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CPE 301-1001
Assignment #3
September 21, 2016

Assignment Description:

We will be performing a lab in which we will combine multiple RAM chips to expand both the word size and the number of words. We will be doing this with inverters, switches, resistors, and memory chips. We will be using tai-state output devices which means that they also have high impedance as an output condition. This basically means that when we do a read operation there is an output of the complement (in this case) of the stored data, otherwise the output is high impedance. It is important to remember during the lab that we will be reading the complement of what we write. First we will use two memory chips to expand the number of words, then we will use two memory chips to expand the number of bits per word.

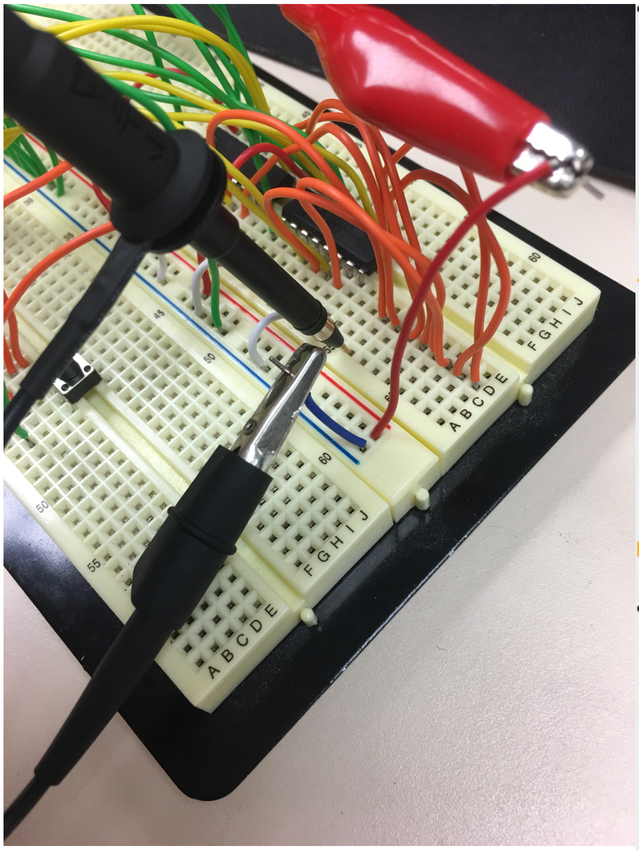
Problems Encountered:

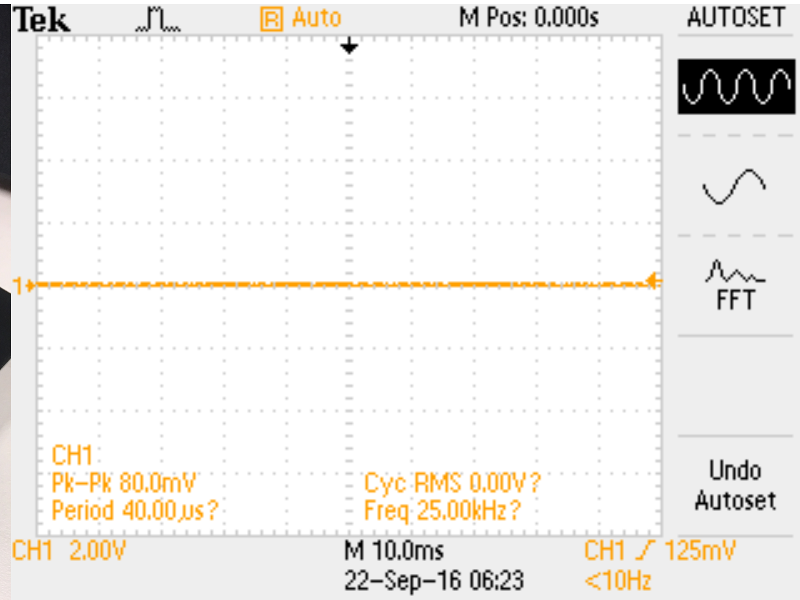
The main issue in this lab was the difficulty in keeping track of each wire and making sure they were all hooked up in the correct manner. We also spent a sad 10 minutes trying to figure out why our first setup was not producing a strong signal, and finally realized we had not turned on the function generator. I also had trouble understanding the layout of the output bits at first, and was trying to read the stored data from the wrong side of the bit set. Once we figured these small issues out, we had a very productive lab session.

