## Verification of Law for Two Variables

| $A$ | $B$ | $\bar{A}$ | $\bar{B}$ | $A+B$ | $A \cdot B$ | $\overline{A+B}$ | $\bar{A} \cdot \bar{B}$ | $\overline{A \cdot B}$ | $\bar{A}+\bar{B}$ |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

## Simplification of Given Expression using De-Morgan's Law

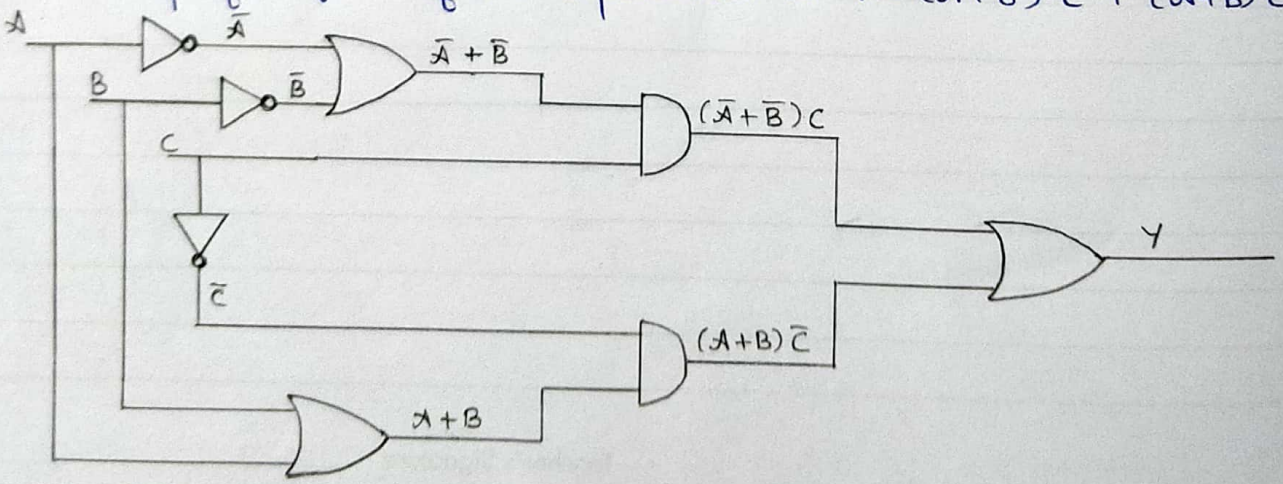
Given expression is $Y = \overline{(AB+\bar{C})(\overline{A+B}+C)}$

Simplifying this expression using De-Morgan's law

$$Y = \overline{(AB+\bar{C})(\overline{A+B}+C)}$$
$$= \overline{(AB+\bar{C})} + \overline{(\overline{A+B}+C)}$$
$$= \overline{AB} \cdot \bar{\bar{C}} + \overline{(\overline{A+B})} \cdot \bar{C}$$
$$= \overline{AB} \cdot C + (A+B) \cdot \bar{C}$$
$$= (\bar{A}+\bar{B}) \cdot C + (A+B)\bar{C}$$

## Implementation Using Basic Gates

The simplified form of the expression is $Y = (\bar{A}+\bar{B}) \cdot C + (A+B) \cdot \bar{C}$



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## Aim

1. To verify de-morgan's law for two variables.
2. To simplify the given expression using de-morgan's law and implement using basic gates.

$Y = \overline{(AB + \bar{C})(\overline{A+B} + C)}$

## Components Required

IC 7404, IC 7408, IC 7432 and connecting wires.

## Theory

In propositional logic and boolean algebra, De Morgan's laws are a pair of transformation rules that are both valid rules of inference. They are named after Augustus De Morgan, a 19-th century British Mathematician. The rules allow the expression of conjunctions and disjunctions purely in terms of each other via negation.

The rules can be expressed in English as follows:

1. The negation of a disjunction is the conjunction of the negations.
2. The negation of a conjunction is the disjunction of the negations.

In electrical and computer engineering, De Morgan's laws are commonly written as follows:

1. $\overline{A \cdot B} = \bar{A} + \bar{B}$
2. $\overline{A + B} = \bar{A} \cdot \bar{B}$

where:

· is the logical AND

+ is the logical OR

the overbar is the logical NOT of what is underneath the overbar.

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From the table, it is verified that columns 7 & 8 as well as columns 9 & 10 are the same.

Procedure

1. Place ICs on the bread board.
2. Connect $V_{cc}$ and ground (GND) to their respective pins.
3. Provide input from the switch.
4. Connect the output of LED and verify the laws as per the truth table obtained.
5. Repeat these steps for the simplified expression obtained.

Result

1. Verified De Morgan's law for two variables.
2. Simplified the given expression using De Morgan's law and implemented using basic gates.

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