RAJSHAHI UNIVERSITY OF ENGINEERING AND TECHNOLOGY

LAB REPORT - 03

COURSE NAME: SESSIONAL BASED ON CSE 2103
COURSE CODE: CSE 2104

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4.1) Experiment Name: Implement Various Logic Functions (For Example F(a, b, c, d) = SOP (0, 2, 3, 4, 6, 10, 14, 15)).

Objectives:

- To learn about Boolean algebra.
- To understand what are combinational logic circuits.
- To learn about canonical & standard form.
- To learn about using the sum-of-products method to design a logic circuit based on a design truth table.
- To learn about how to simplify Boolean expression.
- To learn about maxterm & minterm & how to findout these.

Theory: Digital circuit operates using digital signals.These signals have discrete binary values: zero and one.Zero signifies the false state while one signifies the true state.Boolean algebra is a type of algebra that helps to represent binary numbers and binary variables. Canonical form is a method of representing Boolean functions of Boolean algebra while standard form is a simplified version of canonical form.

Minterm: A product term in which all the variables appear exactly once, either complemented or uncomplemented.Denoted by m_j,where j is the decimal equivalent of the minterm's corresponding binary combination (b_j).
Maxterm: A sum term in which all the variables appear exactly once, either complemented or Uncomplemented.Denoted by M_j,where j is the decimal equivalent of the maxterm's corresponding binary combination (b_j).

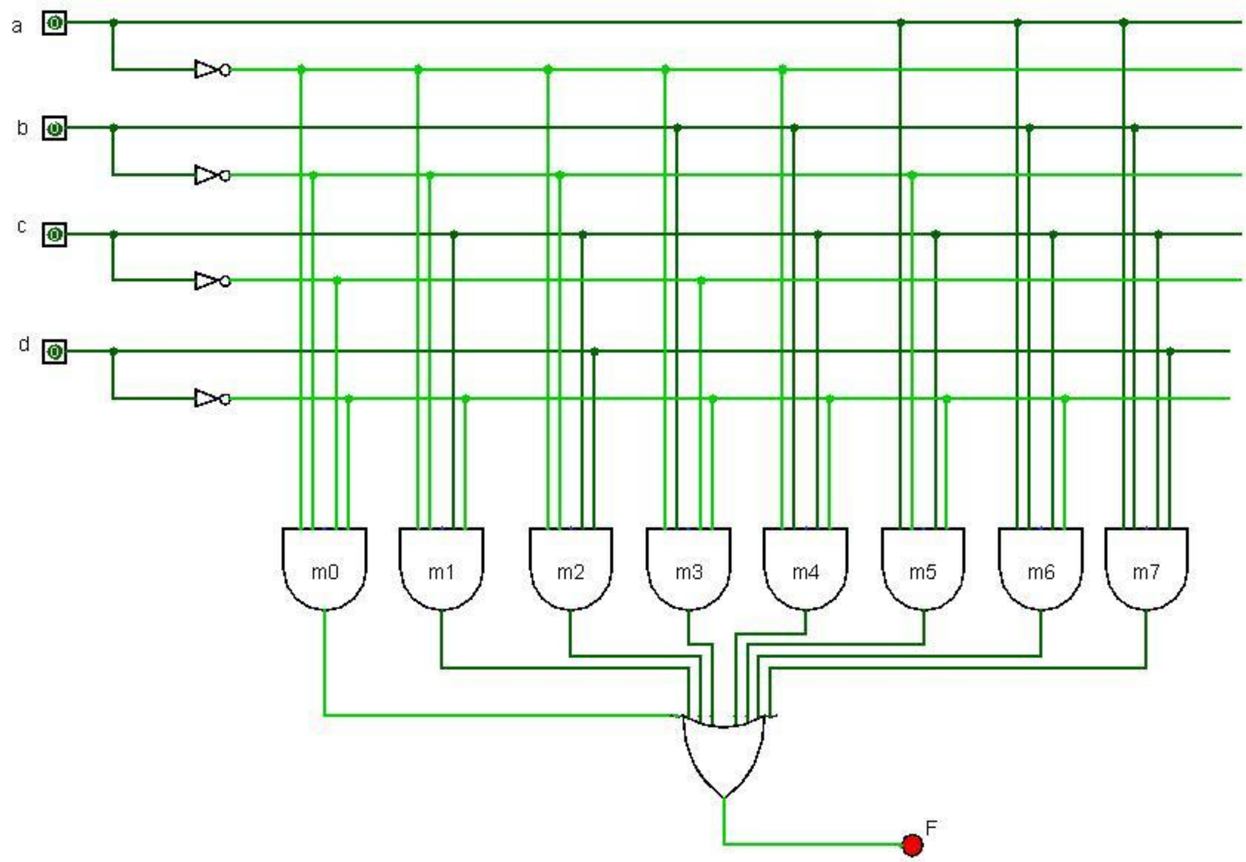
Truth Table notation for Minterms and Maxterms:

