

# Title: USING THE NAND GATE

**Materials:**

[2] 7400 2-input NAND gate ICs

**Procedure:**

1. Insert a 7400 IC into the breadboard.
2. Construct a 2-input AND gate using two 2-input NAND gates.
3. Move the input switches to the positions shown in the input section of Table 3-14. Observe and record the output in the AND gate column in Table 3-14. **Get Instructor's Signature.**
4. Rewire the 7400 to create a 2-input OR gate.
5. Move the input switches to the positions shown in the input section of Table 3-14. Observe and record the output in the OR gate column in Table 3-14.
6. Repeat steps 4 and 5 for the NOR, XOR, and XNOR gates (all using the NAND gate equivalent).
7. **You should have your instructor sign after the AND column, after the OR and NOR (come once ready for both), and come a third time for the XOR and XNOR (come once ready for both). You should then be coming up 3 times in all.**

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

1. Write the Boolean expression for each of the logic functions you constructed from NAND gates in this experiment.
  - a. 2-input AND gate
  - b. 2-input OR gate
  - c. 2-input NOR gate
  - d. 2-input XOR gate
  - e. 2-input XNOR gate
2. Draw a logic symbol diagram of the following using only 2-input NAND gates:
  - a. inverter
  - b. 2-input OR gate
  - c. 2-input NOR gate
  - d. 2-input XOR gate
  - e.  $(A + \bar{B}) \oplus C$  (draw a box around where it can be simplified)
3. Which XOR gate has *fewer* connections and therefore greater reliability?
  - a. 7486 IC
  - b. 7400 IC wired to perform the XOR function

Inputs		Outputs				
A	B	get signature	get these signed together		get these signed together	
		AND gate	OR gate	NOR gate	XOR gate	XNOR gate
0	0					
0	1					
1	0					
1	1					

Table 3-14