# Practical No 2
# Implement the given Boolean expressions using minimum number of gates

**Aim**:

a) Verifying De Morgan's laws.
b) Implement other given expressions using minimum number of gates.
c) Implement other given expressions using minimum number of ICs

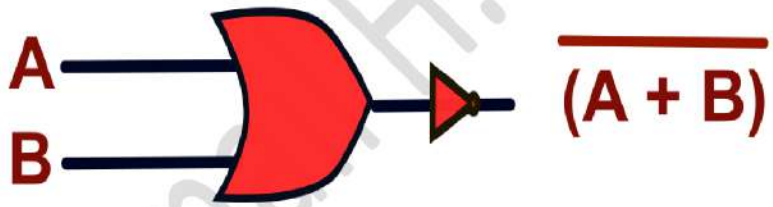
## a) Verifying DeMorgan's laws

**1)** First law: $\overline{A + B} = \overline{A} \cdot \overline{B}$

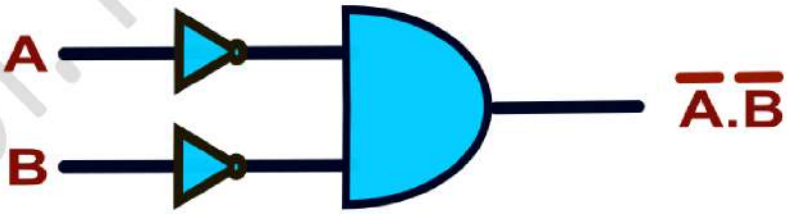
It states that the sum of the complement is equal to the product of the individual complements

**Logic Diagram**

i) Left Hand Side: $\overline{A + B}$




ii) Right Hand Side: $\overline{A} \cdot \overline{B}$



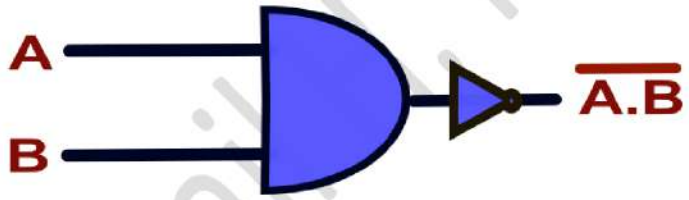
**Truth table**

| Inputs | | Outputs | |
|---|---|---|---|
| A | B | $\overline{A+B}$ | $\overline{A}.\overline{B}$ |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 |

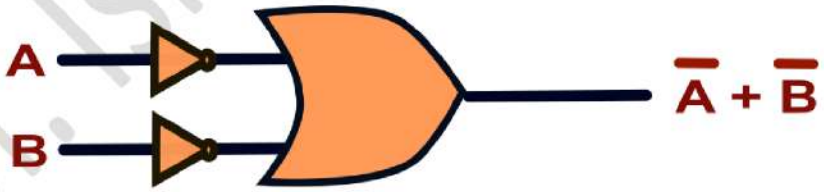
**2)** Second law: $\overline{A.B} = \overline{A} + \overline{B}$
It states that the product of the complement is equal to the sum of the individual complements

**Logic Diagram**

i) Left Hand Side: $\overline{A.B}$




ii) Right Hand Side: $\overline{A} + \overline{B}$




**Truth table**

| Inputs | | Outputs | |
|---|---|---|---|
| A | B | $\overline{A.B}$ | $\overline{A}+\overline{B}$ |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |

b) **Implement other given expressions using minimum number of gates.**

Consider the following Boolean expression

$$Y = A + \overline{A}.B$$

The above expression requires 3-gates, i.e. OR gate, AND gate and NOT gate, we simplify the above expression using some basic laws of Boolean algebra

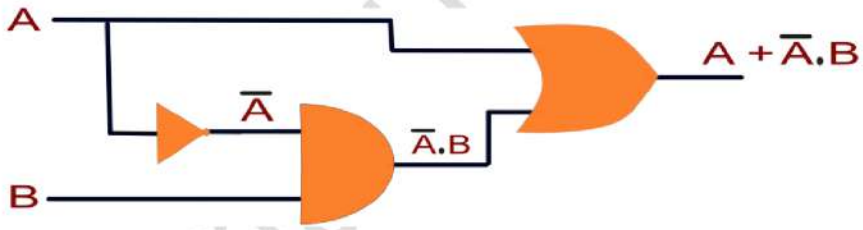
$$Y = A + \overline{A}.B$$
$$Y = A.1 + \overline{A}.B$$
$$Y = A.(1 + B) + \overline{A}.B$$
$$Y = A.1 + B.A + \overline{A}.B$$
$$Y = A + B.(A + \overline{A})$$
$$Y = A + B$$

So, we conclude that the expression $A + \overline{A}.B$ is equivalent to A + B in other words whatever output we get for $A + \overline{A}.B$, the same is obtained using A + B.

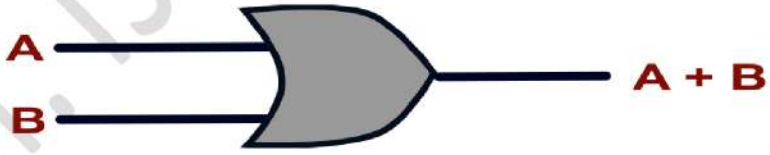
The advantage we get in using the second expression is that we only require 1-OR gate .

**Logic Diagram**

Without reducing the expression:




Reduction the expression using Boolean algebra



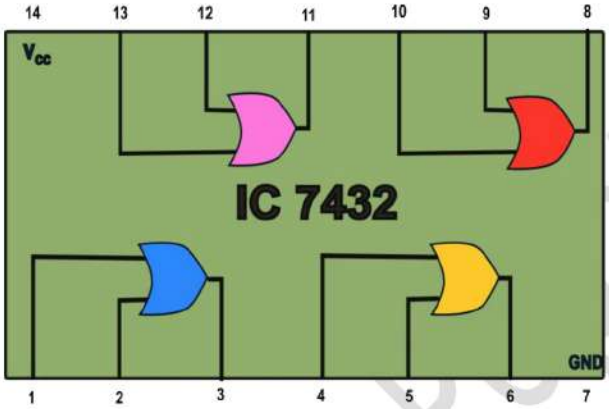

**Truth table:**

| Inputs | | Outputs | |
|---|---|---|---|
| A | B | $A + \overline{A}.B$ | A + B |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 |

c) **Implement other given expressions using minimum number of ICs.**
We use the similar expression used in part b),

$$A + \overline{A}.B = A + B$$

IC 7432 is a quad 2-input OR gate, so we use this IC to realize the given expression




The truth table is similar to the previous part (part B)

**Result:** The DeMorgan's laws have been verified, the given expression was reduced using the basic laws of Boolean algebra and the equivalent expression was verified using Basic gates and also using the IC

For video demonstration of the given practical click on the link below or scan the QR-code

https://youtu.be/pLSIP3DOamo