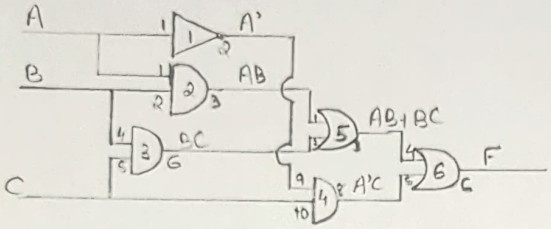
II) Pre-Lab →

a) $F = AB + A'C + BC$



b)

Inputs			Outputs				
A	B	C	A'	AB	A'C	BC	F = AB + A'C + BC
0	0	0	1	0	0	0	0
0	0	1	1	0	1	0	1
0	1	0	1	0	0	0	0
0	1	1	1	0	1	1	1
1	0	0	0	0	0	0	0
1	0	1	0	0	0	0	0
1	1	0	0	1	0	0	1
1	1	1	0	1	0	1	1

c) $F = AB + A'C + BC$

$= AB + A'C + BC(A' + A)$

$= AB + A'C + A'BC + ABC$

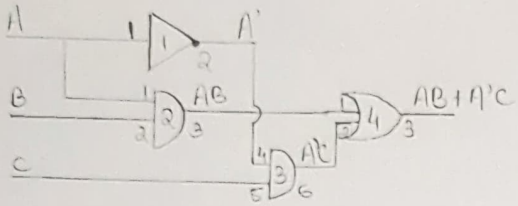
$= AB(1 + C) + A'C(1 + B)$

$= AB + A'C$

Inputs			Outputs			
A	B	C	A'	AB	A'C	AB' + A'C
0	0	0	1	0	0	0
0	0	1	1	0	1	1
0	1	0	1	0	0	0
0	1	1	1	0	1	1
1	0	0	0	0	0	0
1	0	1	0	0	0	0
1	1	0	0	1	0	1
1	1	1	0	1	0	1

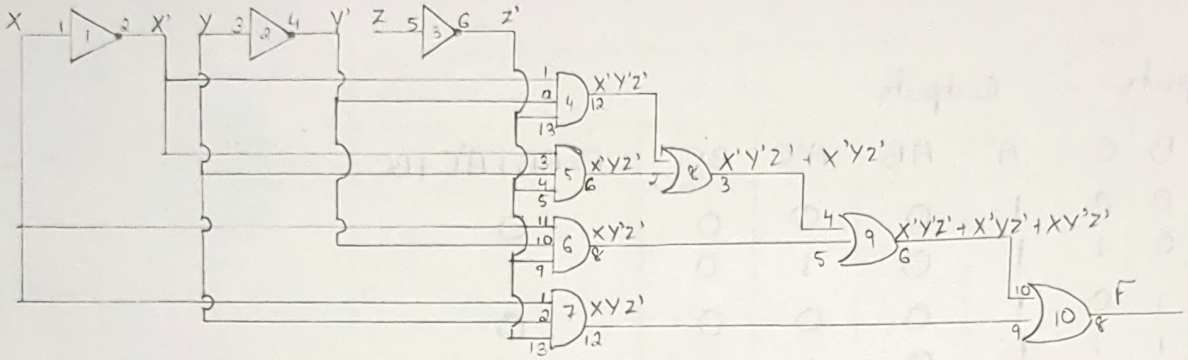
∴ $AB + A'C$ has the same output as F.

d) $F = AB + A'C$



2) i) $F = X'Y'Z' + X'YZ' + XY'Z' + XYZ'$

a)



Inputs			Outputs							
X	Y	Z	X'	Y'	Z'	X'Y'Z'	X'YZ'	XY'Z'	XYZ'	F
0	0	0	1	1	1	1	0	0	0	1
0	0	1	1	1	0	0	0	0	0	0
0	1	0	1	0	1	0	1	0	0	1
0	1	1	1	0	0	0	0	0	0	0
1	0	0	0	1	1	0	0	1	0	1
1	0	1	0	1	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	1	1
1	1	1	0	0	0	0	0	0	0	0