x	y	z		Minterm	Maxterm
0	0	0		$x'y'z' = m_0$	$x+y+z = M_0$
0	0	1		$x'y'z = m_1$	$x+y+z' = M_1$
0	1	0		$x'yz' = m_2$	$x+y'+z = M_2$
0	1	1		$x'yz = m_3$	$x+y'+z' = M_3$
1	0	0		$xy'z' = m_4$	$x'+y+z = M_4$
1	0	1		$xy'z = m_5$	$x'+y+z' = M_5$
1	1	0		$xyz' = m_6$	$x'+y'+z = M_6$
1	1	1		$xyz = m_7$	$x'+y'+z' = M_7$

Experimental Analysis:

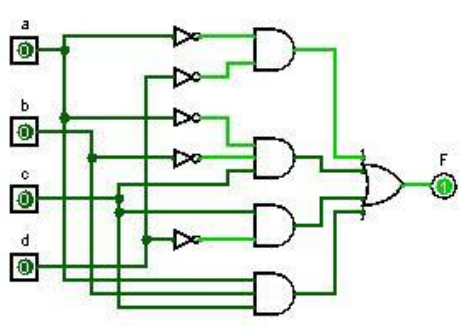
- **Circuit Diagram:**

4.1.1- Drag & drop circuit diagram:



4.1.1-(Drag & drop) Implement Various Logic functions (For example F(a,b,c,d) = SOP(0,2,3,4,6,10,14,15)

4.1.2-Analyse circuit diagram:



4.1.2-(Analyse) Implement Various Logic functions (For example F(a,b,c,d) = SOP(0,2,3,4,6,10,14,15)

)

- **Truth Table:**

a	b	c	d	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Conclusion: In this experiment,we discussed about canonical form,it’s characteristics and diagram.

4.2) Experiment Name: Verify the result of simplified version of F in 1.

Objectives:

- To learn about how to simplify Boolean expression.
- To learn about how to use rules of Boolean expression.

Theory: In Boolean algebra simplification, a Boolean expression is translated to another form with less number of terms and operations.

Simplification: $\bar a\bar b\bar c\bar d + \bar a\bar b c\bar d + \bar a\bar b cd + \bar a bc\bar d + \bar a b\bar c\bar d + a\bar b c\bar d + abc\bar d + abcd$

$$\Rightarrow \bar a\bar b\bar d + \bar a\bar b cd + \bar a bc\bar d + \bar a b\bar c\bar d + a\bar b c\bar d + abc\bar d + abcd \quad [\because c+\bar c = 1]$$

$$\Rightarrow \bar a\bar d(\bar b + bc) + \bar a\bar b cd + \bar a b\bar c\bar d + a\bar b c\bar d + abc\bar d + abcd.$$

$$\Rightarrow \bar a\bar d(\bar b + c) + \bar a\bar b cd + \bar a b\bar c\bar d + a\bar b c\bar d + abc\bar d + abcd$$

$$\Rightarrow \bar a\bar d(\bar b + c + b\bar c) + \bar a\bar b cd + a\bar b c\bar d + abc\bar d + abcd$$

