

EGC221: Digital Logic Lab

Experiment #3 Combinational Logic Circuits

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Assessment:

Assessment Point	Weight	Grade
Methodology and correctness of results		
Discussion of results		
Participation		
Assessment Points' Grade:		

Comments:

Experiment #3:**Basic Logic Circuits****Objectives:**

The objectives of this experiment are to:

1. Verify a logic function through circuit simulation, then by building the logic circuit,
2. Analyze a logic circuit using a truth table, and
3. Investigate the concept that two or more circuits can result in exactly the same output.

Procedure:

Use Logisim and Digital I/O Module, DC Power Supply, Breadboard, Wires, and 74xx Logic ICs to solve the following exercises.

Exercise 1:

(a) Derive the **logic expression** for the circuit illustrated in Figure 1.

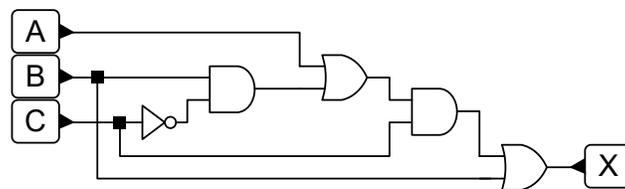


Figure 1. Basic logic circuit with three inputs A, B, and C.

Logic Expression:	X =
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(b) Analyze the circuit in Figure 1 and complete **Table 1** below.

Table 1. Basic logic circuit with three inputs A, B, and C.

INPUTS			INTERMEDIATES				OUTPUT
A	B	C					
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

- (c) Use the breadboard in **Figure 2** and mark (using a **color pen or pencil** or import to **Paint**) all the necessary connections to build the circuit shown in Figure 1. Connect Input A on switch S7, Input B on switch S6, Input C on switch S5, and connect output X on LED 7. [**Note:** Use a ruler to draw the lines connecting the components and clearly indicate connection points.]