b) $F = X'Y'Z' + X'YZ' + XY'Z' + XYZ'$

$= X'Z'(Y' + Y) + XZ'(Y + Y')$

$= X'Z' + XZ'$

$= Z'(X + X')$

$= Z'$

c) Y

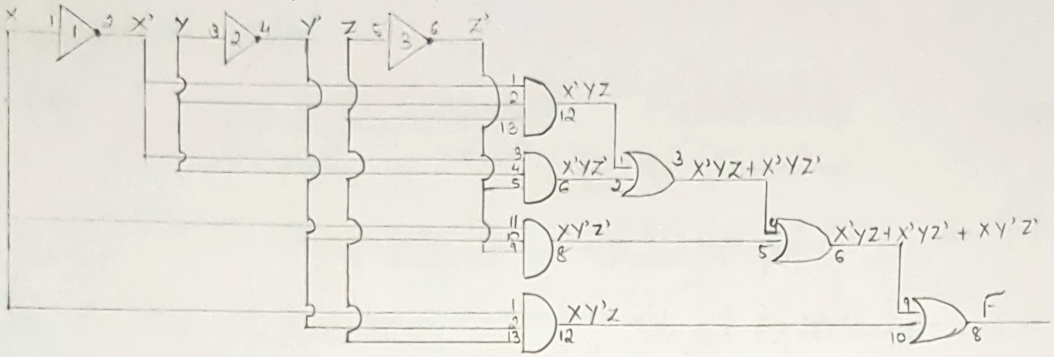
Y

Z Z'

Inputs			Outputs	
X	Y	Z	Z'	
0	0	0	1	Same as F
0	0	1	0	
0	1	0	1	
0	1	1	0	
1	0	0	1	
1	0	1	0	
1	1	0	1	
1	1	1	0	

a) $F = x'yz + x'yz' + xy'z' + xy'z$

b)



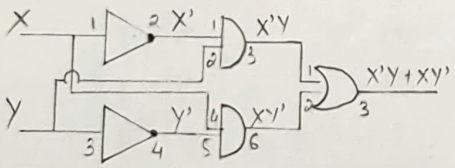
Inputs			Outputs							
X	Y	Z	X'	Y'	Z'	X'YZ	X'YZ'	XY'Z'	XY'Z	F
0	0	0	1	1	1	0	0	0	0	0
0	0	1	1	1	0	0	0	0	0	0
0	1	0	1	0	1	0	1	0	0	1
0	1	1	1	0	0	1	0	0	0	1
1	0	0	0	1	1	0	0	1	0	1
1	0	1	0	1	0	0	0	0	1	1
1	1	0	0	0	1	0	0	0	0	0
1	1	1	0	0	0	0	0	0	0	0

b) $F = x'yz + x'yz' + xy'z' + xy'z$

$= x'y(z+z') + xy'(z'+z)$

$= x'y + xy'$

c)

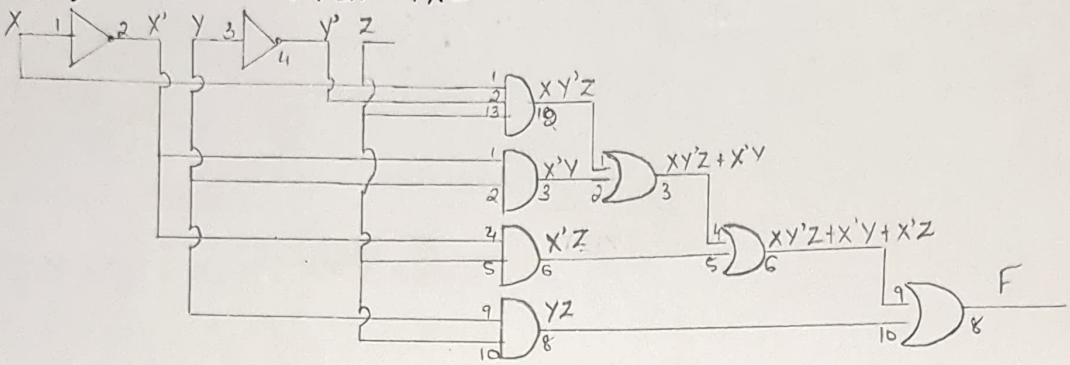


Inputs		Outputs				
X	Y	X'	Y'	X'Y'	X'Y	X'Y + XY'
0	0	1	1	0	0	0
0	0	1	1	0	0	0
0	1	1	0	0	1	1
0	1	1	0	0	1	1
1	0	0	1	1	0	1
1	0	0	1	1	0	1
1	1	0	0	0	0	0
1	1	0	0	0	0	0

$\therefore X'Y + XY'$ has the same output as F.

