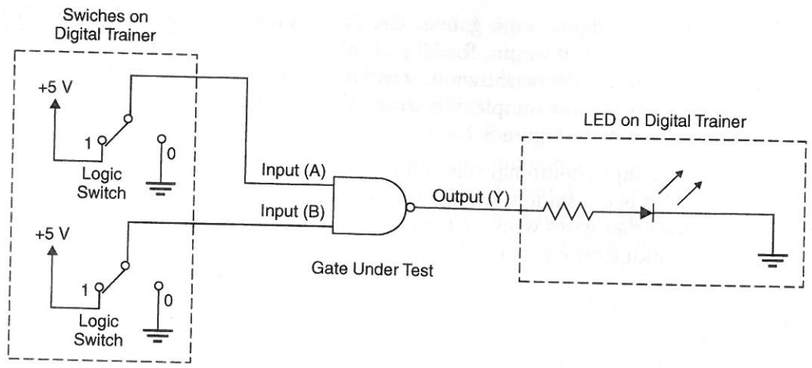

Figure 3.4 Testing a Gate in a DIP IC (with a Digital Trainer)

4. Take the truth table of the gate by changing inputs *A* and *B* to make all possible combinations of input (*AB* = 00, 01, 10, 11) and writing down whether the LED at output 3 indicates logic 1 (ON) or logic 0 (OFF) for each input combination. Fill in Table 3.2 with your results.

5. Move the logic input connections to pins 4 and 5 and the lamp to pin 6 and repeat Step 4. Also repeat with:

   logic switches at pins 9 and 10 and lamp at pin 8, and;

   logic switches at pins 12 and 13 and lamp at pin 11.

6. Repeat the above steps with the other gates listed in the parts list. (Note that the 74LS02/74HC02 and 74LS04/74HC04 gates require different connections than the rest of the gates. Consult Figure 3.2 for details.) Make a truth table for one gate in each IC. See Tables 3.3 through 3.7.

Table 3.2 NAND Truth Table

A	*B*	*Y*
0	0	
0	1	
1	0	
1	1	

Table 3.3 AND Truth Table

A	*B*	*Y*
0	0	
0	1	
1	0	
1	1	

Table 3.4 NOR Truth Table

A	*B*	*Y*
0	0	
0	1	
1	0	
1	1	

Table 3.5 OR Truth Table

A	*B*	*Y*
0	0	
0	1	
1	0	
1	1	

Table 3.6 Inverter Truth Table

A	*B*
0	
1	

Table 3.7 XOR Truth Table

A	*B*	*Y*
0	0	
0	1	
1	0	
1	1	

Instructor's Initials _____

Lab 4

Expanding Logic Gates

Name _____ Class _____ Date _____

Objectives Upon completion of this laboratory exercise, you should be able to:

- Configure a NAND or NOR gate to act as an inverter.
- Expand an AND, OR, NAND, or NOR gate from a 2-input to a 3-input gate.
- Draw a logic diagram that conforms to standard digital design practice.
- Obtain the truth tables of each gate to be tested.

Reference Ken Reid and Robert Dueck, *Introduction to Digital Electronics*
Chapter 2: Logic Functions and Gates

Equipment Required Digital trainer
Wire strippers
#22 solid-core wire, as required
Components as follows:

Part No.	Qty.	Description
74LS00 or 74HC00	1	Quad 2-input NAND gate
74LS02 or 74HC02	1	Quad 2-input NOR gate
74LS32 or 74HC32	1	Quad 2-input OR gate

Experimental Notes

When using more than one logic gate in a circuit, it is a good practice to draw a **logic diagram,** such as the one shown in Figure 4.1. Such a diagram simplifies the process of troubleshooting and allows for neat documentation of the circuit.

Figure 4.1 shows several characteristics of a good logic diagram. A logic diagram shows all connections between logic elements (the two AND gates), but may omit symbols for input devices, such as logic switches; output devices, such as LEDs; or power and ground connections of the chip.

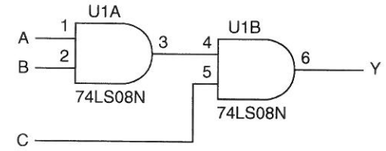

Figure 4.1 Logic Diagram Showing Two Gates from the Same Chip