

# Micro Electronics 120 Lab #1

## Resource Materials:

Digital Electronics Textbook Chapter 3

## Questions: (Answer on separate sheet)

1. Draw the AND gate logic symbol, the Boolean expression, and Truth Table.
2. Draw a schematic diagram of the inside of a 7408 AND IC, label the terminals, and identify Vcc and Ground.
3. What does the DIP stand for when referring to IC's?
4. Why is the AND gate called the "All or Nothing" gate?

## Procedure:

### MATERIALS

#### Qty.

1 7408 2-input AND gate IC  
1 LED indicator-light assembly

#### Qty.

3 logic switches  
1 5- V dc regulated power supply

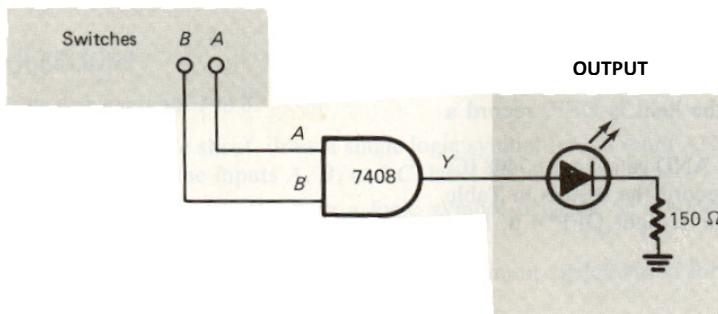
### SYSTEM DIAGRAMS

Figure 3-3 is the electronic system you will construct to perform the 2-input AND function.

The logic symbol diagram in Fig. 3-4 is the second circuit you will construct. This circuit will perform as a 3-input AND circuit.

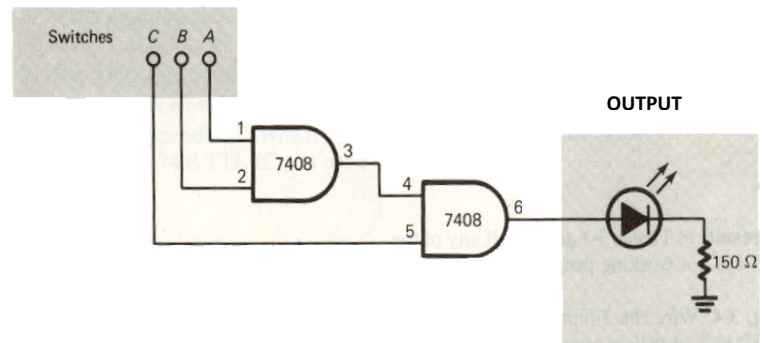
#### INPUTS

Fig. 3-3 Wiring a 2-input AND gate.



#### INPUTS

Fig. 3-4 Wiring a 3-input AND gate.



## Instructions:

1. Insert the 7408 IC into the mounting board.
2. Power OFF. Connect power to the 7408 IC: the red wire for +5 V ( $V_{cc}$ ) and the black wire for GND.
3. Refer to Fig. 3-3. Wire the 2-input AND circuit (switches, 7408 IC, LED indicator-light assembly). Refer to pin diagrams in Appendix A of this manual. Notice that the 7408 IC actually contains four AND gates in the one package. You will test each of the four AND gates in this experiment.

4. Make copies of **tables 3.1, 3.2, and 3.3** on a separate piece of paper. Power ON. Move input switches *A* and *B* to each combination in the left part of the truth table in **Table 3-1**. Record the results (an ON or OFF) in the Light column, Table 3-1.
5. Record the binary digits 0 or 1 in the Binary column, **Table 3-1**. If the light is ON, record a binary 1. If the light is OFF, record a binary 0.
6. Power OFF. Rewire the second to fourth AND gates in the 7408 IC.
7. Power ON. Test each AND gate and record the results in **Table 3-2**. Record the results as a binary 0 or 1 (light OFF = 0, light ON = 1).
8. Power OFF. Look at the results in Tables 3-1 and 3-2. If any of the AND gates in the 7408 IC are not working properly, contact your instructor.
9. Power OFF. Refer to **Fig. 3-4**. Wire the 3-input AND gate (input switches, 7408 IC, and LED indicator-light assembly). Pin numbers are shown in Fig. 3-4.
10. Power ON. Operate the input switches *A*, *B*, and *C* according to the truth table in Table 3-3. Record a 0 for a LOW output voltage (GND). Record a 1 for a HIGH output voltage (near + 5 V). Observe and record the results in the Output column of Table 3-3.
11. Power OFF. Take down the circuit and return all equipment to its proper place.

**Lab Questions:**

**Complete questions 1 to 8 on a separate sheet of paper .**

1. Draw a single logic symbol for a 3-input AND gate. Label the inputs *A*, *B*, and *C*; label the output *Y*.
2. Draw a logic symbol diagram of a 4-input AND gate using three 2-input AND gates.
3. In this experiment a LOW voltage at the input switch stood for a:
  - a. Logical 0
  - b. Logical 1
4. In this experiment a HIGH voltage (near + 5 V) stood for a
  - a. Logical 0
  - b. Logical 1
5. Make a truth table for a 4-input AND gate. Label the inputs *A*, *B*, *C*, and *D*; label the output *Y*.
6. When powering the IC in this experiment, the  $V_{cc}$  pin is connected to the \_\_\_\_\_ of the power supply.
7. The AND gate's unique output is a \_\_\_\_\_ (0, 1) which only occurs when all inputs are \_\_\_\_\_ (HIGH, LOW).
8. Refer to Appendix A. Which CMOS chip will perform the same logic as the 7408 TTL IC you used in this experiment?

**Table 3.1 Truth Table 2-Input AND Gate**

INPUTS				OUTPUT	
<i>B</i>		<i>A</i>		Light	Binary
Voltage	Binary	Voltage	Binary		
LOW	0	LOW	0		
LOW	0	HIGH	1		
HIGH	1	LOW	0		
HIGH	1	HIGH	1		

**Table 3-2 Truth Table for 7408 IC**

INPUTS		OUTPUTS		
<i>B</i>	<i>A</i>	Second AND gate	Third AND gate	Fourth AND gate
0	0			
0	1			
1	0			
1	1			

**Table 3-3 3-Input AND Gate**

INPUTS			OUTPUT
<i>C</i>	<i>B</i>	<i>A</i>	
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	