference Manual which was provided to us by our handy Teacher and Teaching Assistances or Figure 3. We use these pins to associate them with the corresponding signals we want, hence these are the documentation of which pins of the FPGA I used and how they connect to the LEDs, pushbuttons, and switches.

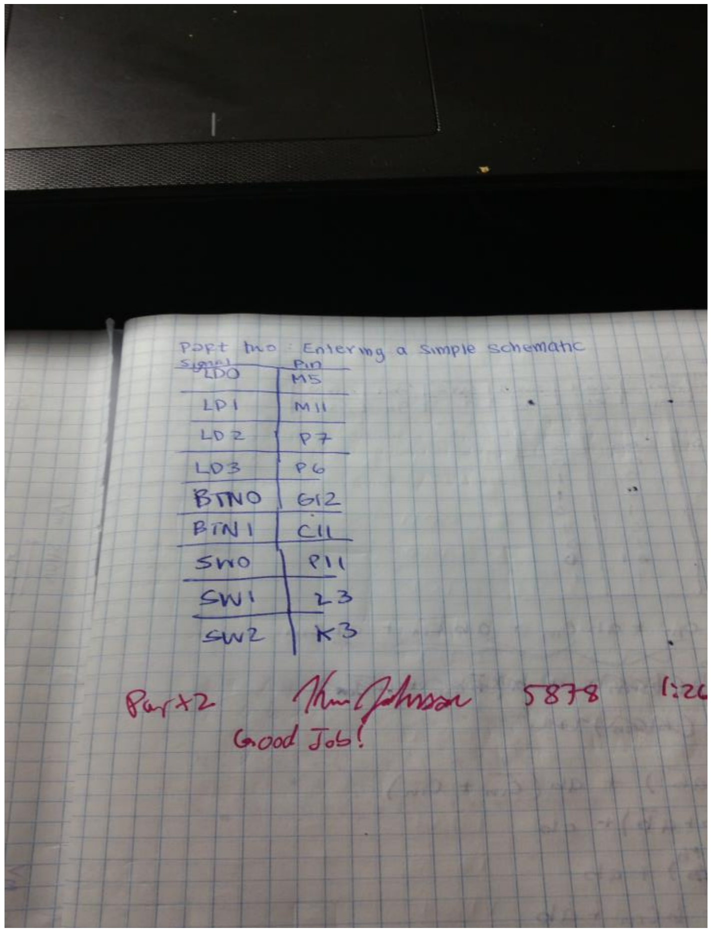
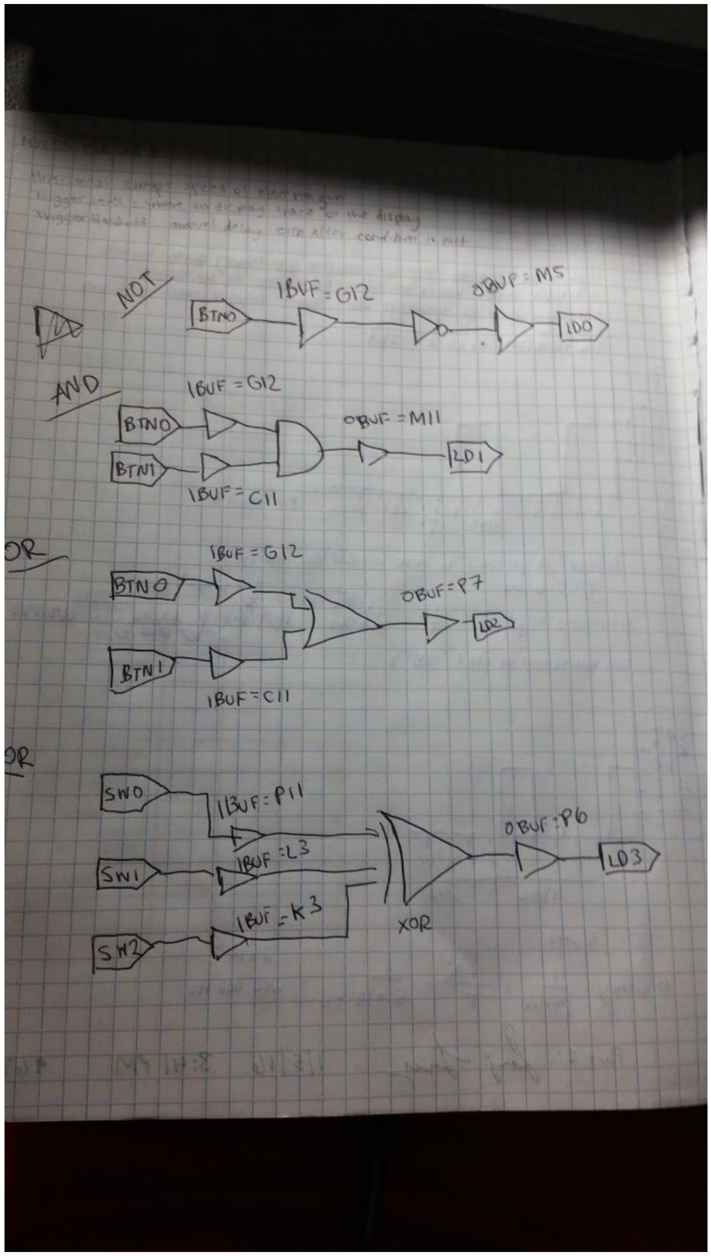


Figure 3

After noting down the following signals we then draw out our schematics just like Figure 4. Here we assign one OBUF or IBUF to the pin. The last schematic is an XOR, just that the picture cropped out that part.



Results:

To go more in depth about the schematic, the first one (NOT) we know from our logic design that the inverse of an input leads us to a NOT. Therefore, when we invert BTN0 and send the output to LD0 we get a NOT. The second schematic, we know that an AND gate led us to an AND truth table with the inputs being BTN0 and BTN1, the output is sent to LD1. The third design was an OR gate, the inputs being BTN0 and BTN1, with the output sent to LD2. And lastly, we have sw0, sw1, and sw2 as our inputs, sent the signal through an XOR gate and out to LD3. After we design the schematic on ISE, we generate a bit file and run it on Adept. There we can see on the Basays2 Board that our results end with what we wanted to build and hence got the expected output.

Conclusion:

In part A of this lab, we used an oscilloscope to determine the voltages at various points of a Basays2 Board, more specifically JB1 and JB4. We then used the oscilloscope probes to calculate and visually see the wave trends and wrote down their frequency. As the results showed up, they were in accordance with what our theoretical values would have been. In part B, we used an ISE design program to familiar ourselves with creating schematics on the Basys2 Board. I used simple algebra to get the output of my signal using the inputs I wanted. I then simulated and downloaded the design to the demo board using Adept to verify the results. In all, I have familiarized myself with the oscilloscope, ISE program, Adept program and the Basys2 Board.