Lab2

September 21, 2020 2:33 PM

Objective

To Investigate active high /active low I/O connections to digital logic circuits
To Investigate t e transformational nature of logic functions
To Introduce components used as input or output devices in digital circuits
To reinforce the use of test and measurement equipment
To Provide more experience in prototyping circuits using a breadboard

Prelab Notes

Might be a good idea to plug every aldm cable to the test header. For organization's sake.

For figure 1, we use active low. Meaning when switch is on, output is red/off. When off, the output is red/on

RAMS

This lab will include working with electrical circuits. As such, we should avoid leaving food and drink among lab equipment.

When making adjustments to our board, we should turn off the protoboard - stop the voltage source. This is to avoid electric shock.

We should avoid clutter, which might cause slips/trips/falls. This will ensure safety during the lab

Pre-Work Plan

This lab is being done individually, so all roles/responsibilities fall to the individual.

Equipment used:

- **Analog Devices ADALM2000 • Solder-less Breadboard wit power supply and wiring kit • 74HC00 and 74HC04 Integrated Circuits**

To start, we followed the procedure to configure our test headers. ADALM and SCOPY are setup.

We then made the circuit associating to figure 1. This included steps a-k

Next, we started SCOPY, to observe the voltage at pin 1 and pin 2. My observations were that our logic gate produced a logical 1 when output was low, and a logical 0 when output was high. In other words, our output was ~3.3v when input was low.

Results for part 2 can be found in *work results*

Next, we build the circuit in figure 2. To do this, we followed the steps outlined in part 3.

Work Result

1

ADLM and SCOPY are setup for this lab

2

We build figure 1 on the breadboard, and use SCOPY to measure the voltage on pin 1/2 of the gate.
When the switch is open, a low input is passed through the gate. This this is a not gate, the output is high
When the switch is closed, a high input is passed through the gate. This is a not gate, so the output is low.

Closed switch

Vin (pin 1)	Vo (pin 2)
-0.135vdc	2.950vdc

Green LED is on

Open switch

Vin (pin 1)	Vo (pin 2)
1.594vdc	0.974vdc

Red LED is on

When a high output is given, our green LED will light up. When the output given is low, our red LED will light up.

Note, the switch is configured to provide an active low input

We need a 10k ohm resistor, so our voltage is not straight to ground. This is a current limiter

3

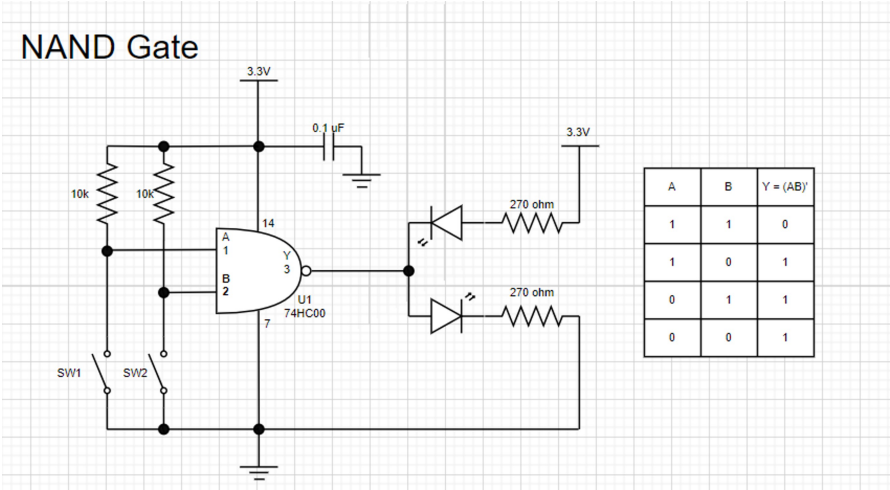
This is a nand gate.
As such, we expect logical inputs of 0, in order to get a logical output of 1. Therefore, the LED will always be green unless both switches are open. If both switches are closed, we will have low input a and low input b, resulting in a high input, which triggers the green LED. Furthermore, if one switch is closed, we will still have a green LED. This occurs as our NAND gate requires two low inputs to output a high voltage - or logical 1. So, to trigger a red LED, both switches must be open - sending high input into AB. Doing this, our output will be low - which allows the red LED to light up

