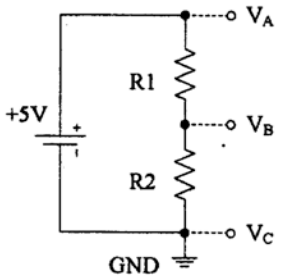
CS 2420 Lab 1

T1 is pretty straight forward. The software we use for the boards is called something like NI Elvis instrument launcher. I tell them to type in "instrument" into the start search bar and it will pop up. Remember that whenever they use any of the software they have to click run in all of the windows for multiple items to work.
The probes go into the top two plugs on the left side of the board. Red into red and black into black. Sounds simple but someone will get it wrong.

When they get to building the circuits make sure to remind them to look for resistors that have the same color band sequence. These color bands represent the amount of resistance they provide. Different resistors can have the same colors but if the order is not the same the resistance is not the same.

T2. Measure a circuit

In order to do this you must find the current that is flowing through the circuit. In order to do this you must find the total resistance for the circuit. Because the resistors are in series you simply add them together to find R_{eq} . Once that is found, using Ohms law, v=iR, find the current ($i=v/R_{eq}$). Once that is found return to original circuit that has both resistors. You have to do this because when you reduced the circuit to find the current, V_b no longer existed. So with the newly found current you can find the voltage at V_b one of two ways.



1) V_a - ($i*R_1$) where V_a = 5.0V since it is connected directly to the power source. You have to subtract the value from V_a because when you use Ohms law on a resistor you are finding the voltage dissipation across the resistor. This means what you find by multiplying the current by a resistor is how much voltage that resistor is going to stop from passing through. So you have to find how much of the 5.0V was allowed through.
2) The second way is to simply multiply the current by R_2. The reason you can do this is because the end of the resistor touching V_c is actually touching ground. This means that R_2 has to stop everything that is left in order for it to reach 0.0V.

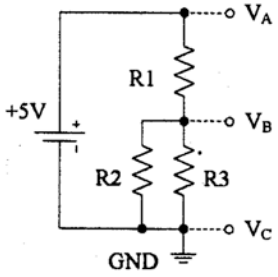
No matter what resistance value you choose the final answer for V_b will always be the same. The current may be different but because the current is based off the voltage and resistance, the voltage dissipation will be the same. Cool huh.

Probing Points	V_A	V_B	V_C
Expected Voltage (V)	5.0V	2.5V	0.0V
Measured Voltage (V)			

When it comes to actually measure the circuit, the black probe needs to always stay on the side of the resistor connected to the ground wire or the ground wire itself. Only the red probe will actually be moving around to measure the different points. Check picture at end of document for more on measuring.

T3. Measure a Circuit

This circuit literally takes one extra step that the previous one. Because there are resistors in parallel you must reduce those. To do this you can use voltage division, which is $R_{23} = (R_2 * R_3)/(R_2+R_3)$ or you can do it $1/R_{23} = 1/R_2 + 1/R_3$ Both will give you the same answer after you solve for R_{23}. You have to do this because in this circuit there are actually two currents flowing; one in the big part and one going around in the little loop around R_2 and R_3. After you reduce that you will have a circuit that looks exactly like the one from T2, except the two resistors will not be equal. For this problem because all the resistance values need to be equal when



starting R_{23} will actually just be half of the original value. This will be a good way to check to make sure they are doing it right.

Probing Points	V_A	V_B	V_C
Expected Voltage (V)	5.0V	1.66V	0.0V
Measured Voltage (V)			

T4. Get Digital Signals from NI Elvis Software

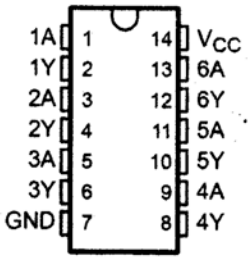
The DigOut simply turns a 5v power supply on and off based at the channel you choose. These voltages will not be exact but they will be around there. There should never be a voltage above 5.0V but something below 0.0V might occur but it will most likely be something like -0.7mv which is really small anyways so that's basically 0.0V

For this part, and T5, the black probe needs to always be touching ground in order to "complete the circuit". If this doesn't happen they will never be able to read any voltages. So for this just have them run a random wire to ground and touch the black probe to it.

Manual DIO 1	Manual DIO 0	Voltage DIO 1	Voltage DIO 0	Voltage LED 1	Voltage LED 0
lo	lo	0.0V	0.0V	0.0V	0.0V
lo	hi	0.0V	5.0V	0.0V	5.0V
hi	lo	5.0V	0.0V	5.0V	0.0V
hi	hi	5.0V	5.0V	5.0V	5.0V

