VERIFICATION OF BOOLEAN THEOREMS

EXP.NO. : 2

AIM:

To study and verify the Boolean theorems using logic gates.

COMPONENTS REQUIRED:

S.No.	Apparatus	Specifications	Quantity
1.	IC Trainer kit	--	1 no
2.	Logic gate IC's	IC 7404, IC 7408	1no each
3.	Logic gate IC's	IC 7402, IC 7486	1no each
4.	Connecting wires	--	1 set

Theorems:

1. **Idempotent laws:**
   a) $x + x = x$
   b) $x.x = x$

2. **Identity law:**
   $x + 1 = x$

3. **Null law:**
   $x.0 = x$

4. **Involution law (or) double negation law:**
   $(x')' = x$

5. **Associative law:**
   $x + (y + z) = (x + y) + z$
   $x.(y.z) = (x.y).z$

6. **Demorgan's law:**
   $(x + y)' = x'.y'$
   $(x.y)' = x' + y'$

7. **Adsorption theorem:**
   $x + (x.y) = x$
   $x.(x + y) = x$

1. Idempotence laws:

TRUTH TABLE

a) $x + x = x$

IC 7432

x	$x + x = x$
0	**0**
1	**1**

b) $x.x = x$

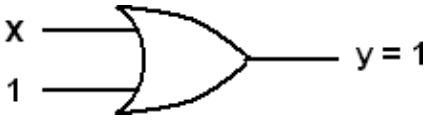
IC 7408

x	$x.x = x$
0	**0**

2. Identity law:

$x + 1 = 1$

IC 7432

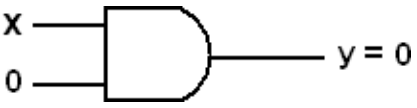


x	$x + 1 =$
0	**1**
1	**1**

3. Null law:

$x.0 = 0$

IC 7408

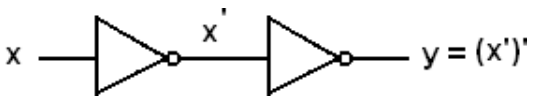


x	$x.0 = 0$
0	**0**

4. Involution law (or) double negation law:

$(x')' = x$

IC 7404 **IC 7404**



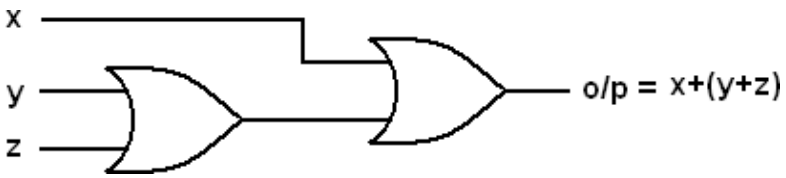
x	x'	$(x')' = x$
0	**1**	**0**

5. Associative law:

a) $x + (y + z) = (x + y) + z$

x	y	z	$y + z$	x+ (y+z)	$x + y$	$(x + y) + z$
0	0	0	0	0	0	0
0	0	1	1	1	0	1
0	1	0	1	1	1	1
0	1	1	1	1	1	1
1	0	0	0	1	1	1
1	0	1	1	1	1	1
1	1	0	1	1	1	1
1	1	1	1	1	1	1

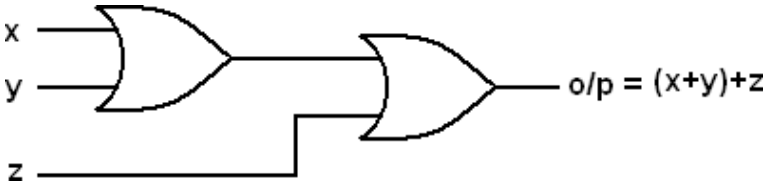
L.H.S



IC 7432 **IC 7432**

R.H.S

IC 7432 **IC 7432**

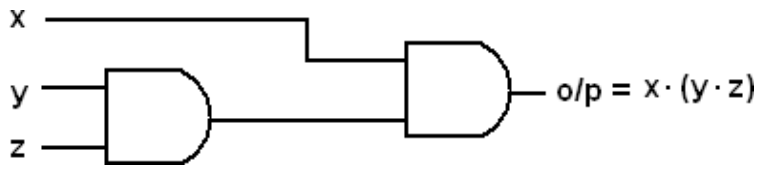


b) $x.(y.z) = (x.y).z$

L.H.S

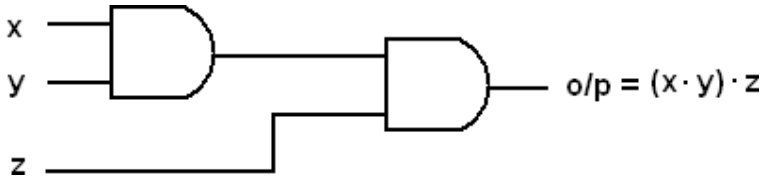
x	y	z	$y.z$	$x.(y.z)$	$x.y$	$(x.y).z$
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	1	0	0	0	0	0
0	1	1	1	0	0	0
1	0	0	0	0	0	0
1	0	1	0	0	0	0
1	1	0	0	0	1	0
1	1	1	1	1	1	1