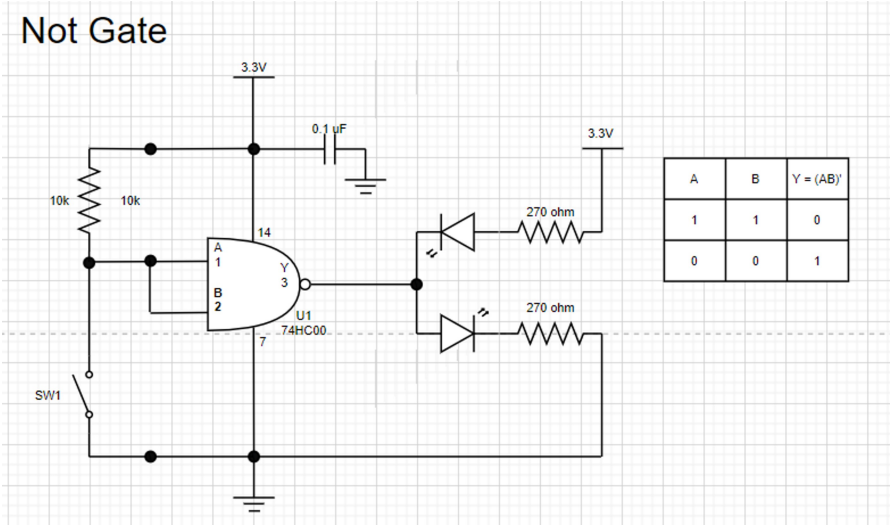
A	B	Y = (AB)'

1	1	0
1	0	1
0	1	1
0	0	1

Why is the NAND function referred to as a “universal” function?

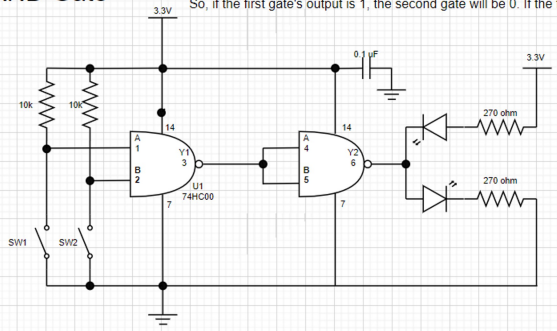
NAND and NOR are called universal gates because all the other gates like and,or,not,xor and xnor can be derived from it.





AND Gate

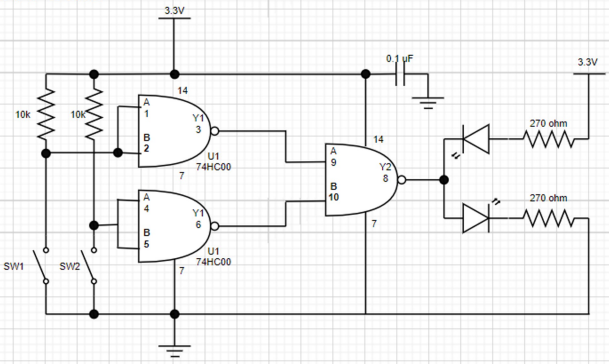
This essentially inverts anything given to the final AND gate, making the entire system essentially an AND circuit
So, if the first gate's output is 1, the second gate will be 0. If the first gate's output is 0, the second gate will be 1



A	B	Y1 = (AB)'	Y2 = Y1'
0	0	1	0
0	1	1	0
1	0	1	0
1	1	0	1

OR Gate

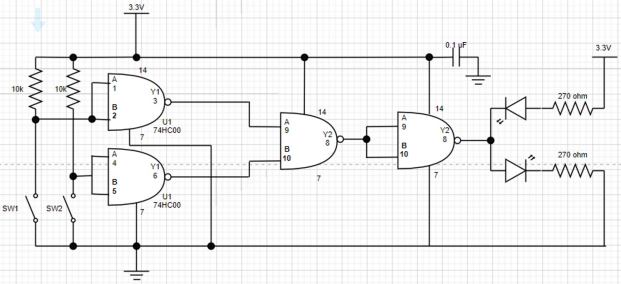
Text



A	B	Y1 = (AB)'	Y2 = Y1'
0	0	1	0
0	1	1	0
1	0	1	0
1	1	0	1

NOR Gate

Text



A	B	Y1 = (AA)'	Y2 = (BB)'	Y3 = (Y1Y2)'	Y4 = (Y3)'
0	0	1	1	0	1
0	1	1	0	1	0
1	0	0	1	1	0
1	1	0	0	1	0