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Basic PLC Electronics Lab #2

Program: Electrician Technician

Course: EL- 180 – Programmable Logic Controls

Objectives: Under the supervision of your instructor, you should be able to do the following:

- Construct AND, OR Gates using DIODES.
- Construct AND, OR Gates using Transistors.
- Construct AND Gate using IC 74LS08.
- Construct OR Gate using IC 74LS32.
- Verify the correct operation of each.

Lab Equipment:

- 1 – DMM (digital multi-meter)
- 1 – 5 VDC Power Source
- 1 – Breadboard
- 1 – set of test leads

Required Tools"

- 1 – Pair of strippers

Materials:

- 8 – 1N4004 Diodes
- 1 – Texas Instrument IC 74LS08 AND Gate (Dual Input Quad IC)
- 1 – Texas Instrument IC 74LS32 Or Gate (Dual Input Quad IC)
- 1 – Various Resistors including 100-ohm, 1K ohm, 10K ohm, 2.2K ohm, 220 ohm, 22K ohm and 4.7K resistors.
- Several 2N3904 NPN, 2N2222, BC547 (at least one each)
- Various NPN and PNP Transistors. (at least one each)

Safety (PPE):

- Safety glasses/goggles

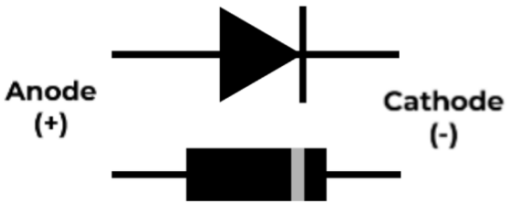
Resources: N/A

Required Time: 240 Minutes

Shop Maintenance:

- All work will cease 20 minutes prior to the end of class.
- All work areas must be cleaned.
- Tools and equipment must be cleaned and returned to the designated areas (cage, tool room, cabinets)
- Any broken or missing tools must be reported immediately.
- Tools and equipment are students' responsibility.

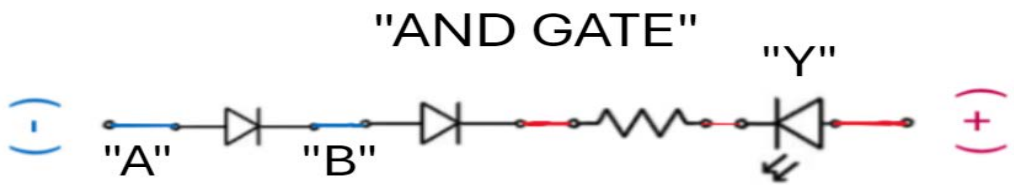
Instructor notes:



Procedures: *(Eye protection must always be worn, and power must be turned off till testing)* DIODE

LOGIC GATES:

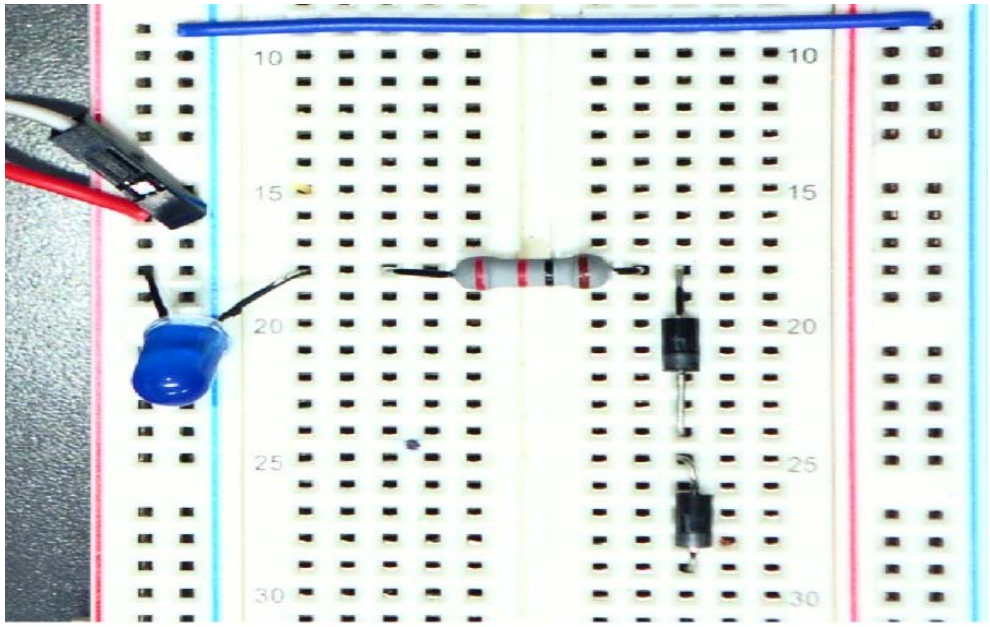
Exercise 2.1: Construct a diode "AND" gate circuit on the breadboard per the schematic below. Test. Use diode 1N4004 or equivalent.
Colors on the schematic match the colors below on the breadboard.



Complete the Truth Table for an AND gate: Solve for "Y"