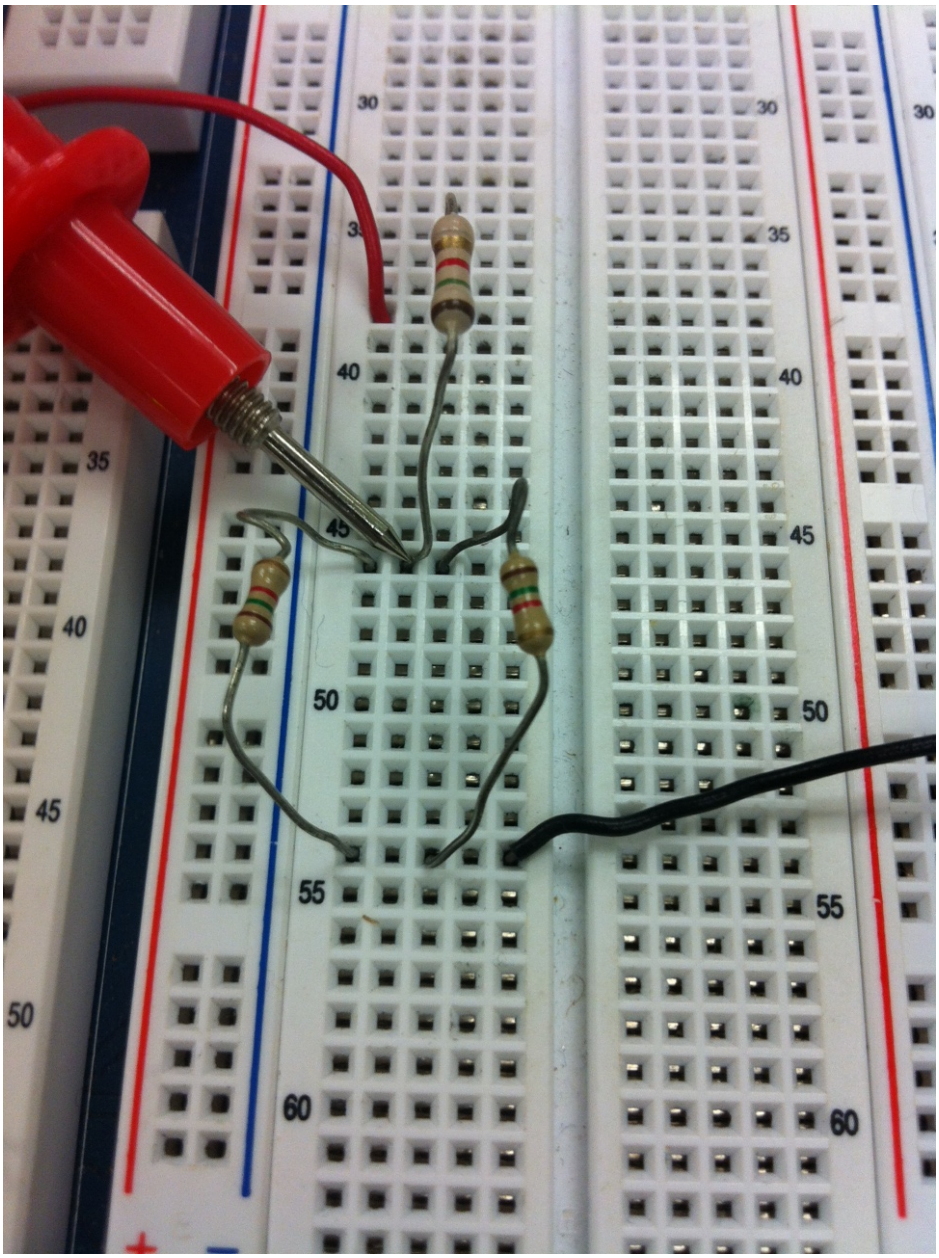
T5. Use chips with NI Elvis

Make sure the chip has a +5v running in the Vcc and a ground running into the GND pins otherwise nothing will work. The 7404 is a NOT gate chip. Have them try to touch the metal from the wire as opposed to the pin on the chip. It give a more accurate reading.



Input		Output		
Logic Input	Voltage at 1A	Voltage at 1Y	Logic Output	LED 7 (on/off)
0 (lo)	0.0V	5.0V	1	On
1 (hi)	5.0V	0.0V	0	off

The logic input is in '1' and '0' because that's what logic is, '1' and '0's. But in order to make logic '0' signal come from the DIO channel that DIO channel has to be 'lo'. The '0' and '1' in the input has nothing to do with the DIO channel itself. Some kids have confusion there.



So! This is the circuit from T3. The red wire is connected to the +5v which means that the current is flowing downwards. This is also means that the end of the resistor that is sharing a row with the red wire is point V_a.

To measure V_a touch the end of the resistor sharing a row with the red wire OR touch that end of the red wire if there is metal exposed.

Where the red probe is, the row with three resistors are sharing, is point V_b. In order to measure V_b you can touch ANY of the three resistor ends that go into that row.

In order to measure V_c just touch the end of either resistor sharing a row with the black wire that is connected ground. Or you can touch the ground wire itself is there is metal exposed.

As explained on top, the black probe needs to always be touching the ground side of the resistors or the ground wire itself. Only the red probe will be moving around to V_a, V_b, and V_c