Lab 2 - 2/14/22

NAND & XOR Gates

EGT 245 - Digital Electronics

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Introduction

The purposes of this experiment are as follows: allow students to build a physical circuit using multiple different components, build familiarity with lab equipment and the mentioned components, and utilize the learned formulae to compute theoretical circuit values, then test those values against real-world models.

Required Equipment & Components

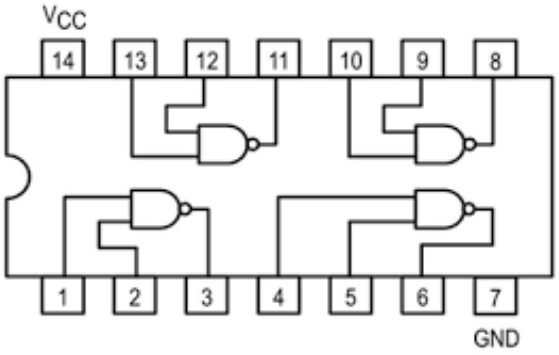
- 74HC00 (4 Channel NAND Gate IC)
- 74HC86 (4 Channel XOR Gate IC)
- Breadboard with Jumper Wires
- SPST Switch (x2)
- 5V Power Supply

Theory

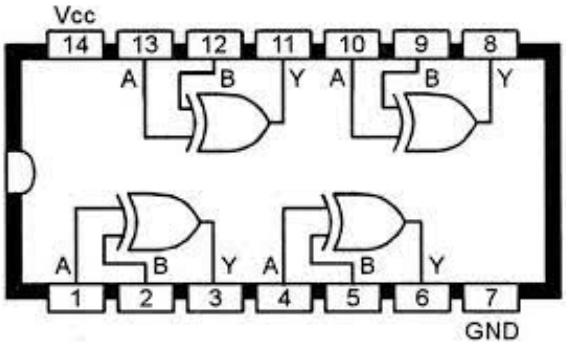
Each utilized IC contains four, independent, dual input, gates. The 74HC00 contains NAND gates and the 74HC86 contains XOR gates. Each channel has two inputs. In the case of the HC00, **both inputs must be *high* to create a *low* output** ($A * B = \overline{C}$). For the HC86, **only one input can be *high* to create a *high* output** ($A\overline{B} + \overline{A}B = C$). In this demonstration, a single gate from each IC would be connected to two switches, one per input. The switches were toggled based on the sequences found in the truth tables below. The output LED was illuminated if the correct logic was applied.

Component Layout

74HC00



74HC86



Experimental Results

74HC00 NAND Gate		
Switch S1	**Switch S2**	**Output (LED)**
0	0	1
0	1	1
1	0	1
1	1	0

74HC86 XOR Gate		
Switch S1	**Switch S2**	**Output (LED)**
0	0	0
0	1	1
1	0	1
1	1	0

Conclusion

Through the use of NAND and XOR gate Integrated Circuit (IC) chips, we were able to learn more about their applications. These applications would be seen in the form of logic gate-based LED circuits. Once the current passed through the logic gates and returned their value the LED would light up depending on that said output. The NAND gates were straightforward since it'a a NOT of an AND output. This means if the output of an AND gate with the given inputs is zero then it flips it to a one allowing the current to pass to the LED. These inputs were applied through switches which either sent the current through the circuit or not. The XOR gates were also straightforward since if the inputs were on opposite levels (0,1) then current in the circuit would return true and light up the LED. Overall, we believe that this lab was a great way to introduce NAND and XOR logic-based circuits using IC chips.