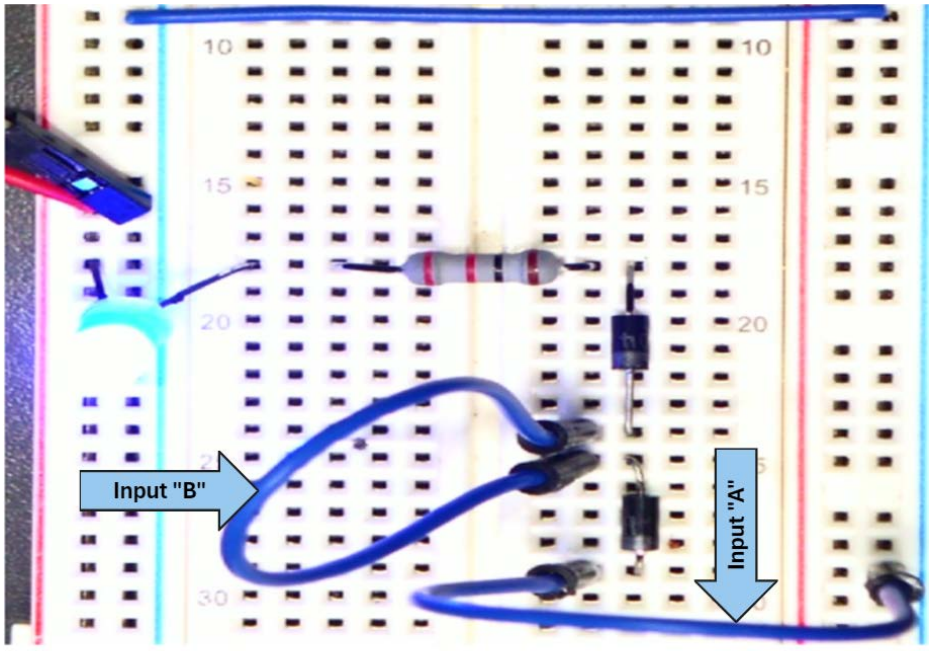
TRUTH TABLE

INPUTS		OUTPUT
A	B	Y
0	0	
0	1	
1	0	
1	1	



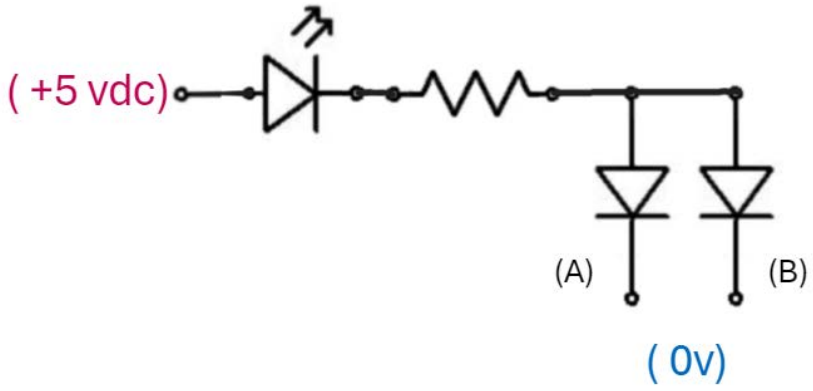
"AND GATE"

When both INPUTS are True the OUTPUT (LED) is TRUE (ON)

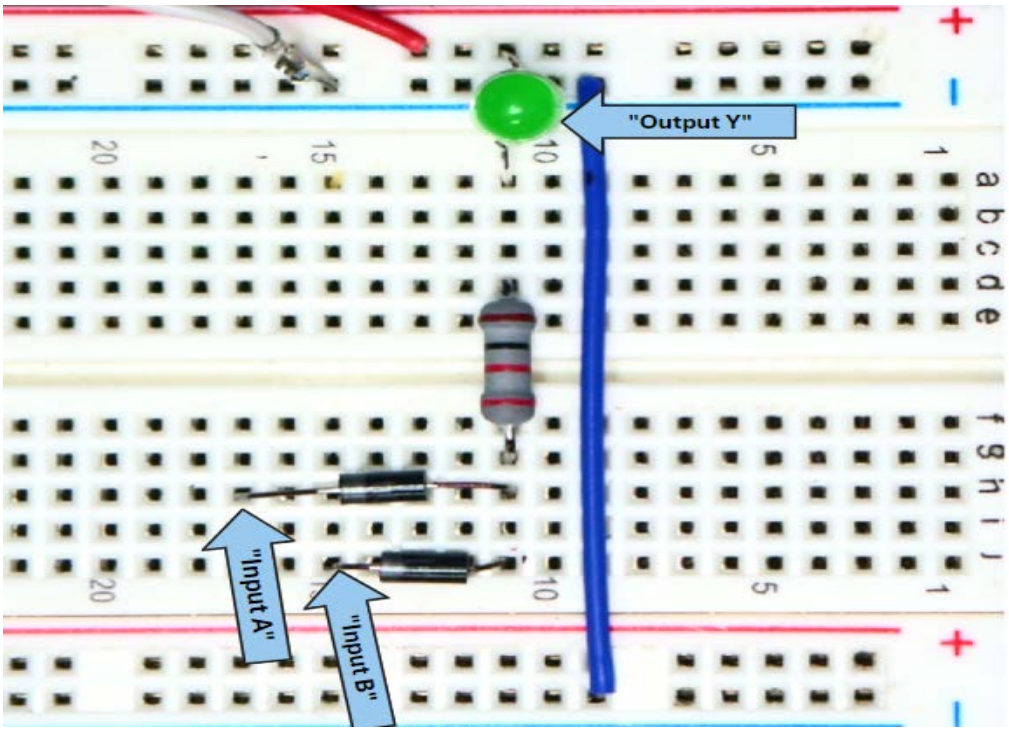


"AND GATE TRUE"

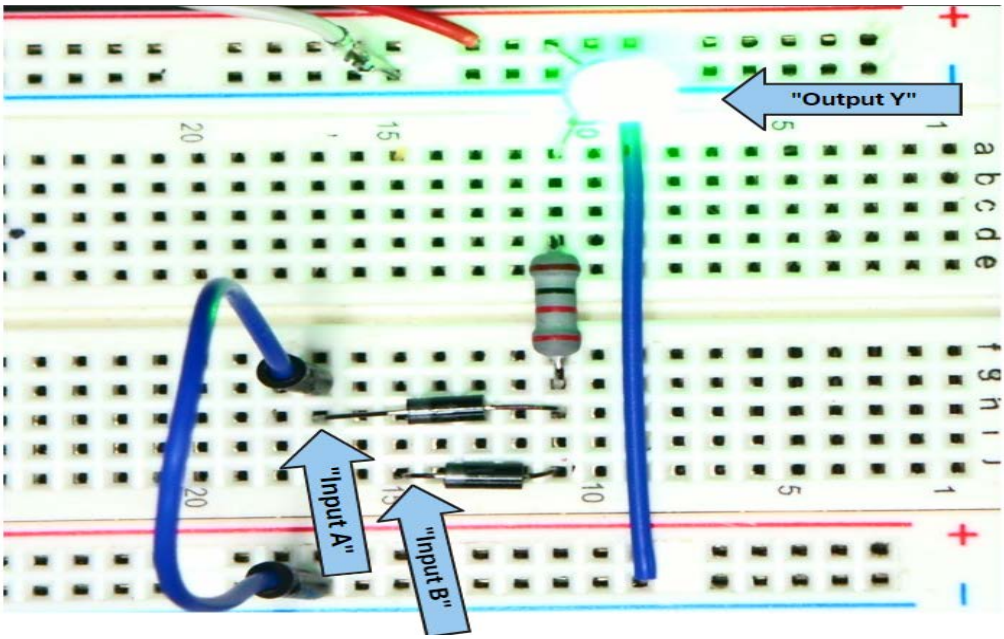
Exercise 2. 2: Construct a diode "OR" gate" circuit on the breadboard per schematic. Test. Use Diodes 1N4004 or equivalent.



