[Lab 2]. Basic logic Gates (AND, OR, and NOT gates)

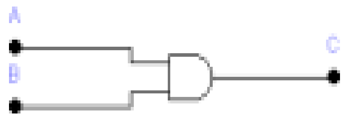
Objectives

1- To study and understand the 3 basic gates.
2- Implement the basic gate in EWB.
3- The study the specifications of every gate when connected it with one input constant and the other is variable.

AND and NAND gates

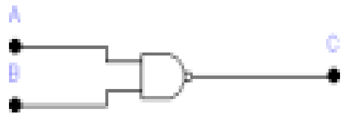
This gate gives high output (1) if all the inputs are 1's. otherwise the output will be low (0).

Its Boolean algebra representation is: C=A.B
And it's truth table and schema as following:



A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

The NAND gate works opposite to the AND gate. Its Boolean algebra representation is: C=(A.B)'
And it's truth table and schema as following:

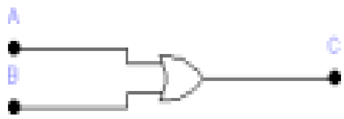


A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

OR and NOR gates

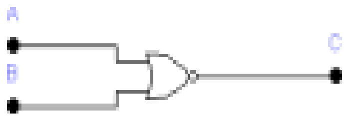
This circuit will give high output (1) if any input is high (1).

Its Boolean algebra representation is: C=A+B
and it's truth table and schema as following:



A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

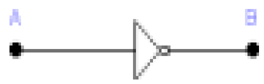
The NOR gate works opposite to the OR gate. Its Boolean algebra representation is: C=(A+B)'
And it's truth table and schema as following:



A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

NOT gate

This is the simplest gate it just inverts the input, if the input is high the output will be low and conversely.
So B=A'

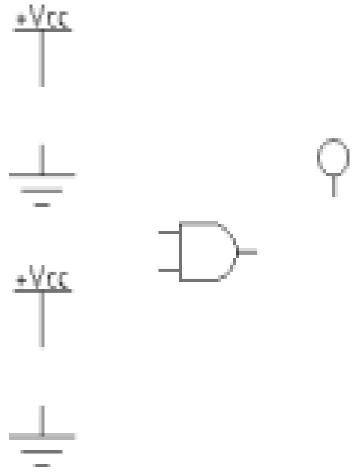


A	B
0	1
1	0

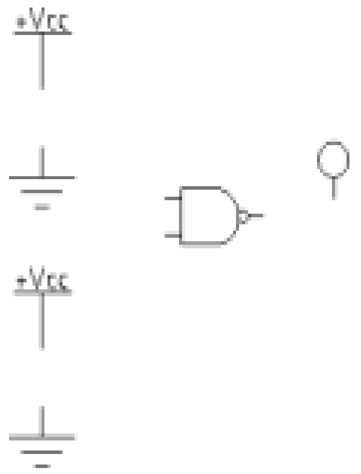
Lab Tasks

Task 1: The AND and NAND gates

In EWB, draw the following two circuits and fill the truth table below

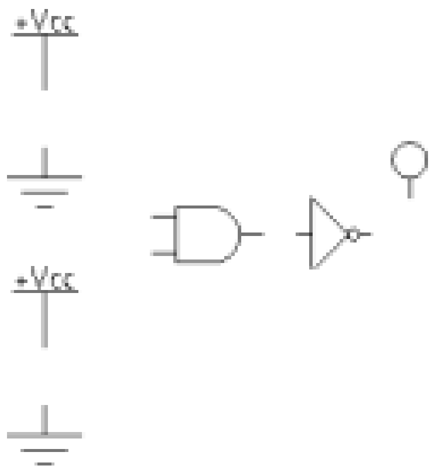


A	B	A.B	(A.B)'
0	0		
0	1		
1	0		
1	1		



Task 2: The AND-NOT combination

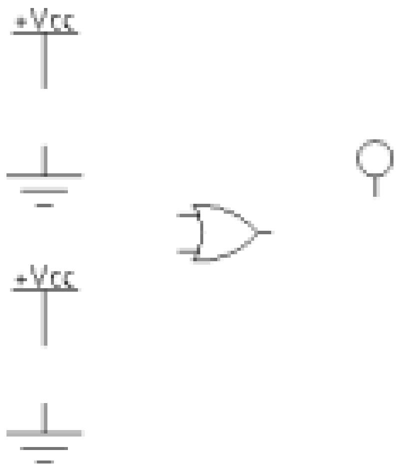
In EWB, draw the following circuit and fill the truth table