Lessons Learned:

This lab solidified in my mind how the sequential process of storing and reading data works. Obviously this process and system is greatly smaller compared to our version, but it was nice to be able to visualize and see exactly how each switch enabled a single bit of the byte and how to read each of those bits.

Description of Completed Lab:





2.2) We started with 2.2 as Frank suggested. When we entered in the address of 0x00 by using the switches, then entered the data of 0x23 and stored it using the button, we could read it by simply using the oscilloscope and it's accessory to read the voltage of the pins horizontally from our output pins. In this case, we could read the first, second, and sixth pins as high and the rest as low (technically, we read the complement of our outputs). As 0x23 in binary is 100011. Above is the image of me reading my outputs (row of orange wires) and you can see how the voltage was affected when reading high vs. low voltages with the oscilloscope. On the following page of this report is a picture of the completed board.

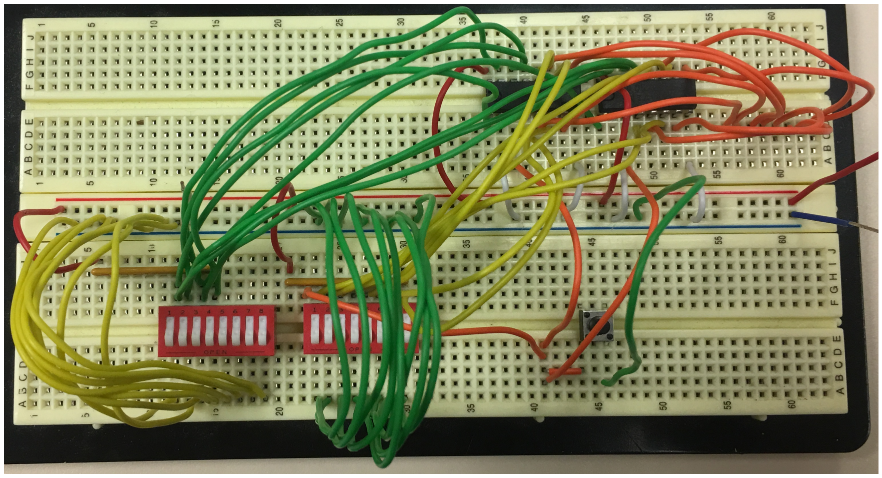
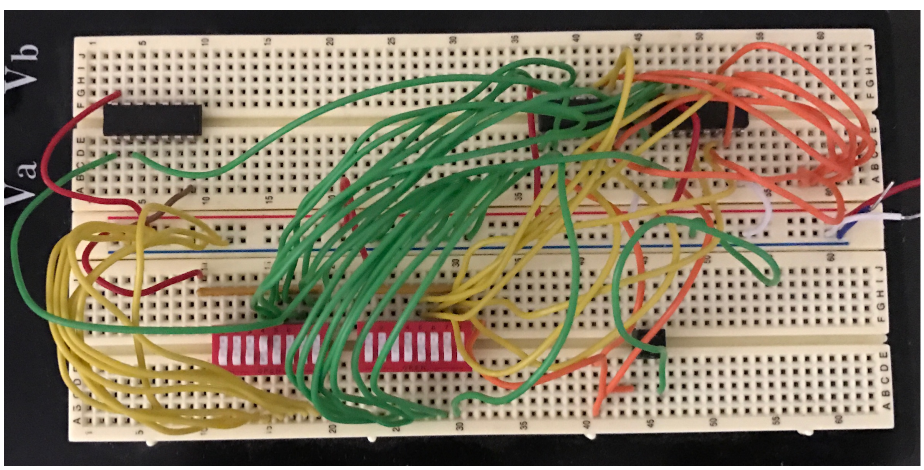


Image description: The 2 yellow components are SIP resistors, the red and white components are the switches. The left switch was used as the address, and the right was used as the data. The button is shown to the bottom right, the two 74189 memory chips are to the top right. And finally the outputs are to the trop right, shown as a row of orange wires.

2.1) In this section of the lab we were to build a 32-word RAM memory system in which each word is 4 bits. Here is what my final version of the board looked like after implementing these instructions. You can see the



addition of the 74LS04 inverter to the top left. Writing to the 0x00 address data of 0x5, I could read that data using the same method as in the previous section. The key difference in this version is that the word size has been expanded rather than the number of words.