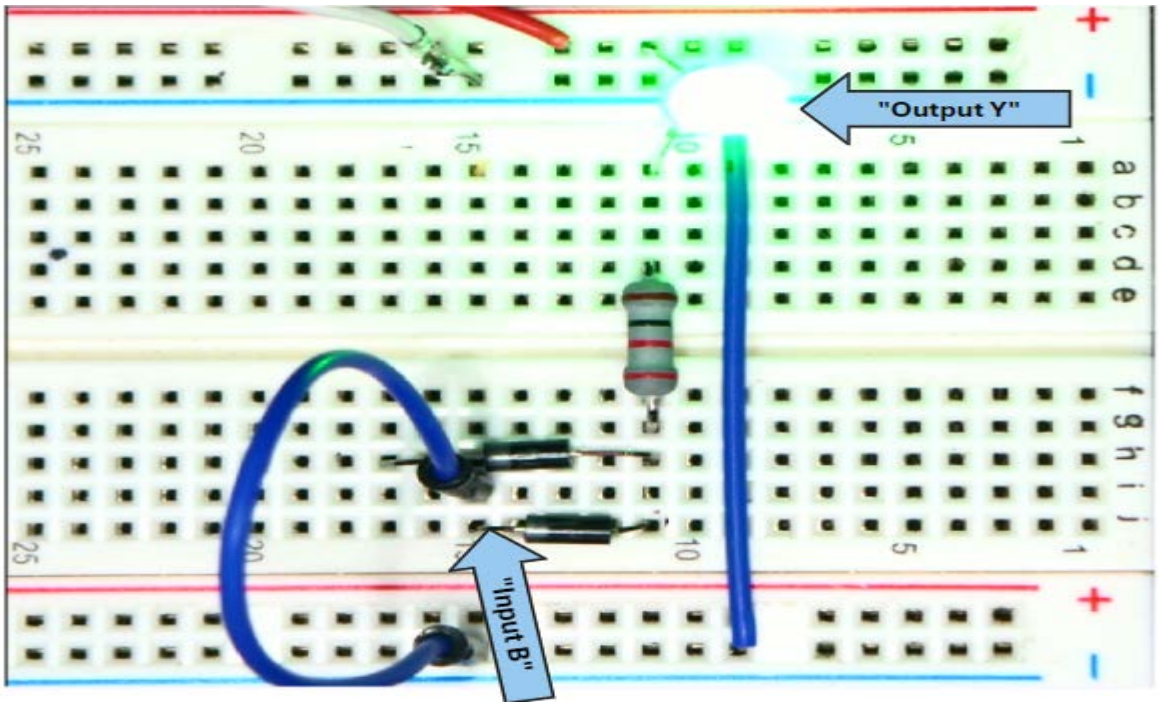
(Below - Diode “OR GATE” layout on breadboard)



(“OR” gate Below – OUTPUT “Y” is True when either Input is True)



(“OR” gate Below – OUTPUT “Y” is True when either Input is True)



Complete the Truth Table for the “OR” gate. Solve for “Y”

TRUTH TABLE

INPUTS		OUTPUT
A	B	Y
0	0	
0	1	
1	0	
1	1	

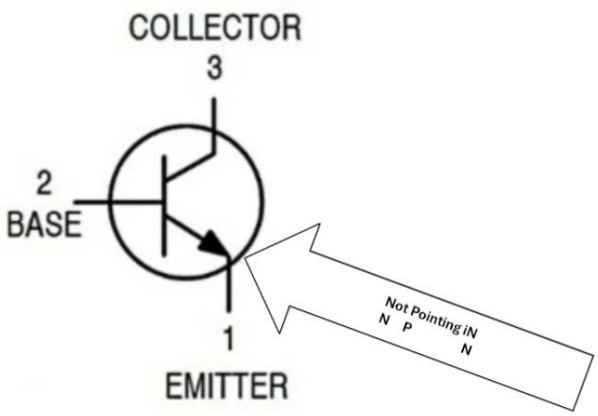
Transistor Exercises

“AND” gate using transistors.

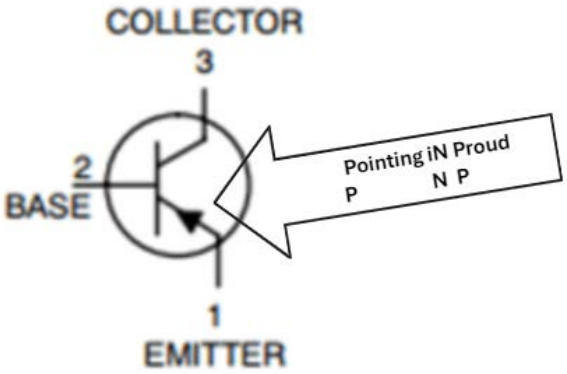
Exercise 2.3:

Instructor resources: NPN and PNP explained.

