

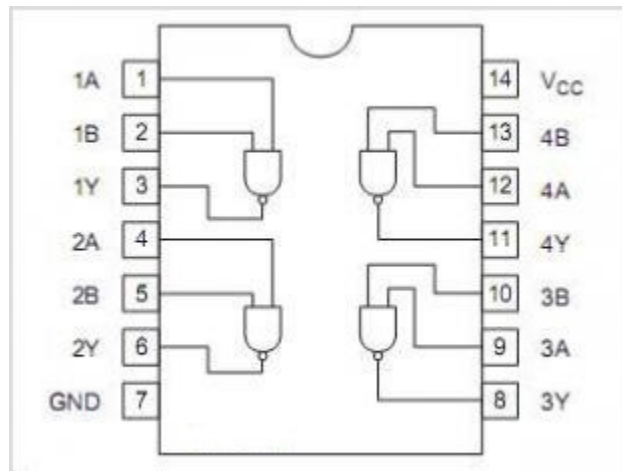
1 Pre-Lab Work

Using Logisim, create the following logical circuits, and bring the diagrams to lab with you. Use the poke tool or the table from the Analyze Circuit option to verify that the circuit has the correct output.

1. Using just NAND gates, create a circuit that simulates a NOT gate.
2. Using just NAND gates, create a circuit that simulates an AND gate.
3. Using just NAND gates, create a circuit that simulates an OR gate. Hint: DeMorgan's laws may come in handy to figure this out. Recall that DeMorgan's laws, in our logical notation, are $(A + B)' = A'B'$ and $(AB)' = A' + B'$. DeMorgan's laws can change AND gates to OR gates and OR gates to AND gates as long as you have a negation (NOT gate) but you know how to construct a NOT gates using NAND gates. Also remember that $(A')' = A$, so start with $A + B = ((A + B)')'$ and see where it goes.
4. Using just NAND gates, create a circuit that simulates an XOR gate. Hint: There are several standard ways to do this. Recall from the last lab that we had a circuit using AND, OR, and NOT gates that simulated an XOR. So substituting your answers for the last three questions into this circuit will clearly work. Another approach is to consider the logical expression, $\overline{\overline{A}B} \overline{\overline{A}B}$, I am using the bar notation for NOT to make it more readable. Simplify this expression and think about how the original expression translates to NAND gates.

2 NAND Gates — HD74LS00P

NAND Gates — HD74LS00P: These devices contain four independent 2-input NAND Gates, they perform the Boolean function, $Y = \overline{AB} = \overline{A} + \overline{B}$, in positive logic.



3 Exercises

1. Using the NAND gate chip, HD74LS00P, test that all four of the NAND gates on the chip are functioning correctly. That is, the output of the gates all correspond to the truth table for the NAND Gate.
2. Using your design for the NOT gate, create the circuit with the HD74LS00P chip and test it. Once you have the circuit finished and tested, let me see the circuit and you will then verify its functionality for me. Do not move on to the next circuit until I check this one.
3. Using your design for the AND gate, create the circuit with the HD74LS00P chip and test it. Once you have the circuit finished and tested, let me see the circuit and you will then verify its functionality for me. Do not move on to the next circuit until I check this one.
4. Using your design for the OR gate, create the circuit with the HD74LS00P chip and test it. Once you have the circuit finished and tested, let me see the circuit and you will then verify its functionality for me.
5. Using your design for the XOR gate, create the circuit with the HD74LS00P chip and test it. Once you have the circuit finished and tested, let me see the circuit and you will then verify its functionality for me.

Hand in your diagrams from your pre-lab work, one copy per group is fine.