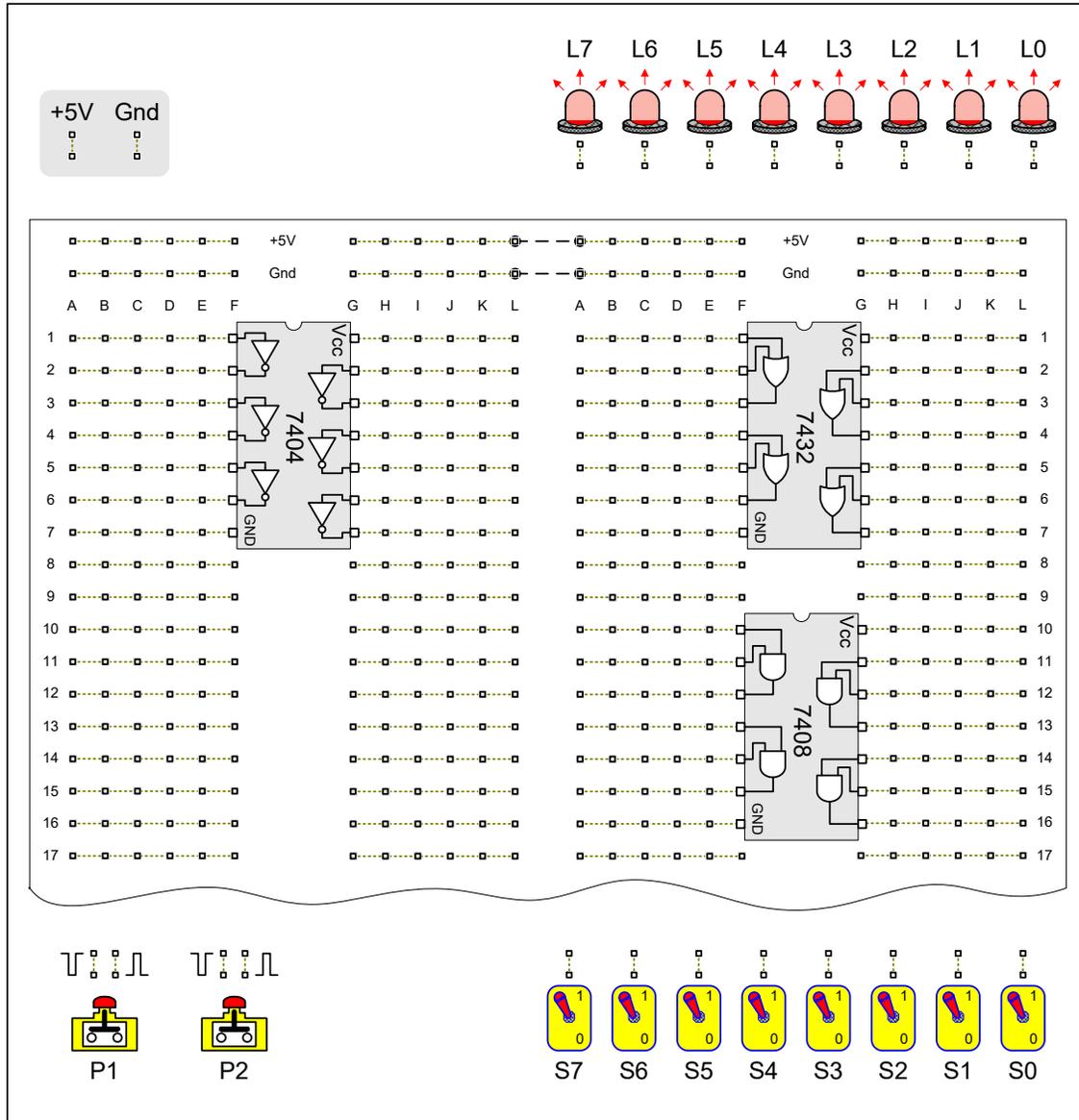


Figure 2. Breadboard diagram for logic function X.

- (d) Use Logisim to simulate the ICs and connections shown in Figure 2. Complete **Figure 3** and **Table 2**.

[Insert Logisim circuit here]

Figure 3. 7404, 7408 and 7432 ICs circuit simulation

Table 2. Basic logic circuit – Logisim results.

S7	S6	S5	L7
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

- (e) Verify the operation of your circuit using a Digital I/O Module, DC Power Supply, Breadboard, 7404, 7408 and 7432 ICs, and Wires. Complete **Figure 4** and **Table 3**.

[Insert Photo of circuit here]

Figure 4. Combinational circuit photo

Table 3. Basic logic circuit – Build results.

S7	S6	S5	L7
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

- (f) Compare the results from Tables 1, 2, and 3:

Exercise 2:

- (g) Use Logisim to simulate the logic expression: $X = AC + B$. Complete **Figure 5** and **Table 4**.

[Insert Logisim circuit here]

