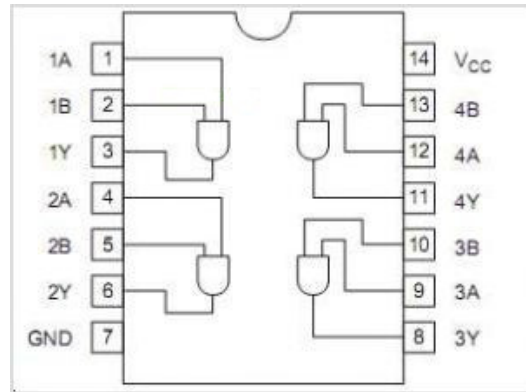
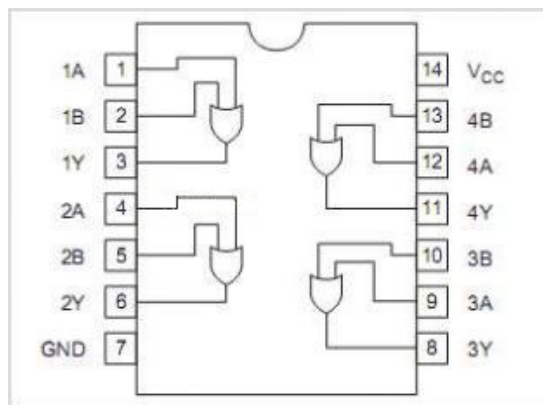


# 1 AND, OR, and NOT Gates

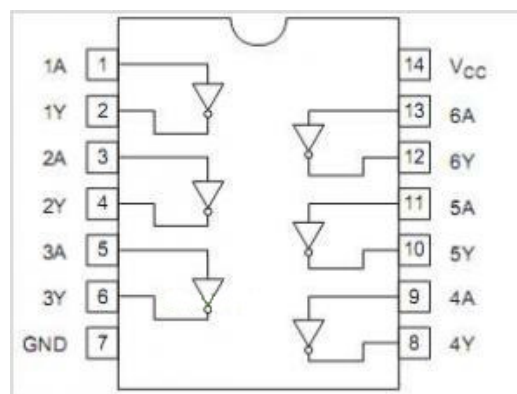
**AND Gates — HD74LS08P** These devices contain four independent 2-input AND Gates, they perform the Boolean functions in positive Logic;  $Y = AB$ .



**OR Gates — HD74LS32P** These devices contain four independent 2-input OR Gates, they perform the Boolean functions in positive Logic;  $Y = A + B$ .

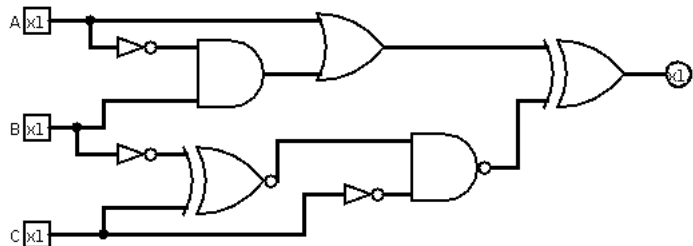


**NOT Gates — HD74LS04P** These devices contain four independent 1-input NOT Gates, they perform the Boolean functions in positive Logic;  $Y = \overline{A}$ .



## 2 Exercises

1. Build the following circuit in Logisim.

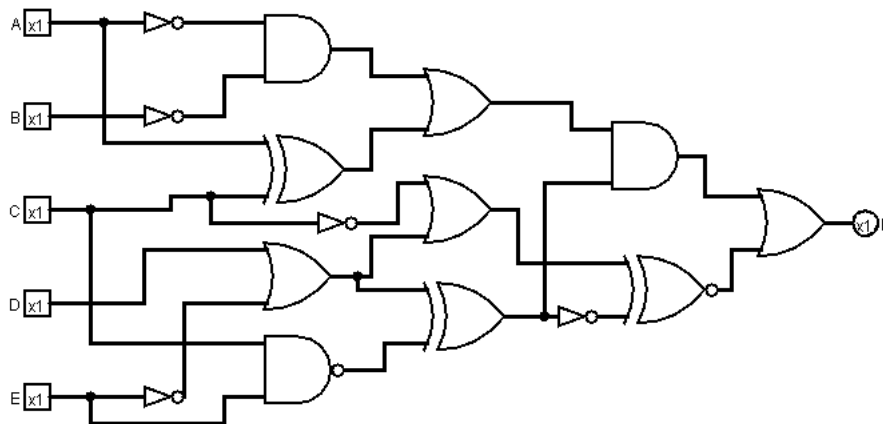


- (a) Write the truth table for the circuit. Recall that Logisim has this built in, select Project > Analyze Circuit, then click on the table tab.
- (b) Convert the truth table into a canonical SOP logical expression. Show all work.
- (c) Using a K-map, minimize the logical expression. Show all work.
- (d) Using the Quine-McCluskey procedure, minimize the logical expression. Show all work.
- (e) Draw out the resulting circuit from either the K-map or Quine-McCluskey procedure. If they are different, you may use the easier one, as long as it is correct.
- (f) Build the minimized circuit in Logisim and use the truth table of the minimized circuit to verify that it produces the same output as the original circuit.
- (g) Using the AND, OR, and NOT gate chips, build the minimized circuit on the proto-board.
- (h) Test the circuit completely. When it is working, let me see the circuit and you will then verify its functionality for me.

### Hand In:

- (a) The truth table for the circuit.
- (b) The canonical SOP logical expression for the original circuit. Show all work.
- (c) The K-map, your minimizing procedure, and the simplified expression. Show all work.
- (d) The Quine-McCluskey procedure you did to minimize the logical expression, and the simplified expression. Show all work.
- (e) A drawing of the resulting minimized circuit.

2. Build the following circuit in Logisim.



- Write the truth table for the circuit.
- Convert the truth table into a canonical SOP logical expression. Show all work.
- Using the Quine-McCluskey procedure, minimize the logical expression. Show all work.
- Draw out the resulting circuit from the Quine-McCluskey procedure.
- Build the minimized circuit in Logisim and use the truth table of the minimized circuit to verify that it produces the same output as the original circuit.
- Using the AND, OR, and NOT gate chips, build the minimized circuit on the proto-board. As above, each logic switch can have only one wire coming out.
- Test the circuit completely. When it is working, let me see the circuit and you will then verify its functionality for me.

### Hand In:

- The truth table for the circuit.
- The canonical SOP logical expression for the original circuit. Show all work.
- The Quine-McCluskey procedure you did to minimize the logical expression, and the simplified expression. Show all work.
- A drawing of the resulting minimized circuit.