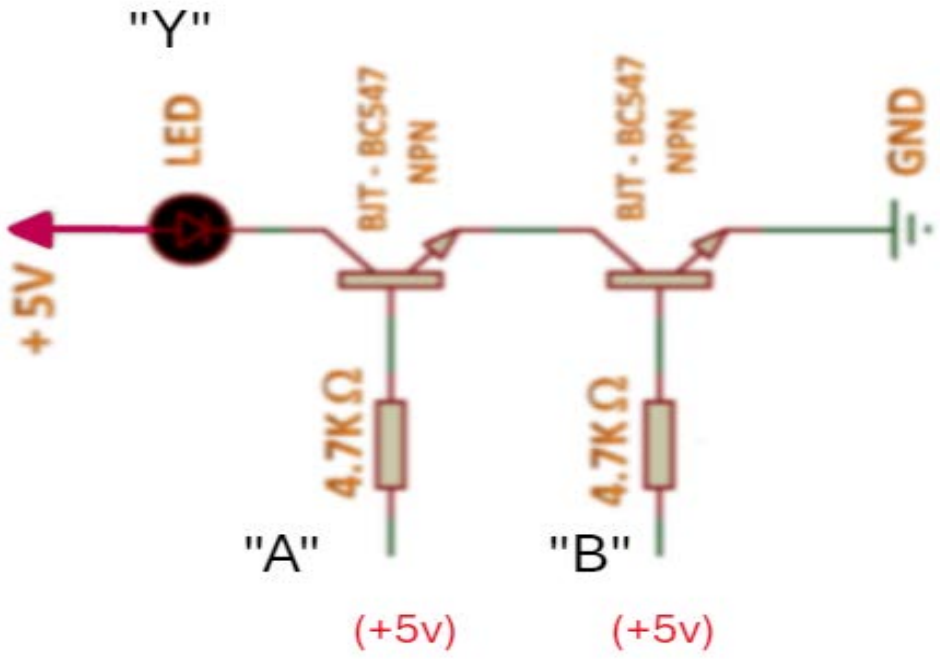
NPN: The arrow is Not Pointing iN

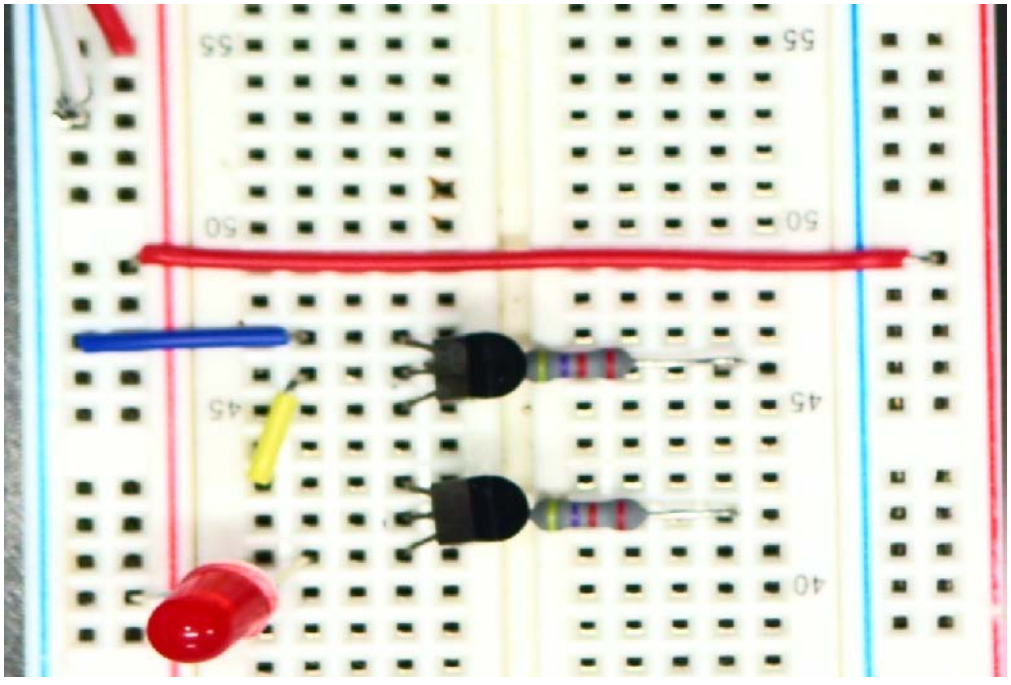


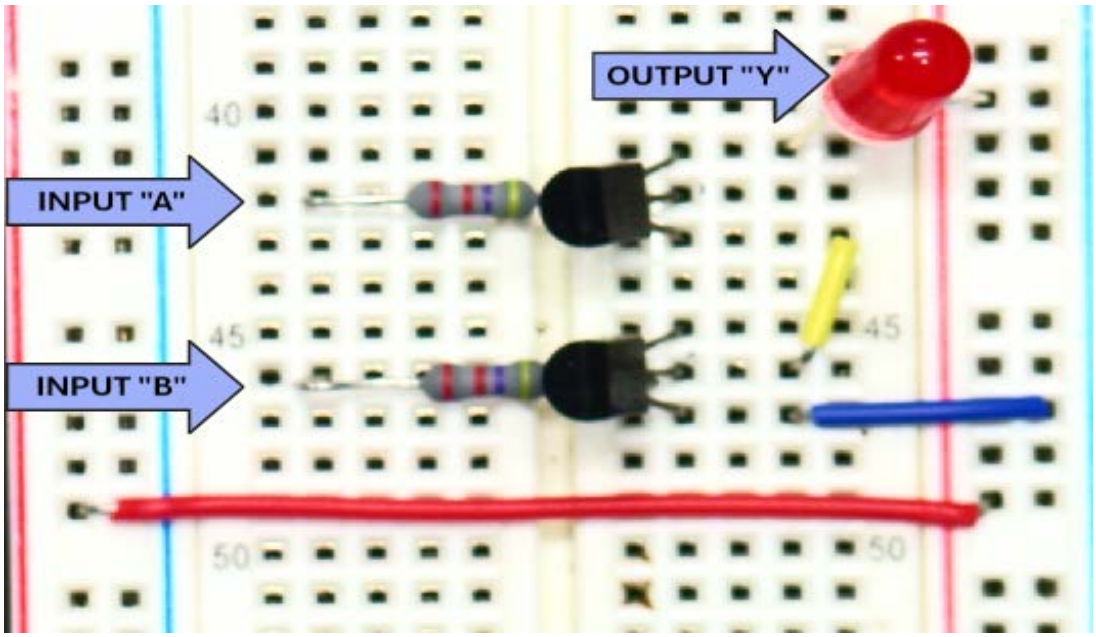
PNP: The arrow is Pointing iN Proudly



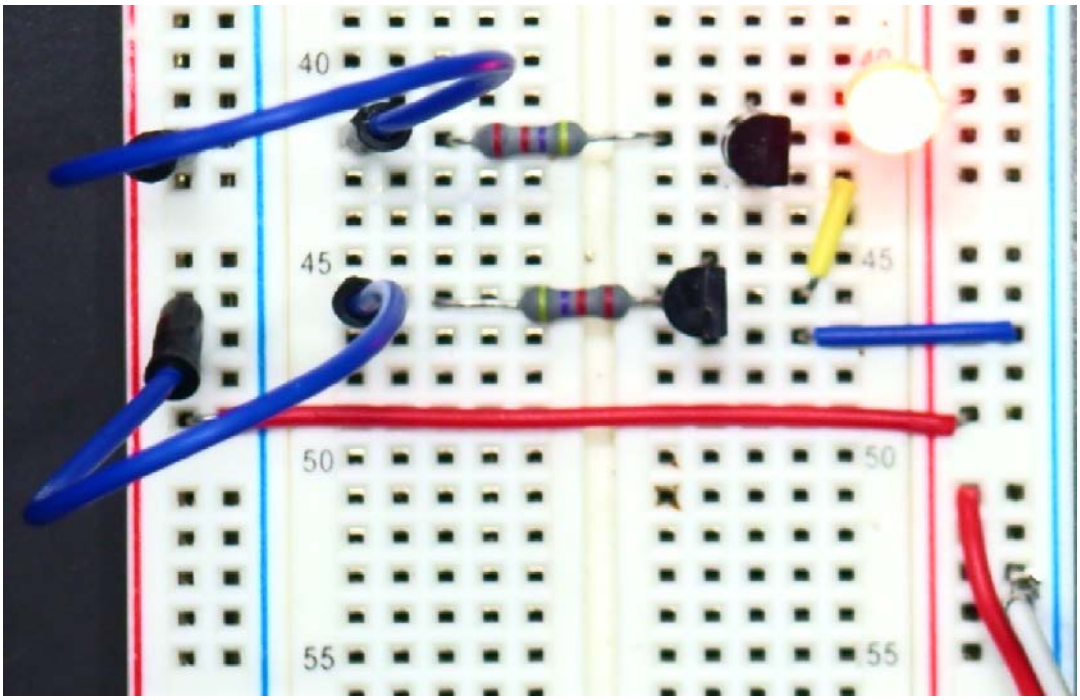
Exercise 2.4: Create and test and "AND" gate using any two of the following NPN Transistors (2N3904 NPN, 2N2222, BC547) using the schematic below. Test.