IC 7408 **IC 7408**



R.H.S

IC 7408 **IC 7408**



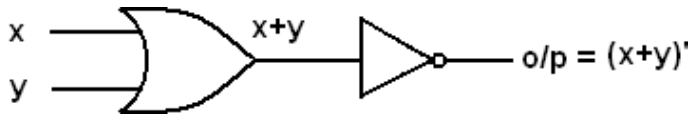
6. Demorgan's law:

a) $(x + y)' = x'.y'$

L.H.S

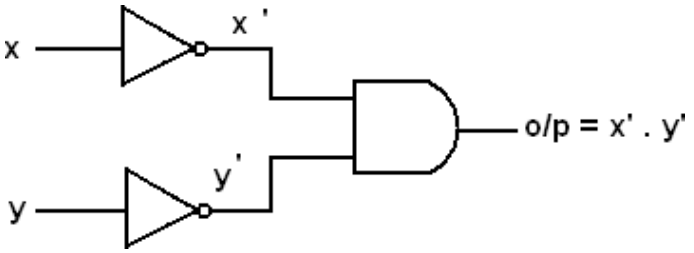
IC 7432 **IC 7404**

x	Y	$x + y$	$(x + y)'$	x'	y'	$x'.y'$
0	**0**	**0**	**1**	**1**	**1**	**1**
0	**1**	**1**	**0**	**1**	**0**	**0**
1	**0**	**1**	**0**	**0**	**1**	**0**
1	**1**	**1**	**0**	**0**	**0**	**0**



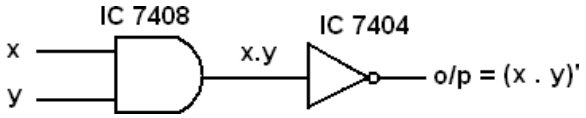
R.H.S

IC 7404 **IC 7408**



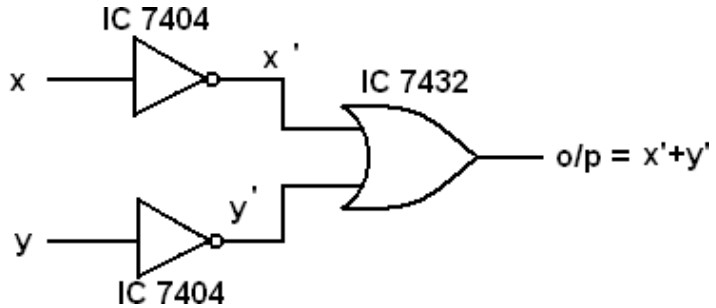
b) $(x.y)' = x' + y'$

L.H.S



x	Y	x.y	(x.y) ′	x′	y′	x′+y′
0	**0**	**0**	**1**	**1**	**1**	**1**
0	**1**	**0**	**1**	**1**	**0**	**1**
1	**0**	**0**	**1**	**0**	**1**	**1**
1	**1**	**1**	**0**	**0**	**0**	**0**

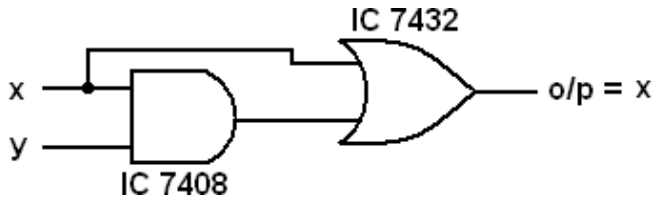
R.H.S



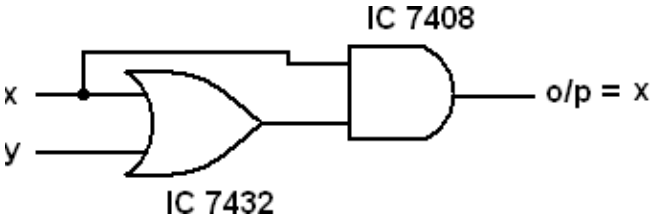
7. Adsorption theorem:

a) $x + (x.y) = x$

x	y	$x.y$	$x + (x.y) = x$
0	**0**	**0**	**0**
0	**1**	**0**	**0**
1	**0**	**0**	**1**



b) $x.(x+y) = x$



x	y	$x + y$	$x.(x+y) = x$
0	**0**	**0**	**0**
0	**1**	**1**	**0**
1	**0**	**1**	**1**
1	**1**	**1**	**1**

Procedure:

1. **Connections are made as per the circuit diagram for each of the theorems.**
2. **Switch on the IC trainer kit.**
3. **Apply logic inputs 0 or 1 to input variables**
4. **Verify the truth table by observing the output indicators for all the theorems.**

Result:

Thus, the Boolean theorems and Laws are studied and verified using logic gates.