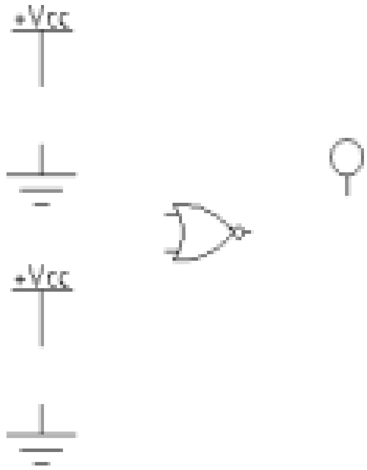
A	B	(A.B)'
0	0	
0	1	
1	0	
1	1	

Task 3: The OR and NOR gates

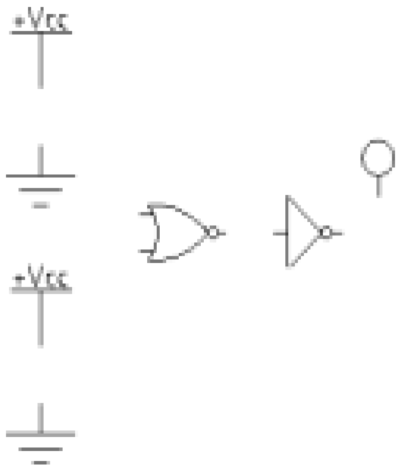
In EWB, draw the following two circuits and fill the truth table below



A	B	A+B	(A+B)'
0	0		
0	1		
1	0		
1	1		



Task 4: The NOR-NOT combination



A	B	((A+B)')'
0	0	
0	1	
1	0	
1	1	

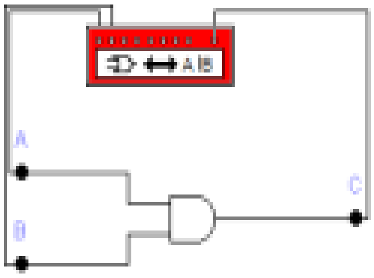
Task 5: Finding the truth table of a gate using the logic converter

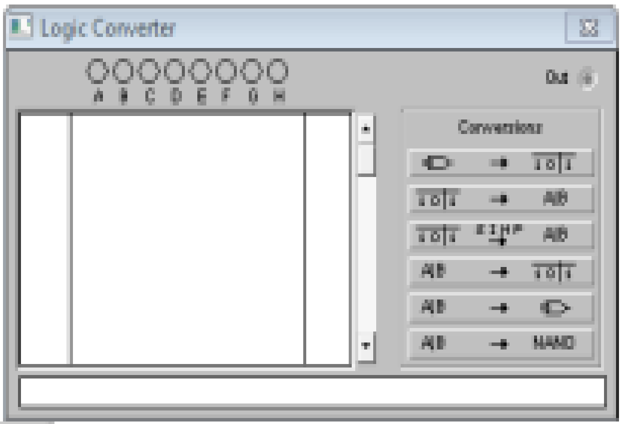
The logic converter can be found in the *Instruments* toolbox. It can be used to derive a truth table from a circuit schematic:

1. Attach the input terminals of the logic converter to up to eight input points in the circuit.
2. Connect the single output of the circuit to the output terminal on the logic converter icon.
3. Click the Circuit to Truth Table  button.

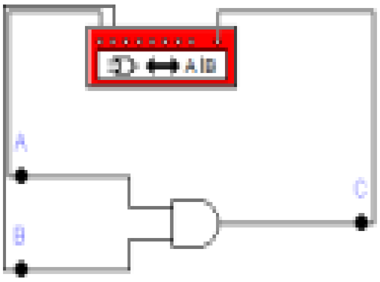
The truth table for the circuit appears in the logic converter's display.

