

*Lab 4*

*Second stage*

*Medical Physical Department*



# *Digital Electronics*

**Lab 4 : Boolean expression**

**By**

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## Boolean expression

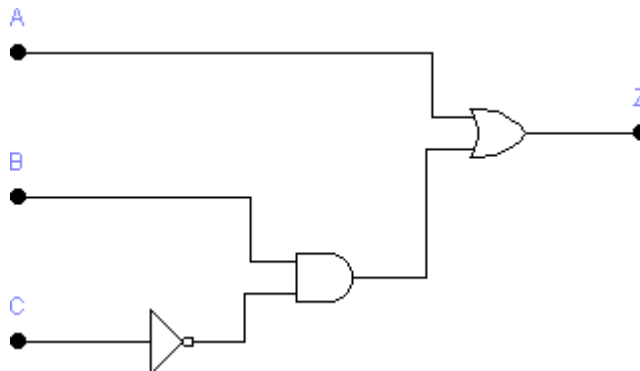
### Objectives

- To learn how to directly convert a Boolean expression to circuit.
- To learn how to analyze a given digital logic circuit by finding the Boolean expression that represents the circuit
- To learn how to analyze a given digital logic circuit by finding the truth table that represents the circuit.

### Example:

$$Z = A + B \cdot C'$$

The above function is implemented in the following digital logic Circuit



Now after drawing the circuit above using EWB we find that its truth table is as shown below ( notice that logic **1** means connect the input to the Vcc line, and logic **0** means connecting the input to the ground)

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

### Lab Tasks

#### Task 1: Converting Boolean expressions into circuits

Convert the following Boolean expression to a circuit, draw the circuit on EWB and simulate it to fill-in its truth table shown below.

$$X = Y + Z \cdot Y'$$



Draw the circuit in the space below

Now, fill-in the truth table of the circuit you drawn

Y	Z	X
0	0	
0	1	
1	0	
1	1	

### Task 2: Converting Boolean expressions into circuits

Convert the following Boolean expression to a circuit, draw the circuit on EWB and simulate it to fill-in its truth table shown below.



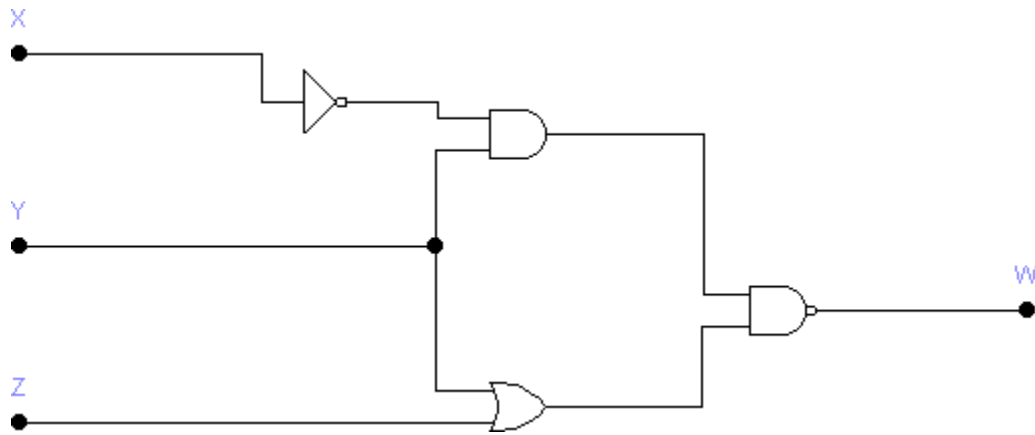
A	B	C	D
0	0	0	
0	0	1	
0	1	0	
0	1	1	

1	0	0	
1	0	1	
1	1	0	
1	1	1	

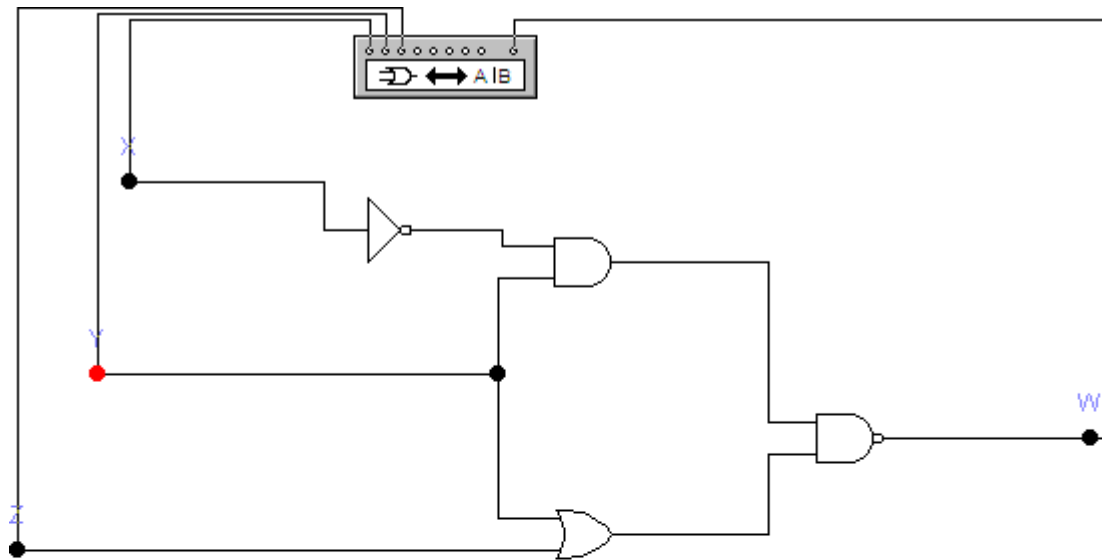
### Task 3: Digital logic circuit analysis – Finding the Boolean expression of a given circuit

Find the Boolean expression of the following circuit, draw the circuit on EWB and simulate it to fill-in its truth table shown below.

W =



Note: the logic converter tool from EWB to fill-in the following table. For that, you need to connect the A, B and C inputs of the logic converter to X, Y and Z lines, respectively. Further, you need to connect the 'out' line of the logic converter to W. As shown in the following diagram



Logic Converter

Out

Conversions

- $\Rightarrow$   $\rightarrow$   $\overline{101}$
- $\overline{101}$   $\rightarrow$   $A\overline{B}$
- $\overline{101}$   $\xrightarrow{\text{SIMP}}$   $A\overline{B}$
- $A\overline{B}$   $\rightarrow$   $\overline{101}$
- $A\overline{B}$   $\rightarrow$   $\Rightarrow$
- $A\overline{B}$   $\rightarrow$  NAND

$A'B'C' + A'B'C + AB'C' + AB'C + ABC' + ABC$

X	Y	Z	W
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	