(When both Inputs are TRUE the Output is TRUE, and the LED is ON)

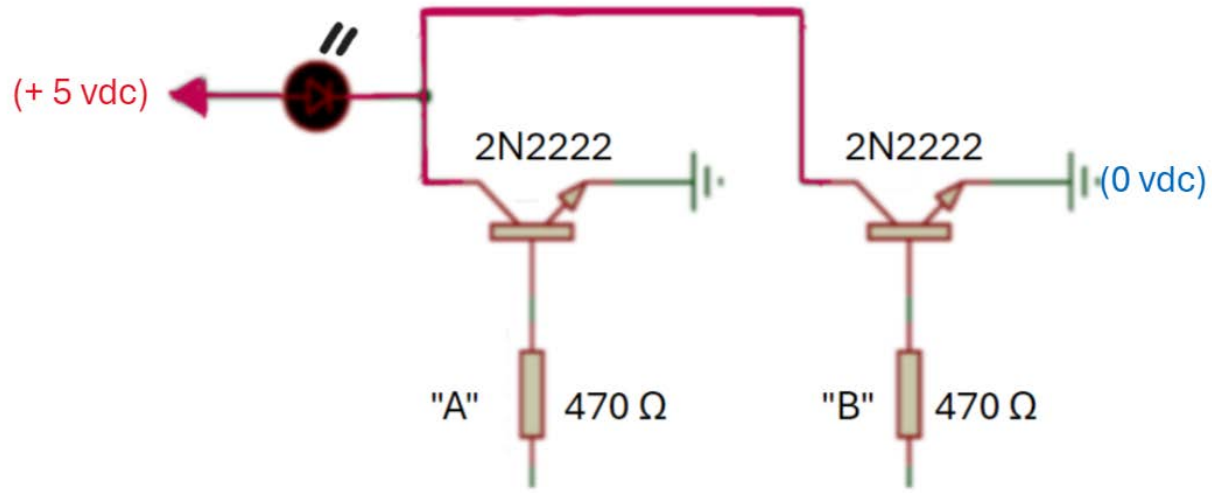


Complete the Truth Table for the "AND" gate. Solve for "Y"

