Lab #4 Name: _____ Per: _____

Title: NAND AND NOR GATES

Materials:

[1] 7400 2-input NAND gate IC
[1] 7404 inverter
[1] 7432 2-input OR gate IC
[1] 7402 2-input NOR gate IC
[1] 7408 2-input AND gate IC

Procedure:

1. Insert a 7400 IC into the breadboard.
2. Connect power (+ and gnd) to the 7400.
3. Wire the 2-input NAND gate using Fig. 3-9 and your pinout diagrams.
4. Move the input switches A and B to the combinations shown in the left side of Table 3-9. Record if the LED is on or off in the right column.
5. Under the Output section fill in the binary column, Table 3-9, with 0's and 1's. **Get Instructor's Signature.**
6. Insert the 7402 and connect power.
7. Refer to Fig. 3-10. Wire the 2-input NOR gate.
8. Move the switches according to the Inputs section in Table 3-10. Record your observed results in the table. **Get Instructor's Signature.**
9. Insert the 7408 and 7404.
10. Wire the circuit diagrammed in Fig. 3-11.
11. Fill out Table 3-11 as you move the switches according to the Inputs section of the table. Notice the column Y should be the output of an AND gate and column $\overline{Y}$ should be the output of a NAND gate. **Get Instructor's Signature.**
12. **Draw** a logic symbol diagram of a 3-input NOR gate. Use two 2-input OR gates and an inverter. Label the inputs A, B and C and the output Y – also label the wires with the correct pin numbers. Put the diagram on a **separate sheet** of paper.
13. Construct the 3-input NOR gate you just designed. Wire the 7432 and 7404.
14. Fill out Table 3-12 as you move the switches according to the Inputs section of the table. **Get Instructor's Signature.**

Questions (answer on a separate piece of paper – **"Draw" means you must use a template**):

1. Write the Boolean expression for each of the following circuits you constructed in this experiment:
    a. 2-input NAND gate
    b. 2-input NOR gate
    c. 3-input NOR gate
2. A High voltage from an input switch in this experiment stands for _____ (binary 0, binary 1).
3. When the indicator LED is on, it means the gate has an output of _____(binary 0, binary 1).
4. The NAND gate's unique output is a _____ (0,1), which only occurs when all inputs are _____(high, low).
5. The NOR gate's unique output is a _____ (0,1), which only occurs when all inputs are _____ (high, low).
6. The NAND function can be created by inverting the output of a(n) _____ gate.

Inputs				Outputs	
A		B		Y	
Voltage	Binary	Voltage	Binary	Light	Binary
low	0	low	0		
low	0	high	1		
high	1	low	0		
high	1	high	1		

Table 3-9 Truth Table for 7400

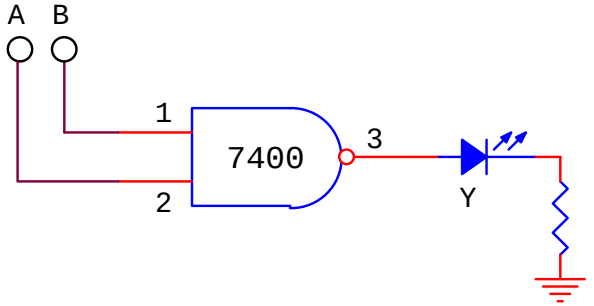

Fig. 3-9 Wiring a 2-input NAND gate

Inputs		Outputs
A	B	Y
0	0	
0	1	
1	0	
1	1	

Table 3-10 Truth Table for 7402

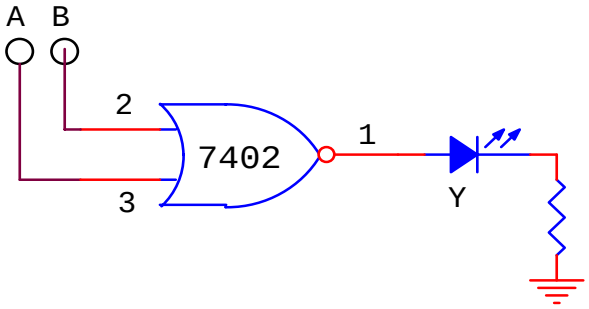

Fig. 3-10 Wiring a 2-input NOR gate

Inputs		Outputs	
A	B	Y	$\overline{Y}$
0	0		
0	1		
1	0		
1	1		

Table 3-11 Truth Table for AND and NAND

Inputs			Outputs
A	B	C	Y
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Table 3-12 3-input NOR gate

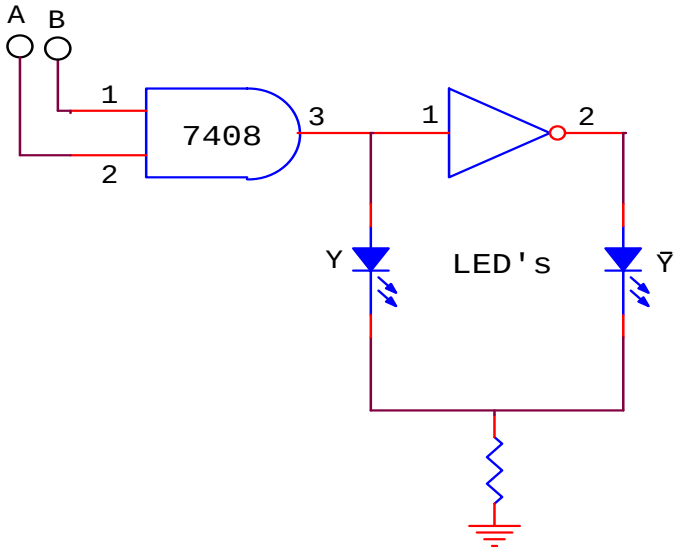

Fig. 3-11 Wiring a 2-input NAND gate