LAB 2 - DIGITAL DESIGN - CS 281

The purpose of this lab is to build off of the introductory information to circuits form lab1 and use it further for more complicated circuits. In this lab, I build a multiplexer and a 1-bit adder circuit. There were four parts to this lab.

1. **PART 1: Adder Circuit**

   In the pre-lab, I made a truth table with three inputs and two outputs demonstrating the adder circuits outputs. I then also completed the Logism model of a 1-bit adder. T implement this on the breadboard, we first take the XOR logic gate chip - IC 7486. The inputs to the first gate on this chip are connected to switch 1 (A) and switch 2 (B) on the breadboard. The output of this gate is connected to one of the inputs on the second gate of the same chip. The second input to this gate is switch 3 (Cin) on the breadboard.
   I then proceed to connect the output of this gate (Y) to a resistor and an LED. I then take a logic AND chip - IC 7408 - and connect the switches A and B to the inputs to one of these gates. The output from this is then inputted to an IC 7432 wich an OR logic chip. On another gate on the AND chip, I plug in the output from the XOR's first gate and Cin and then connect the output of that AND gate as the second input to the OR chip. I then repeat the process of connecting the resistor and an LED to the output (Cout) from the OR chip.
   Please note that all the logic chips were connected to power (+5 volts) on the top right corner and GND on the bottom left corner.
   The video of this is attached.

2. **PART 2: A 2 to 1 Mux**

   In this experiment, we build a 2 to 1 mux using the AND, OR, and NOT gates only. As I designed this mux in the prelab, I first an AND chip - 7408 - and connect Switch 5 as A as one of the inputs in the first AND gate. I then connect Switch 6 as B as the first input on the second gate of the AND chip. I then proceeded to add an IC 7404 on the breadboard (a NOT chip). I connected Switch 0 on one of the gates of the not chip and the output of the gate was then connected as the second input on the first gate on the AND chip (below A). Switch 0 was directly also connected to the second gate on the AND chip (below B). I then placed an OR chip - IC 7432 - on the breadboard. The inputs to this chip were the outputs from both the gates on the AND chip. The output of this chip was then connected to a resistor and an LED.
   Please note that all the logic chips were connected to power (+5 volts) on the top right corner and GND on the bottom left corner.
   The video of this is attached.

3. **PART 3: A 4 to 1 Mux**

For this experiment, we implement a 4 to 1 mux using a 16 to 1 mux. I obtained a 74150 chip and placed it on the breadboard. I then proceeded to wire it as in the pre-lab 2 diagrams. The last two pins on the left side on the chip were connected to GND. On the left side, after leaving four pins, I connected the next four pins (5,6,7,8) to switches 1, 2, 3, 4, correspondingly. These were our four data lines for the mux. The strobe, or pin 9, was also connected to GND. The first pin to the right was connected to the +5 volts power on the breadboard. On the lower right side, from below, the last pin was connected to GND and the next two pins were connected to switches 7 and 8 correspondingly. These were our two selector lines, A and B.
I then placed a 7404 chip - a NOT logic chip on the breadboard. I connected the 10th pin on the 74150 chip on the left side, also called our output or W, to the first left-side pin on 7404 chip. I then connected the second pin - the output of NOT gate - to a resistor and an LED.
Please note that 7404 logic chip was connected to power (+5 volts) on the top right corner and GND on the bottom left corner.
The video of this is attached.

4. **PART 4: A 4 to 1 with Arduino**

In this section of the experiment, we use the Arduino, in place of manual switches, to test the operation of the mux. The Arduino drives the inputs for the mux, reads the output of the mux, and runs a series of tests to verify the correct operation of the mux and my circuit.
I first typed in the program on my laptop. Then I connected the data lines from the mux to pins 10,11,12,13 on the Arduino correspondingly. I also connected select lines A and B to pin 8 and 9 on the Arduino correspondingly. Pin 7 on the Arduino was connected to W and then GND was connected to ground on the breadboard.
What the program does is it takes different possible outputs from the mux and displays if the circuit works fine or not.
The program and the output is attached along with the video of the circuit.