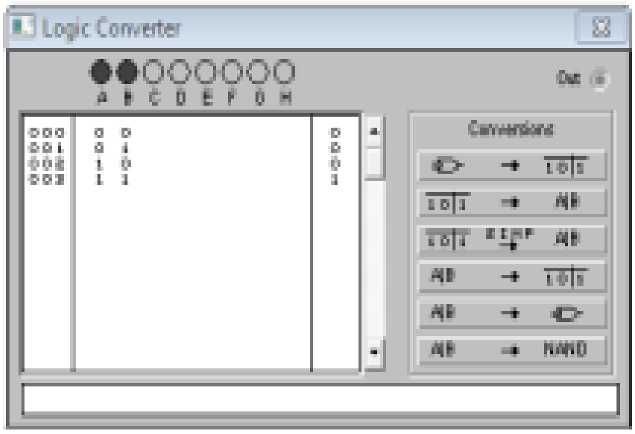
In the following circuit, we will be examining the AND gate. The two inputs of the gate are attached the A and B inputs of the logic converter. The circuit output C is connected to *Out* line of the logic converter.





After clicking on the Truth Table  button of the logic converter, the logic converter tries all possible combinations of the circuit input and derives its truth table.

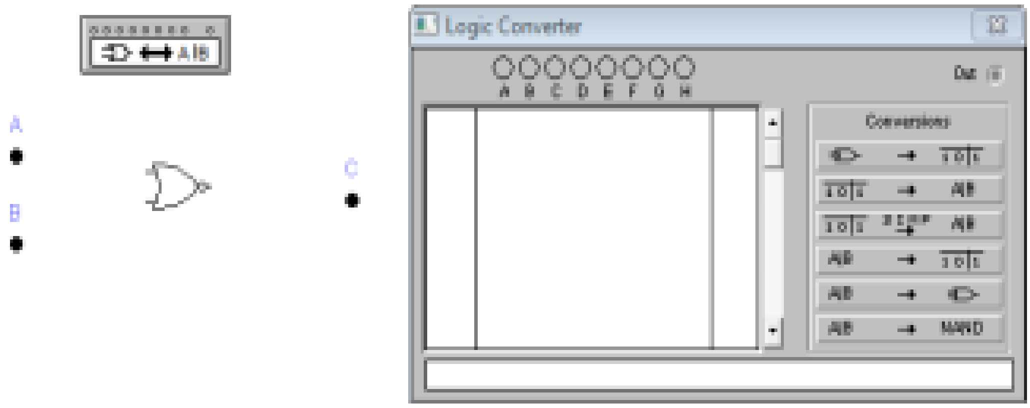




Task 6: Finding the truth table of a gate using the logic converter

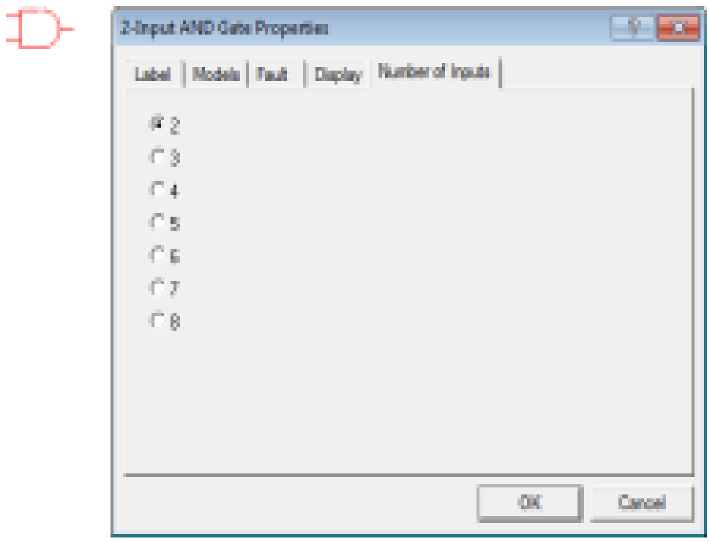
Repeat what you did in task 5 for the NOR gate. Show your connections in the circuit below.

