Project Title: DeMORGAN'S THEOREMS

Course: ELET 1210 – DIGITAL EELECTRONICS 1

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Introduction

This report discusses the use and implementation of De Morgan's Theorem and universal logic gates. A universal logic gate is a logic gate that can be used to construct all other logic gates. De Morgan's Theorem states that inverting the output of any gate results in the same function as the opposite type of gate with inverted inputs. This report verifies De Morgan's Theorem with the use of truth tables, circuits, and universal gates.

Description of Experimental Setup/List of Equipment Used

Equipment Used:

The equipment used for this experiment include, a breadboard, power supply, wires, a DIP switch, resistors, 2 LEDs and ICs.

Required IC's:

74LS04 Hex Inverter

74LS00 Quad 2-Input NAND

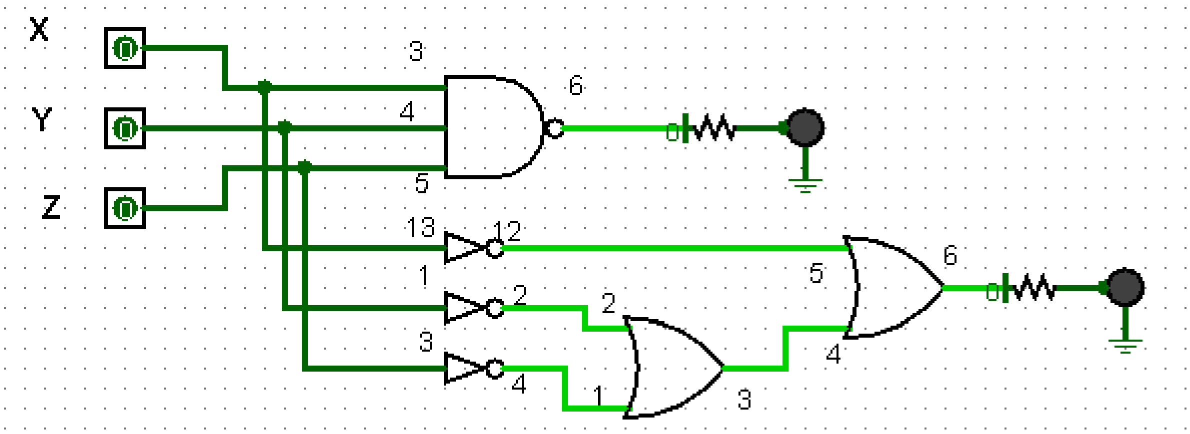
74LS10 Triple-3-Input NAND

Triple 3-Input NOR

74LS32 Quad 2 – Input OR

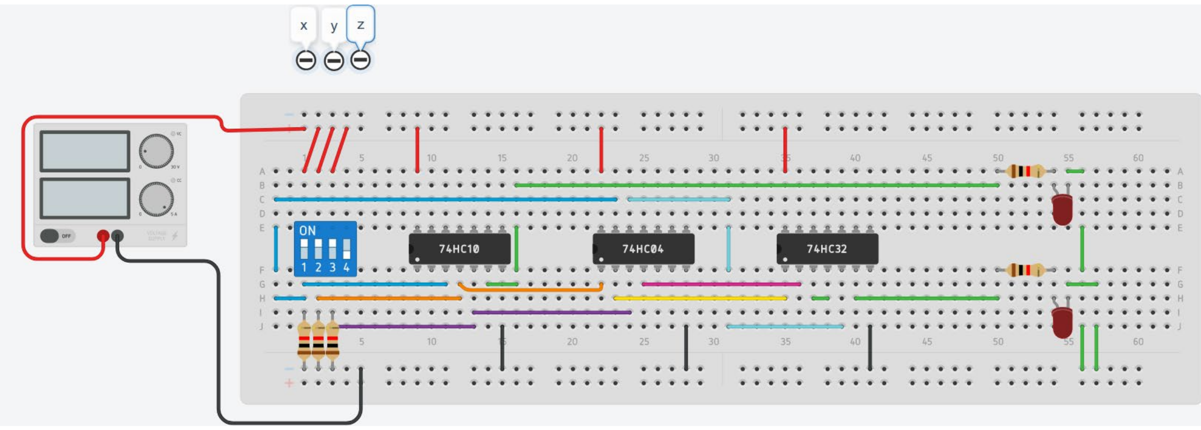
74LS11 Triple 3-Input AND

Logic Diagram Experiment 1A



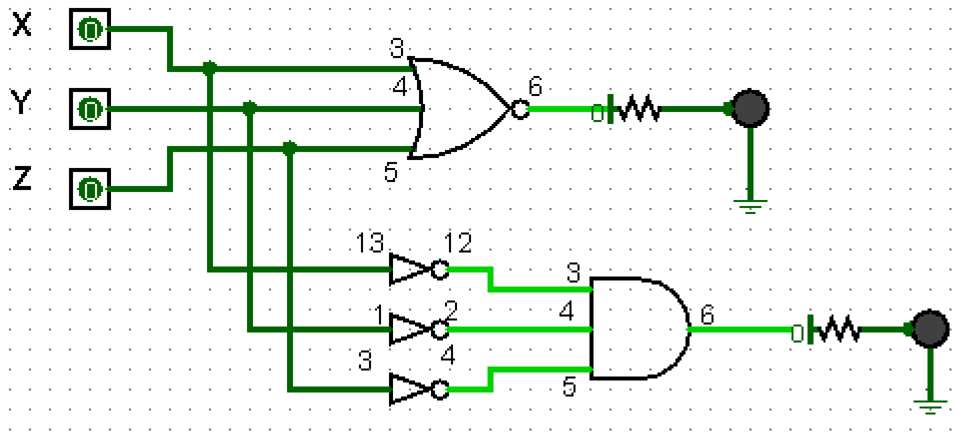
Example of a Logic Diagram for $\overline{XYZ} = \overline{X} + \overline{Y} + \overline{Z}$

Pictorial Diagram Experiment 1A



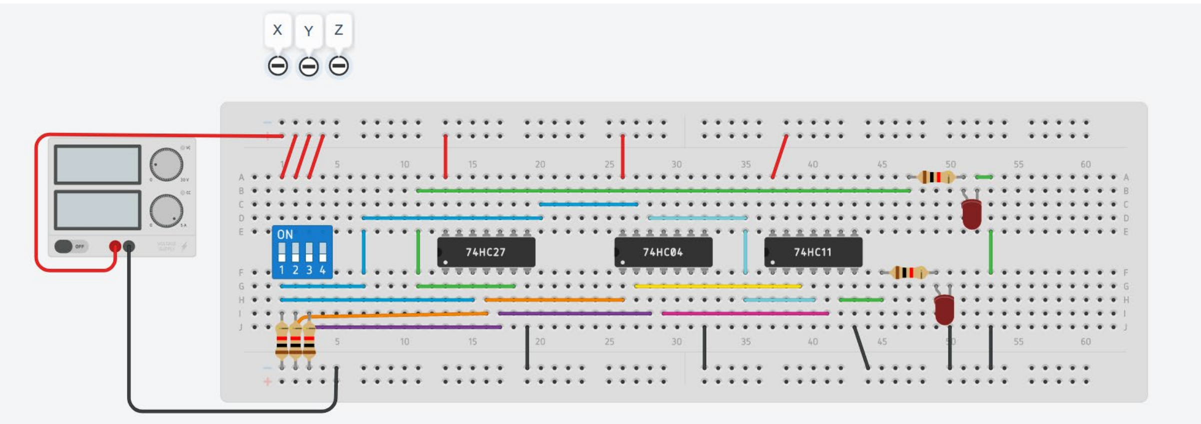
Example of a Pictorial Diagram for $\overline{XYZ} = \overline{X} + \overline{Y} + \overline{Z}$