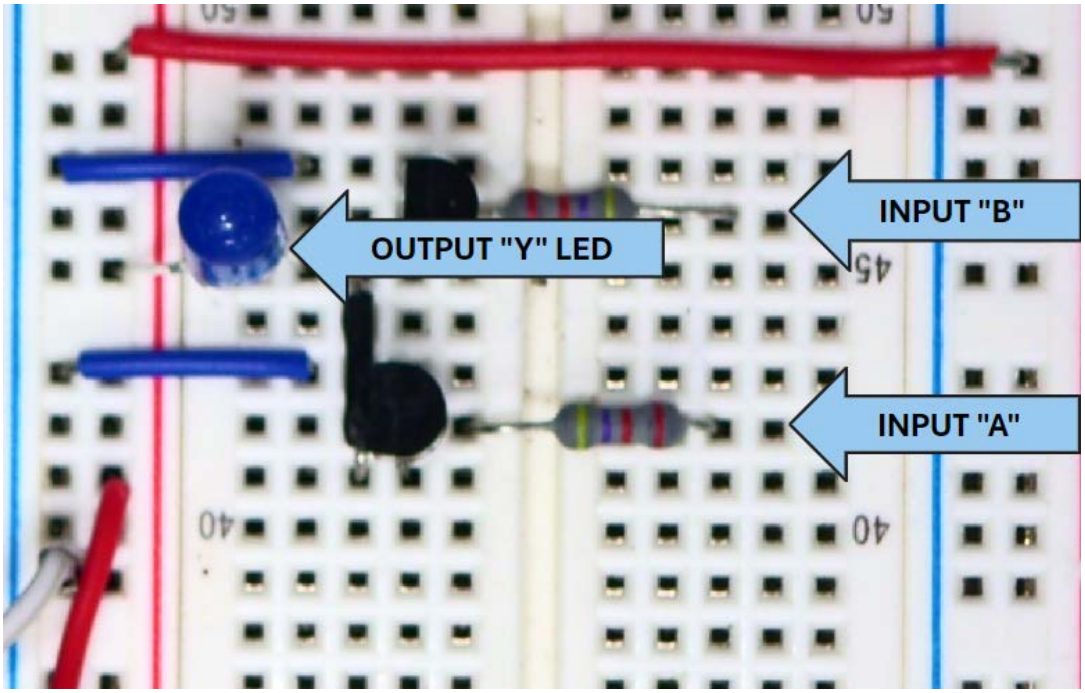
TRUTH TABLE

INPUTS		OUTPUT
A	B	Y
0	0	
0	1	
1	0	
1	1	

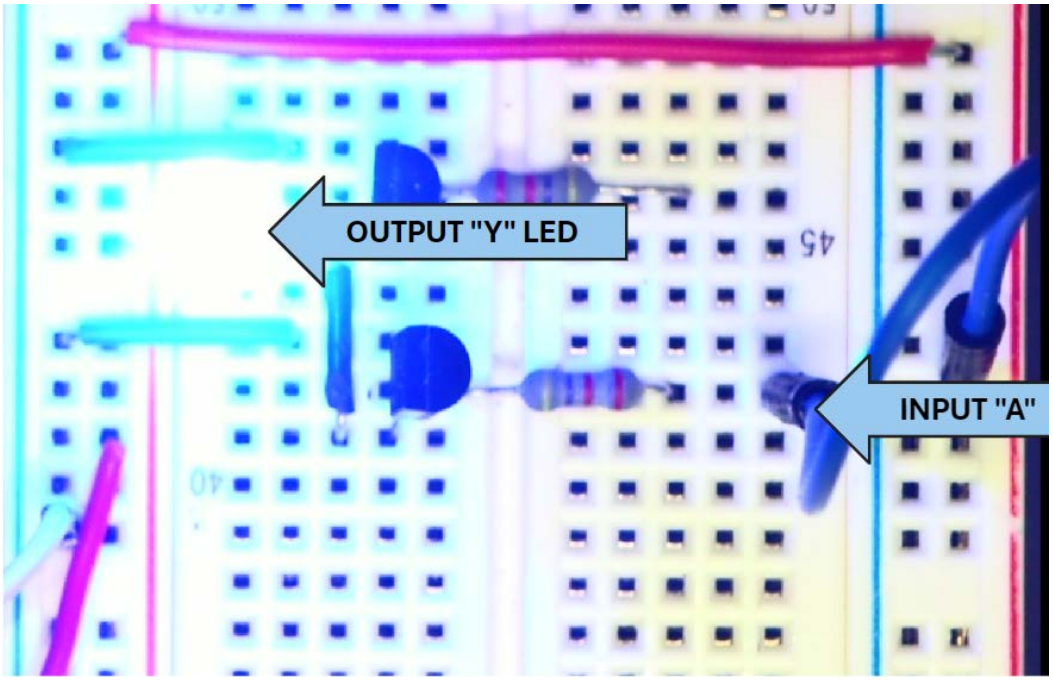
Exercise 2.5: Create and test and "OR GATE" using two NPN Transistors (2N3904 NPN, 2N2222 or BC547) using the schematic below. Test.



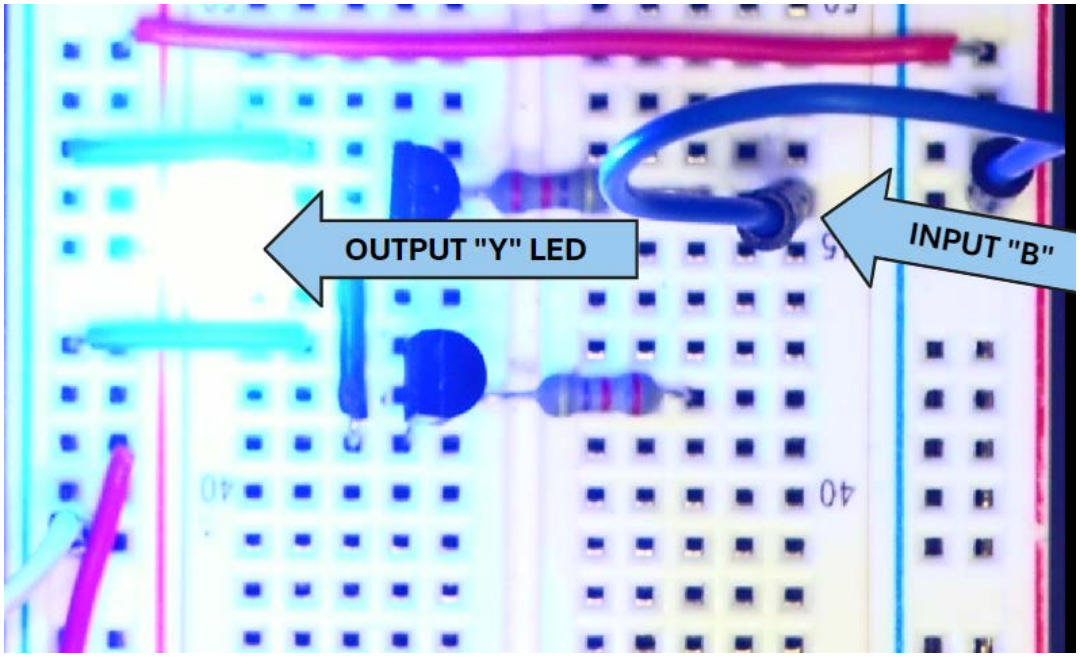
(“OR GATE” layout on Breadboard)



(OUTPUT “Y” is True when either INPUT is True)



(OUTPUT “Y” is True when either INPUT is True)



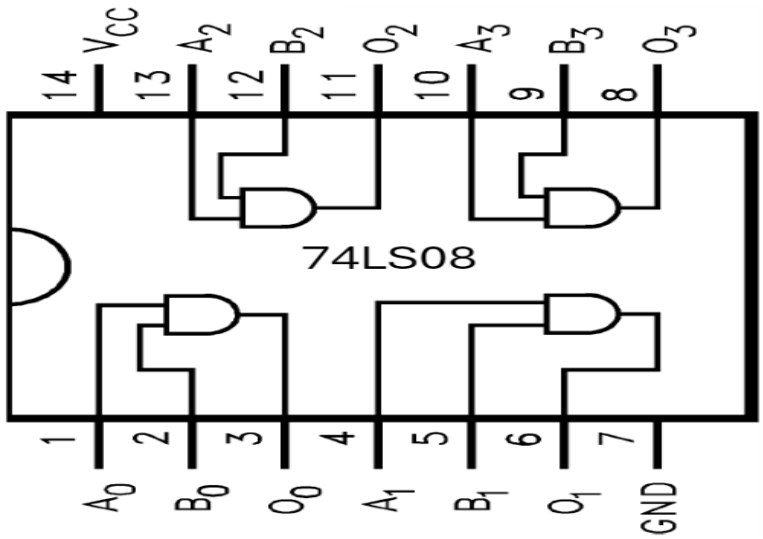
(Solve the Truth Table for Y using OR GATE Logic)

