

Digital Logic Lab 1

CS 2420 Lab Instructors

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0 Pre-lab

Fill in the expected values in the tables below for circuits T-1 and T-2. Use equal values for all resistors, selected from the inventory of the lab listed in Table 1. Be able to show your work as you will need to be able to explain how you calculated these values in your report.

2 k Ω	3 k Ω	1.8 k Ω	1.6 k Ω	
680 Ω	620 Ω	820 Ω	2.7 k Ω	750 k Ω
2.2 k Ω	910 k Ω	1 k Ω		

Table 1: Lab resistor inventory

DO NOT CHANGE ANY SETTINGS ON SWITCHES AND KNOBS ON THE NI ELVIS UNLESS TOLD TO DO SO.

ALWAYS TURN OFF BOARD POWER SWITCH when you want to change something on the board. **ONLY TURN ON POWER TO THE BOARD** after everything is settled on the board.

1 Using NI ELVIS As A Voltmeter

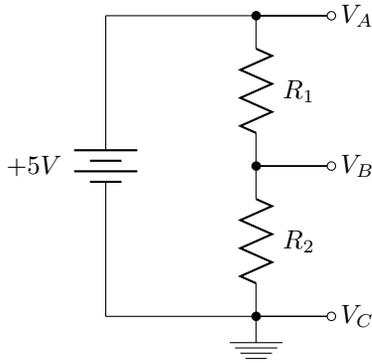
Connect the red probe cable to the DMM (Digital Multimeter) V Ω connector on the left side of the control panel as well as the black probe cable to the COM connector below the red probe.

Start the NI ELVIS software by clicking the "NI ELVISmx" icon from the Start Menu. Click on the "Digital Multimeter" cell (DMM). With the Multimeter pop-up, select the "V=" mode . Specify range 10 V which tells ELVIS to be a voltmeter (for direct current circuits) with a maximum measurement of 10 Volts.

By "touching" various points on the prototyping board with the probes, you will be able to measure voltage levels at different points in circuits. Test this by inserting a wire into the channel labeled "+5 V" as well as a wire into the channel labeled "Ground". After inserting the wires, turn on the board's power supply and click "RUN" on the DMM software. Use the red probe to touch the exposed end of the wire placed in the "+5 V" channel with the black probe touching the exposed end of the other wire in the "Ground" channel. At this point, the DMM should read approximately +5 V.

2 Testing Circuit T-1

Set up two equal resistors in series, as shown in the diagram for circuit T-1. Use the resistor values for R_1 and R_2 selected in the pre-lab exercise. If you are unsure if your resistors are equal, ask your instructor. Connect one end of the circuit to the "+5V" channel and the other end to the "Ground" channel. Once your circuit is built, supply power to the board. Measure the circuit at 3 points: The +5 V end (V_A), the **middle** (V_B) between the two resistors and the **GND** end (V_C). Finally, mark the current direction in the circuit.



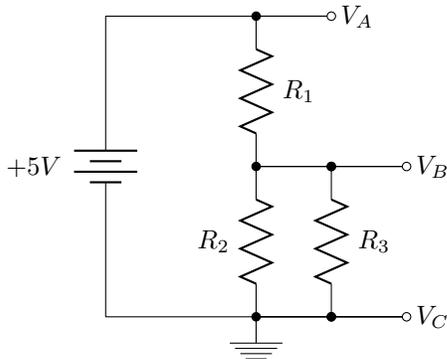
Probing Points	V_A	V_B	V_C
Expected Voltage (V)			
Measured Voltage(V)			

Figure 1: Circuit T-1

3 Testing Circuit T-2

Repeat the steps in section 2 for a new circuit using three equal resistors as shown in the diagram for circuit T-2. Now measure voltage at the three points again and fill in the table below with the data you retrieved. As before, identify the direction of the current.

If still not sure how to reduce/solve circuits, ask your instructor for help.



Probing Points	V_A	V_B	V_C
Expected Voltage (V)			
Measured Voltage(V)			

Figure 2: Circuit T-2

4 Generating Digital Signals with NI ELVIS

Find the channels labeled DIO 0 and DIO 1 on the upper right side of the board. Place a wire running from DIO 0 to the channel labeled LED 0 located on the bottom right side of the board. Run another wire from DIO 1 to LED 1. Make sure that there is some exposed wire so the probe can measure the voltage at either end of the wire.

Now, click on the DigOut (Digital Writer) cell on your NI ELVIS instrument panel. Make sure that the lines to write indicates "0-7" and the manual pattern is "lo, lo" for lines 0 and 1 respectively.

Click on the green "RUN" button. This puts a stable (continuous) 0 V, 0 V on the two channels labeled DIO 0 and DIO 1 respectively. You will be able to visually confirm the outputs because the corresponding LEDs 0 and 1 should still be off at this point. Verify the voltages with the multimeter instrument.

Use the Digital Writer to change the values of DIO 0 and DIO 1 as indicated in Table 2, and record the LED and voltage outputs corresponding to the "hi"/"lo" manual patterns. Use the green Write Button to make sure that the voltages are updated on the DIO channels.

DIO 1	DIO 0	Voltage DIO 1	Voltage DIO 0	Voltage LED 1	Voltage LED 0
lo	lo				
lo	hi				
hi	lo				
hi	hi				

Table 2: Digital Signals and Voltage Outputs

5 Using Logic Chips With NI ELVIS

Find the 7404 chip already placed on the NI ELVIS board by the instructors. The component features 6 inverters with the pin layout shown in Figure 3. For example: 1Y = NOT 1A; 2Y = NOT 2A, etc. Connect the pin V_{CC} to the "+5V" channel and the GND pin to the "Ground" channel using two wires. Supply power to the board and measure the two pins to make sure the chip is correctly powered.

Connect DIO 0 to the input pin 1A and the output pin 1Y to LED 7. This time also measure voltage levels for the input and output pins as you fill in Table 3.

Logic Input	Voltage 1A	Voltage 1Y	Logic Output	LED 7 (on/off)
0 (lo)				
1 (hi)				

Table 3: Logic Chip Voltage Outputs

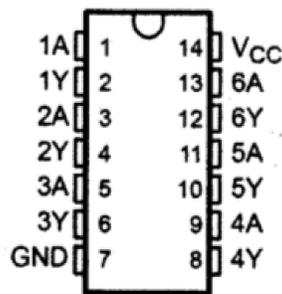


Figure 3: 2-input 7404 pinout