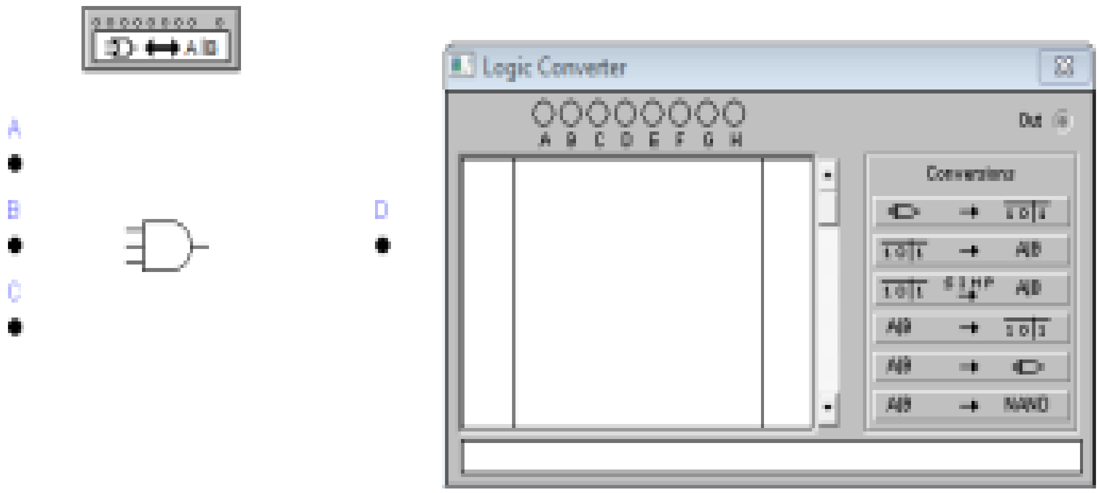
A	B	A+B	(A+B)'
0	0		
0	1		
1	0		
1	1		



Task 7: Finding the truth table of a three input gate using the logic converter

Repeat what you did in task 5 for a three-input AND gate. Show your connections in the circuit below.
Note: you can obtain a three-input AND gate by drawing a regular two-input AND gate and then changing its *Number of Inputs* property as shown next.

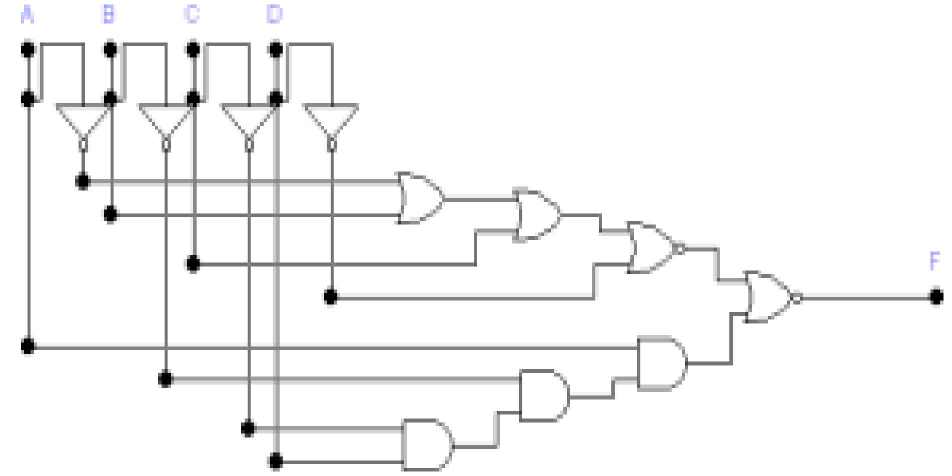




A	B	C	D
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Task 8: Finding the truth table of a given circuit using the logic converter

Find the truth table of the following circuit:



A	B	C	D	F
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	