Lab #8 Name: _____ Per: _____

Title: SIMPLIFYING LOGIC CIRCUITS

Materials:
[1] 7400 IC [1] 7404 IC [1] 7408 IC [1] 7432 IC

Procedure:
1. Develop a minterm Boolean expression from the truth table in Table 4-2. Write the expression in Fig. 4-5(a).
2. From the unsimplified Boolean expression you wrote in Fig. 4-5(a), plot the 1's in the Karnaugh map in Fig. 4-5(b). Make sure you label the rows and columns of the Karnaugh Map.
3. Draw loops on the Karnaugh map in Fig. 4-5(b).
4. Write the simplified Boolean expression (minterm form) in Fig. 4-5(c) by eliminating variables.
5. On a separate sheet of paper, **draw** a logic circuit for your simplified Boolean expression in Fog. 4-5(c). Use input switches, inverters, AND gates, an OR gate, and an output LED indicator light with resistor.
6. Wire the AND-OR logic circuit drawn in step 5.
7. Move input switches A, B, and C to each combination shown in the truth table in Table 4-2. Observe and record the outputs in the AND-OR circuit column. **Get Instructor's Signature.**
8. Remove gates from board.
9. On a separate sheet of paper, **redraw** your logic circuit for the simplified Boolean expression in Fig. 4-5(c). Use input switches, NAND gates only, and an output LED indicator light with resistor. Don't forget to simplify if possible.
10. Wire the logic circuit you just designed in step 9 using only a 7400 IC.
11. Operate the NAND logic circuit according to the truth table in Table 4-2. Observe and record the outputs in the NAND circuit column. **Get Instructor's Signature.**

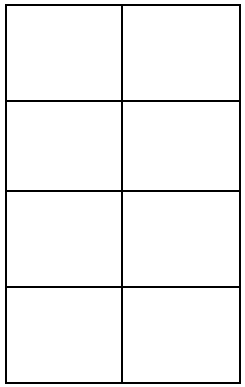
Inputs			**Outputs**		
A	B	C	**Y**	AND-OR circuit	NAND circuit
				Y	**Y**
0	0	0	0		
0	0	1	0		
0	1	0	0		
0	1	1	0		
1	0	0	1		
1	0	1	0		
1	1	0	1		
1	1	1	1		

Table 4-2

Fig 4-5.

(a) Unsimplified Boolean Expression: _____

(b) Karnaugh Map (label, fill-in, circle)



(c) Simplified Boolean Expression: _____

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

1. In this experiment it was found that the _____ (AND-OR, NAND) circuit used fewer ICs to do the job.
2. We used which method of simplifying a Boolean expression in this experiment? (Venn Diagram, Garland Gradation, Allen Elimination, Rodriguez Reduction, Wittry Termination (a.k.a., the "Wittry-ator"), Karnaugh Map)
3. From the truth table in Fig. 4-6, do the following:
    a. Write the unsimplified Boolean expression
    b. Label the rows/columns in the K-Map in Fig. 4-7.
    c. Record five 1's in the K-Map in Fig. 4-7.
    d. Loop the adjacent groups of 1's in Fig. 4-7.
    e. From the looping, eliminate variables.
    f. Write the simplified minterm Boolean expr.
    g. Draw a logic diagram of the simplified Boolean expression using AND, OR, and NOT gates.
    h. Re-draw the AND-OR circuit in g to form a NAND circuit (simplify if possible).
4. Refer to question 3. Which logic circuit would use the fewest ICs? (AND-OR circuit, NAND circuit)

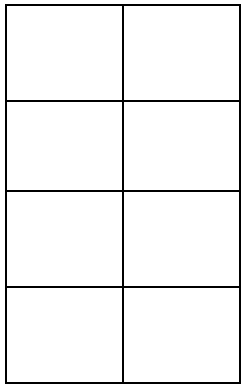
Inputs			Outputs
A	**B**	**C**	**Y**
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Fig. 4-6 Truth Table

Fig 4-7 K-Map (for question 3)

(a) Unsimplified Boolean Expression: _____

(b) Karnaugh Map (label, fill-in, circle)



(c) Simplified Boolean Expression: _____