Logic Diagram Experiment 1B

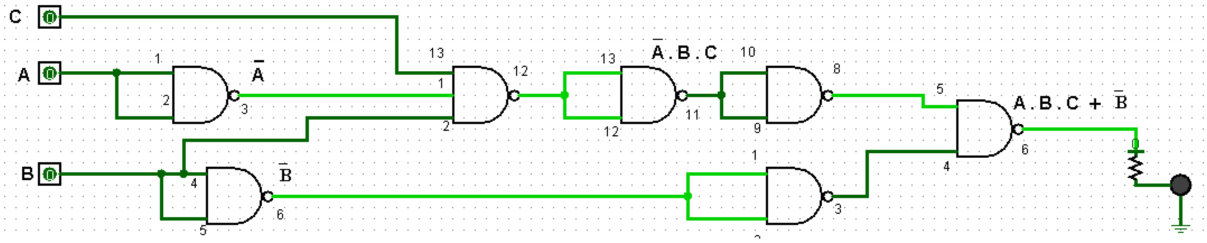


Example of a Logic Diagram for $\overline{X + Y + Z} = \overline{X}.\overline{Y}.\overline{Z}$

Pictorial Diagram Experiment 1B

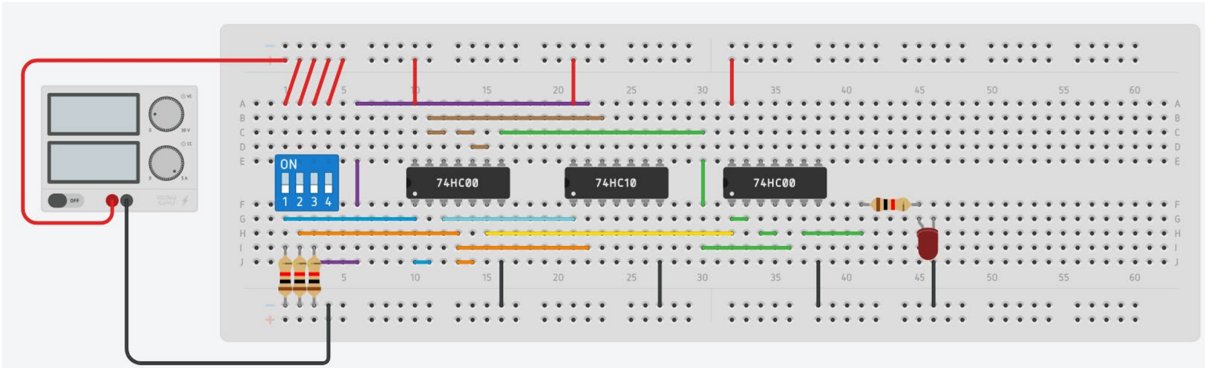


Logic Diagram Experiment 2



Example of a Logic Diagram for $\overline{B} + \overline{A}\ B\ C$ using only NAND gates.

Pictorial Diagram Experiment 2



Example of a Pictorial Diagram for $\overline{B} + \overline{A}\ B\ C$ using only NAND gates.

Procedure/Method

All equipment was gathered, and setup as showed in the pictorial diagrams. All ICs and the DIP switch were powered and grounded. Wires got input from the DIP switch and outputted as showed in the logic diagrams. In experiment 1 2 LED’s were placed on the breadboard. The power supply was then turned on and the switches were then changed to give different inputs from the truth tables and the LEDs were checked to verify the outputs from the truth tables. In experiment 2 only one LED was used, and different switch inputs were used to verify the truth table for the expression. After all inputs were entered and checked for each expression the power supply was then turned off.

Results

In the two experiments results shown in the circuits reflected what truth table for the circuit's expressions showed. The 1's were showed by the LED being on and the LED off represented a 0.

Table for Experiment 1A

Experiment 1A				
X	Y	Z	$\overline{XYZ}$	$\overline{X} + \overline{Y} + \overline{Z}$
0	0	0	1	1
0	0	1	1	1
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

Table for Experiment 1B

Experiment 1B				
X	Y	Z	$\overline{X + Y + Z}$	$\overline{X}\,\overline{Y}\,\overline{Z}$
0	0	0	1	1
0	0	1	0	0
0	1	0	0	0
0	1	1	0	0
1	0	0	0	0
1	0	1	0	0
1	1	0	0	0
1	1	1	0	0

Table for Experiment 2

Experiment 2			
A	B	C	$\overline{B} + \overline{A}BC$
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

Discussion and Conclusion

In conclusion, DeMorgan’s Theorem was proven through truth tables, universal gates, and circuits. Experiment 1 proved the outputs of a complemented and uncomplemented expressions are the same. Experiment 2 showed an expression can be built using only the NAND gate. Both experiments were useful to verify DeMorgan’s Theorem.