

Micro Electronics 120 Lab #9

Resource Materials:

Digital Electronics Textbook Chapter 3 Section 3.9

OBJECTIVES

1. To design, draw, and wire a 3-input AND circuit using 2-input AND gates.
2. To design, draw, and wire a 4-input OR circuit using 2-input OR gates.
3. To design, draw, and wire a 5-input NAND circuit using one 2-input OR gate, one 2-input NAND gate, and one 4-input NAND gate.
4. To design, draw, and wire a 4-input XOR circuit using three 2-input XOR gates

MATERIALS Qty.

- 1 - 7400 2-input NAND gate IC
- 1 - 7420 4-input NAND gate IC
- 5 - logic switches
- 5 V dc regulated power supply
- 1 7408 2-input AND gate IC
- 1 7432 2-input OR gate IC
- 1 7486 2-input XOR gate IC
- 1 LED indicator-light assembly

Procedure

1. On a separate piece of paper design and draw a logic symbol diagram of a 3-input AND gate using two 2-input AND gates.
2. Insert the 7408 IC into the mounting board.
3. Power OFF. Connect power to the 7408 IC (V_{cc} and GND).
4. Construct the circuit you designed in step 1. Wire the input switches $A, B,$ and C ; the 7408 IC; and the LED output indicator-light assembly. Refer to pin diagrams in Appendix A.
5. Power ON. Operate the input switches $A, B,$ and C as shown in the input section of the truth table in Table 3-15 on the next page. Observe and record the output in the 3-input AND column.
6. Power OFF. Remove the 7408 IC.
7. On a separate piece of paper design a logic symbol diagram of a 4-input OR gate using only 2-input OR gates.
8. Insert a 7432 IC into the mounting board. Connect power to the IC (V_{cc} and GND).
9. Construct the circuit you designed in step 7. Wire input switches $A, B, C,$ and D ; the 7432 IC; and the LED output indicator-light assembly.
10. Power ON. Operate the input switches $A, B, C,$ and D according to the input part of the truth table in Table 3-15. Observe and record the output in the 4-input OR column.
11. Power OFF.

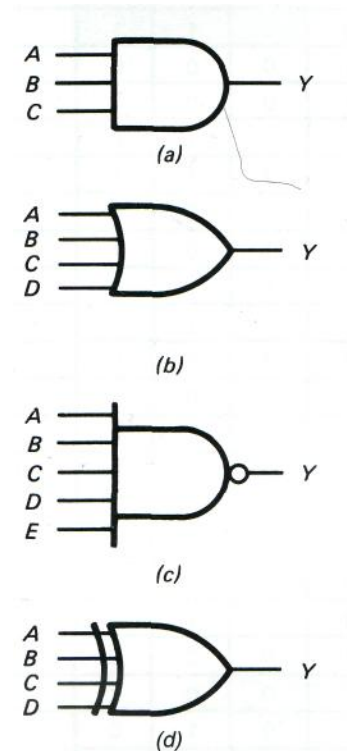


Fig. 3-21 Logic symbols for (a) 3-input AND, (b) 4-input OR, (c) 5-input NAND, and (d) 4-input XOR gates.

12. On a separate piece of paper design and draw a logic symbol diagram of a 5-input NAND gate using 7400, 7420, and 7432 ICs. Refer to pin diagrams in Appendix A.

13. Add a 7400 and a 7420 IC to the mounting board. Connect power to each IC (V_{cc} and GND).

14. Construct the circuit you designed in step 12. Wire the input switches A, B, C, D, and F the 7400, 7420, and 7432 ICs; and the LED output indicator-light assembly.

15. Power ON. Operate the input switches A, B, C, D, and E according to the input part of the truth table in Table 3-15. Observe and record the Output in the 5-input NAND column.

16. On a separate piece of paper design and draw a logic symbol diagram of a 4-input XOR gate using three 2-input XOR gates.

17. Construct the circuit you designed in step 16. Wire four input switches, the 7486 quad 2-input XOR gate IC, and the LED output indicator-light assembly.

18. Power ON. Operate and observe the operation of the 4-input XOR circuit. Show your instructor your design. Demonstrate the operation of the circuit and be prepared to answer questions on the XOR gate.

19. Power OFF. Take down the circuit and return all equipment to its proper place.

INPUTS					OUTPUT		
E	D	C	B	A	5-input NAND gate	4-input OR gate	3-input AND gate
0	0	0	0	0			
0	0	0	0	1			
0	0	0	1	0			
0	0	0	1	1			
0	0	1	0	0			
0	0	1	0	1			
0	0	1	1	0			
0	0	1	1	1			
0	1	0	0	0			
0	1	0	0	1			
0	1	0	1	0			
0	1	0	1	1			
0	1	1	0	0			
0	1	1	0	1			
0	1	1	1	0			
0	1	1	1	1			
1	0	0	0	0			
1	0	0	0	1			
1	0	0	1	0			
1	0	0	1	1			
1	0	1	0	0			
1	0	1	0	1			
1	0	1	1	0			
1	0	1	1	1			
1	1	0	0	0			
1	1	0	0	1			
1	1	0	1	0			
1	1	0	1	1			
1	1	1	0	0			
1	1	1	0	1			
1	1	1	1	0			
1	1	1	1	1			

QUESTIONS

Complete questions 1 to 4 on a separate piece of paper.

1. Write the Boolean expression for each of the following gates constructed in this experiment:

- 3-input AND
- 4-input OR
- 5-input NAND
- 4-input XOR

2. Draw a logic symbol diagram of a 5-input AND gate using 2-input AND gates.

3. The _____ gate's unique output is a 0, which only occurs when all inputs are HIGH.

4. Draw a logic symbol diagram of how 7420 and 7432 ICs would be wired to produce a 7-input NAND function. Show seven inputs and a LED output indicator with a limiting.