TRUTH TABLE

INPUTS		OUTPUT
A	B	Y
0	0	
0	1	
1	0	
1	1	

IC CHIP EXERCISES

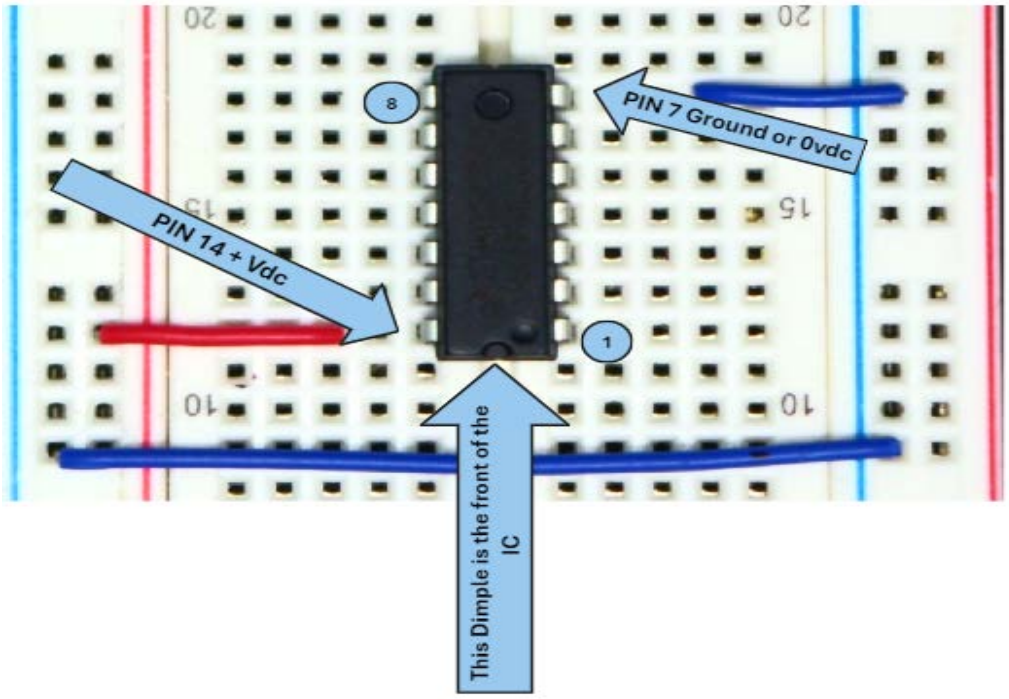
Exercise 2.6: Create and TEST an "AND GATE" IC CHIP Circuit.



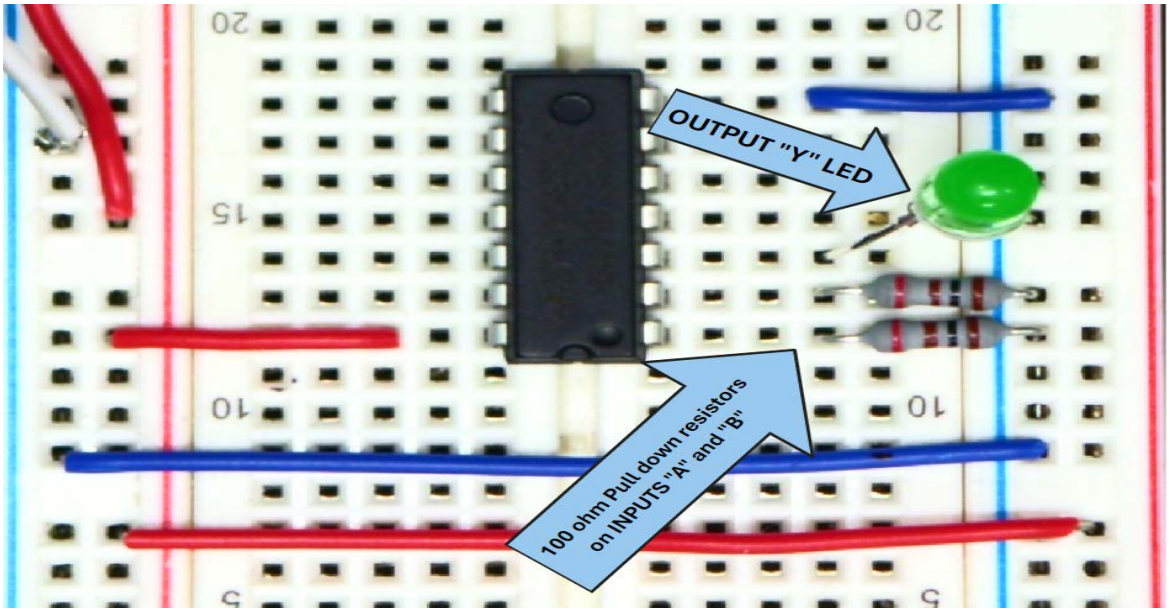
****Instructor NOTE: Since the 74LS08 are essentially TTL IC Chips the outputs are high floating (means they are at binary 1 without any input) we need to put "PULL DOWN" resistors on the INPUT to GND. See pics.**

Install the IC 74LS08 chip on the board per picture.

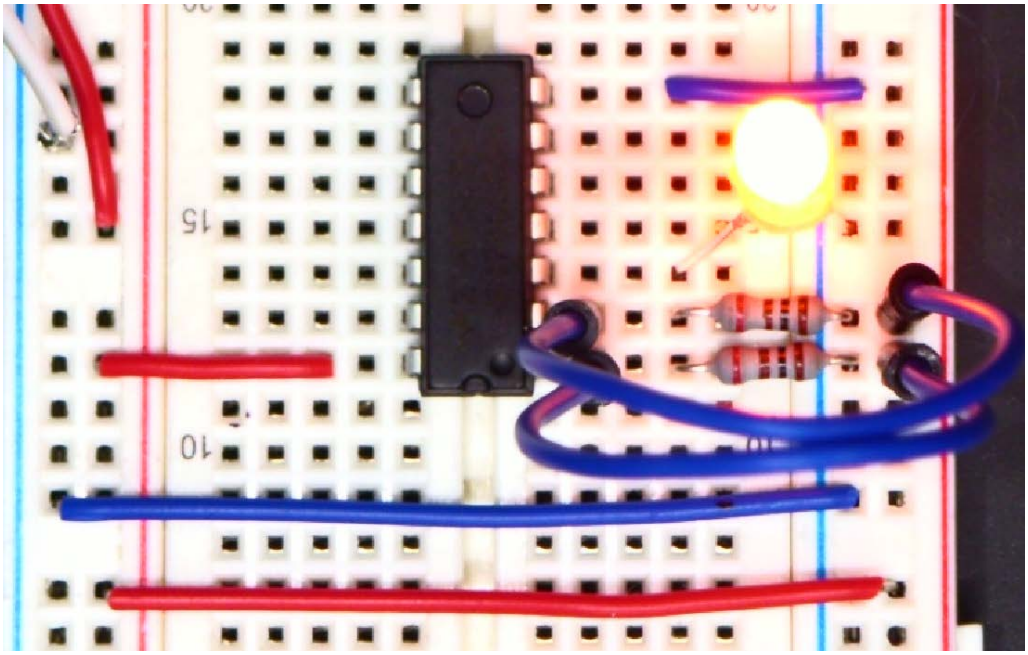
Vcc pin 14 is the + 5vdc power to the IC (See red wire on board). Pin 7 is the 0v pin (see blue wire from chip to 0v).