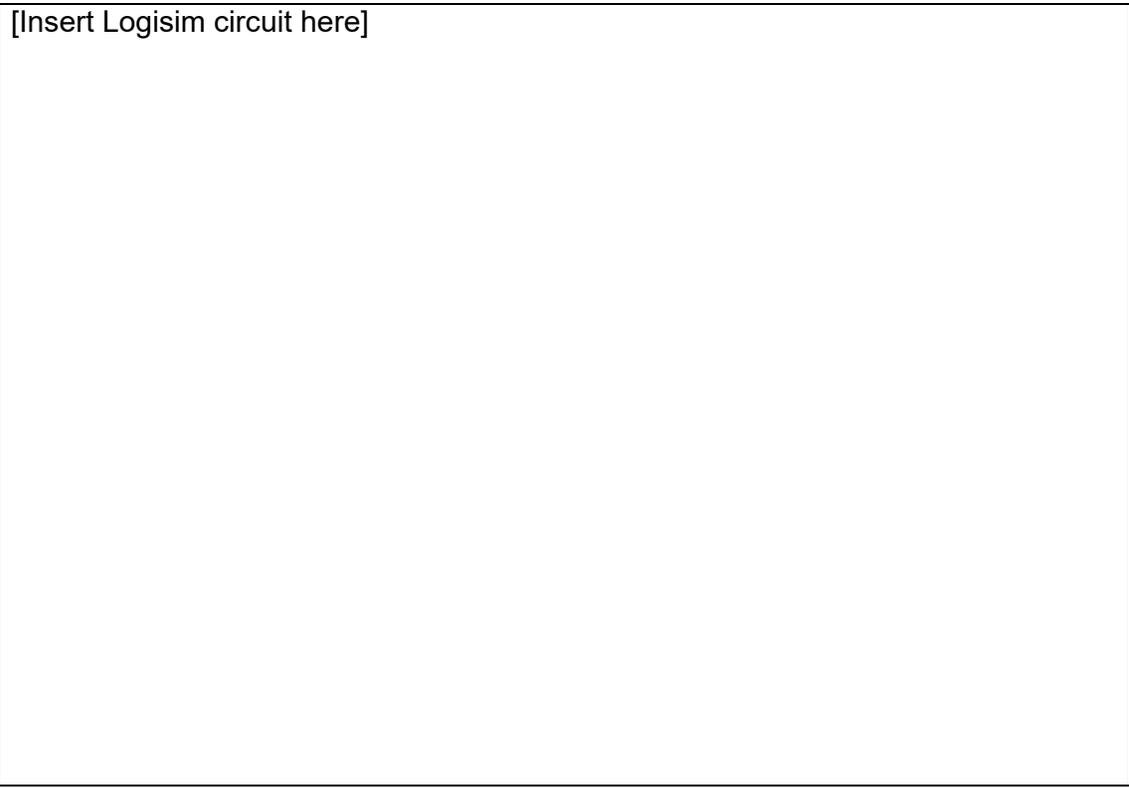


Figure 5. Basic circuit simulation of the logic expression: $X = AC + B$.

Table 4. Basic Logic Circuit – Logisim results.

S7	S6	S5	L7
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

- (h) Use the breadboard in **Figure 6** and mark (using a **color pen or pencil** or import to **Paint**) all the necessary connections to build the circuit illustrated in Figure 4. Connect Input A on switch S7, Input B on switch S6, Input C on switch S5, and connect output X on LED L7. [Note: Use a ruler to draw the lines connecting the components and clearly indicate connection points.]

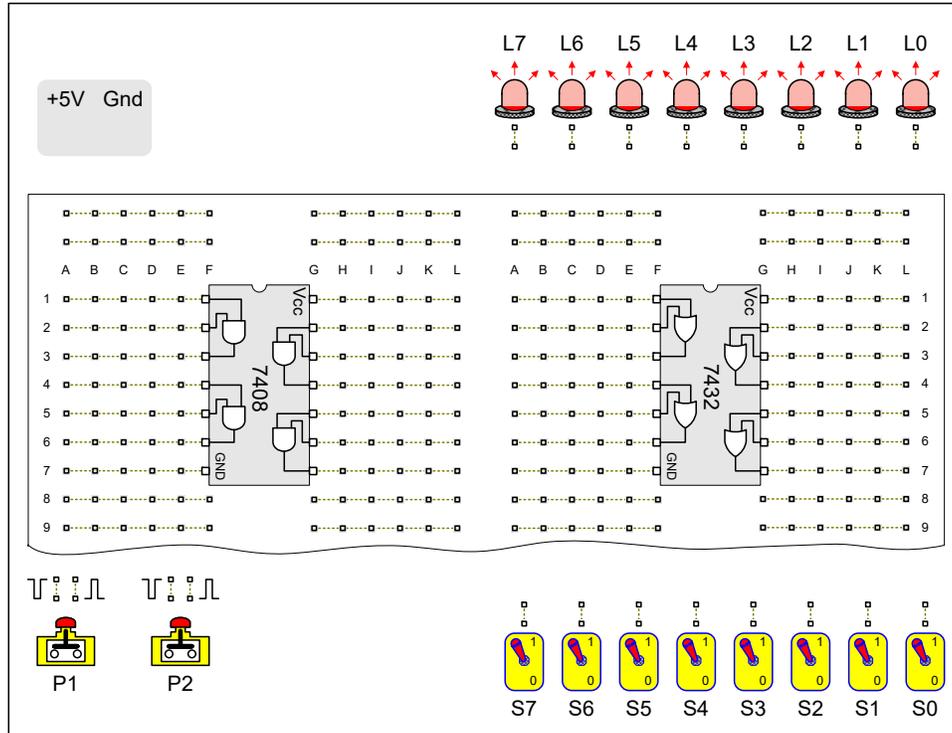


Figure 6. Basic circuit wiring of the logic expression $X = AC + B$.

- (i) Verify the operation of your circuit using a Digital I/O Module, DC Power Supply, Breadboard, 7408 and 7432 ICs, and Wires. Complete **Figure 7** and **Table 5**.

[Insert Photo of circuit here]

Figure 7. Combinational Circuit.

Table 5. Basic Logic Circuit – Build results.

S7	S6	S5	Output
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

- (j) Compare the results from Tables 4 and 5:

(k) Conclusions (discussion of results):