3) $F(x,y,z) = xy'z + x'y + yz' + x'z$

a)



Inputs			Outputs						
X	Y	Z	X'	Y'	XY'Z	X'Y	YZ	X'Z	F
0	0	0	1	1	0	0	0	0	0
0	0	1	1	1	0	0	0	1	1
0	1	0	1	0	0	1	0	0	1
0	1	1	1	0	0	1	1	1	1
1	0	0	0	1	0	0	0	0	0
1	0	1	0	1	1	0	0	0	1
1	1	0	0	0	0	0	0	0	0
1	1	1	0	0	0	0	1	0	1

b) $F(x,y,z) = xy'z + x'y + x'z + yz$

$= z(xy' + y) + x'(y+z)$

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

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

$= zx + zy + x'y + x'z$

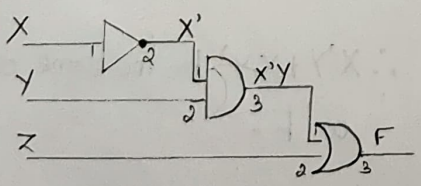
$= z(x' + x) + x'y + zy$

$= \cancel{z(y+1)} + z + x'y + zy$

$= z(y+1) + x'y$

$= z + x'y$

c)



Inputs			Outputs		
X	Y	Z	X'	X'Y	Z+X'Y
0	0	0	1	0	0
0	0	1	1	0	1
0	1	0	1	1	1
0	1	1	1	1	1
1	0	0	0	0	0
1	0	1	0	0	1
1	1	0	0	0	0
1	1	1	0	0	1

LAB →

Components Required →

Sl. No.	Name of the Component	Specification	Quantity
1	7404 IC	Hex Inverter	1
2	7408 IC	Quad 2 input AND Gates	1
3	7411 IC	3 input AND Gate	2
4	7432 IC	Quad 2 input OR Gate	1
5	Universal Trainer Kit	–	1
6	Connecting Wires	23 S WG	As required

Observation →

1) $F = AB + A'C + BC$

Inputs			Theoritical Output		Practical Output in both the cases
A	B	C	AB+A'C+BC	AB+A'C	
0	0	0	0	0	0
0	0	1	1	1	1
0	1	0	0	0	0
0	1	1	1	1	1
1	0	0	0	0	0
1	0	1	0	0	0
1	1	0	1	1	1
1	1	1	1	1	1

2) a) $F = X'Y'Z' + X'YZ' + XY'Z' + XYZ'$

Inputs			Theoritical Output		Practical Output
X	Y	Z	F	Z'	in both the cases
0	0	0	1	1	1
0	0	1	0	0	0
0	1	0	1	1	1
0	1	1	0	0	0
1	0	0	1	1	1
1	0	1	0	0	0
1	1	0	1	1	1
1	1	1	0	0	0

b) $F = X'YZ + X'YZ' + XY'Z + XY'Z$

Inputs			Theoritical Output		Practical Output
X	Y	Z	F	X'Y + XY'	in both the cases
0	0	0	0	0	0
0	0	1	0	0	0
0	1	0	1	1	1
0	1	1	1	1	1
1	0	0	1	1	1
1	0	1	1	1	1
1	1	0	0	0	0
1	1	1	0	0	0

3) $F(X, Y, Z) = XY'Z + X'Y + YZ + X'Z$

Inputs			Theoritical Output		Practical Output
X	Y	Z	F	Z + X'Y	in both the cases
0	0	0	0	0	0
0	0	1	1	1	1
0	1	0	1	1	1
0	1	1	1	1	1
1	0	0	0	0	0
1	0	1	1	1	1
1	1	0	0	0	0
1	1	1	1	1	1

Conclusion →

This experiment Implementing Boolean functions using logic gates. Some basics of logic gates (AND, OR, NOT) in sum of product representation of equations and their implementation using logic gates and 7411 IC, 3 input AND gate is also used.

IV) Post Lab →

Ans.

1) Using Boolean laws, we can minimize a function which helps us to reduce the number of literals and construct the circuit using minimum number of gates.

2) We can represent the Boolean function using 2 forms i.e.

   i) Standard form
   ii) Canonical form

3) $ABCF + ACEF + ACDF$

$= ACF(B+E+D)$