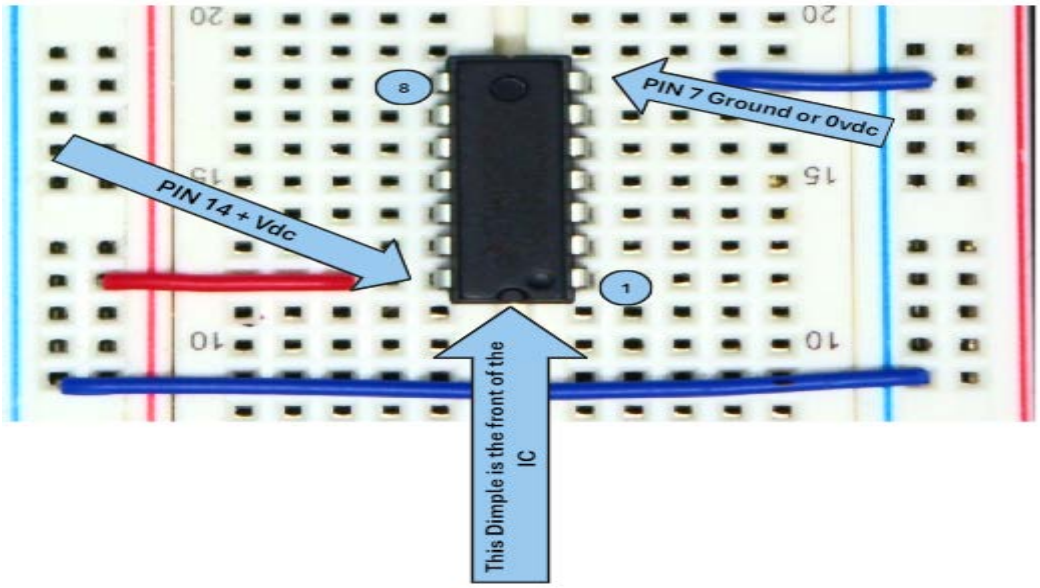
Install 100ohm Pulldown Resistors on INPUTS “A” and “B”. The LED is the OUTPUT “Y”.



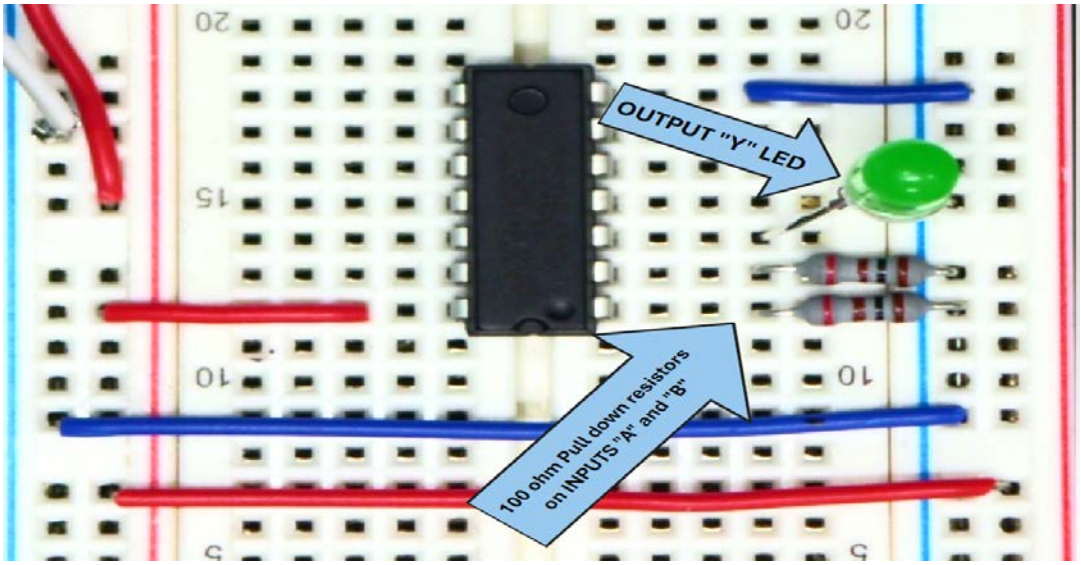
Test “AND GATE”. Connect a jumper from Pin 1 and Pin2 to +5vdc. Led will light ONLY when both INPUTS are connected.



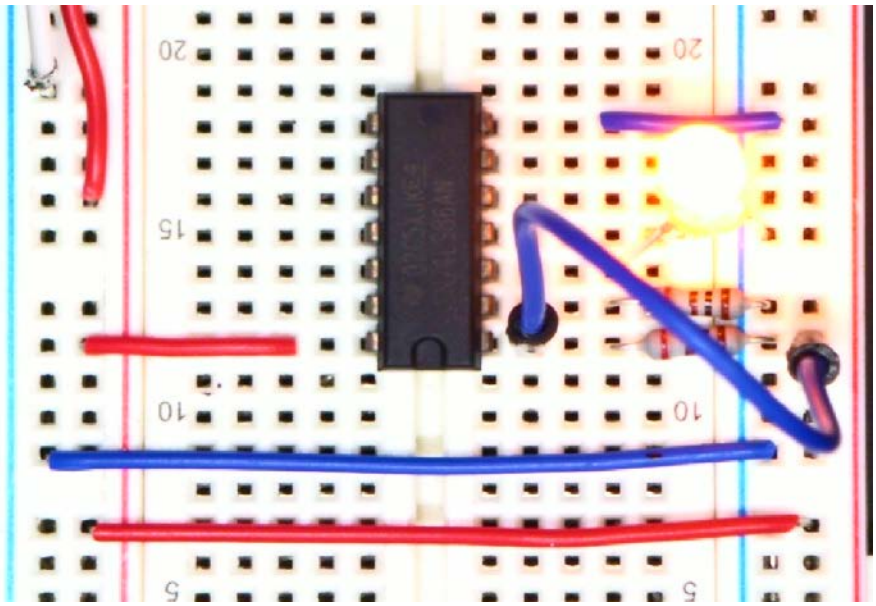
Exercise 2.7: Create and TEST an “OR GATE” IC CHIP Circuit. Use 74LS32.



Install 100ohm Pulldown Resistors on INPUTS “A” and “B”. The LED is the OUTPUT “Y”.



When "A" INPUT is connected +5vdc the LED is "TRUE" (On).



When "B" INPUT is connected +5vdc the LED is "TRUE" (On).