$$\Rightarrow \bar a\bar d\{(\bar b + c + b)(\bar b + c + \bar c)\} + \bar a\bar b cd + a\bar b c\bar d + abc\bar d + abcd.$$

$$\Rightarrow \bar a\bar d + \bar a\bar b cd + a\bar b c\bar d + abc(d + \bar d)$$

$$\Rightarrow \bar a\bar d + \bar a\bar b cd + a\bar b c\bar d + abc$$

$$\Rightarrow \bar a\bar d + \bar a\bar b cd + ac(b + \bar b\bar d)$$

$$\Rightarrow \bar a\bar d + \bar a\bar b cd + ac\bar d + abc.$$

$$\Rightarrow \bar d(\bar a + ac) + \bar a\bar b cd + abc$$

$$\Rightarrow \bar d(\bar a + c) + \bar a\bar b cd + abc$$

$$\Rightarrow \bar a\bar d + c\bar d + \bar a\bar b cd + abc.$$

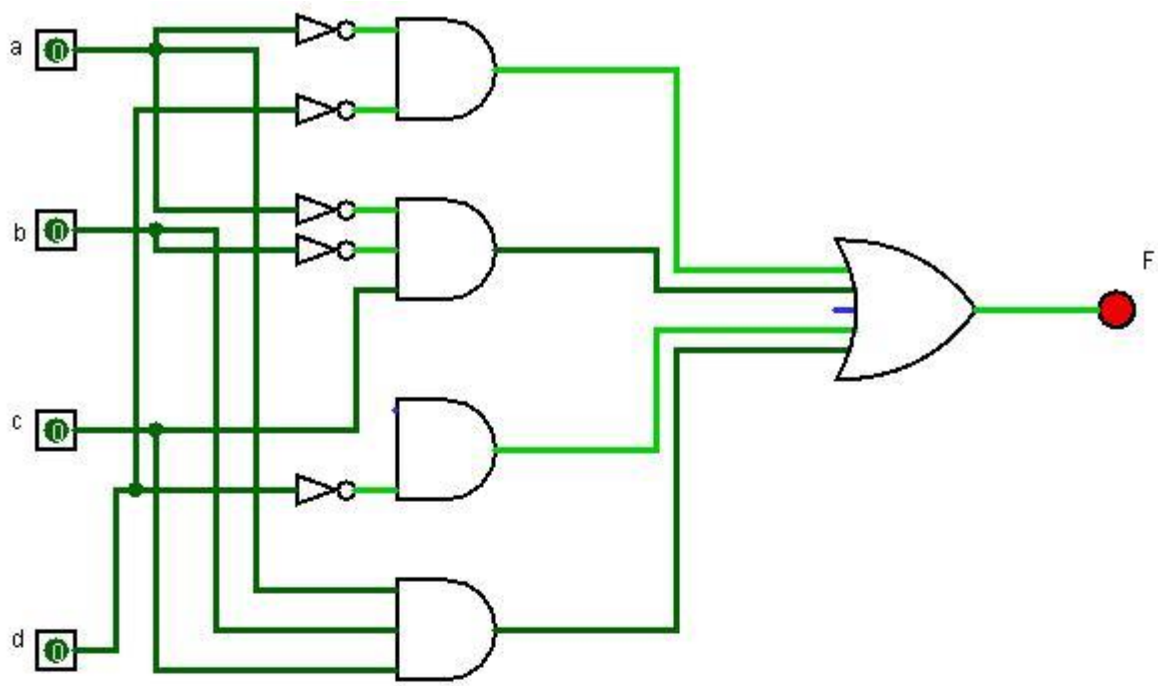
$$\cancel{\Rightarrow \bar a\bar d + c\{(\bar d + \bar a\bar b)\cdot(\bar d + d)\} + ab}$$

$$\Rightarrow \bar a\bar d + c(\bar d + \bar a\bar b) + abc$$

$$\Rightarrow \bar a\bar d + c\bar d + \bar a\bar b c + abc$$

Experimental Analysis:

- **Circuit Diagram:**



4.2-Verify the result of simplifiied version of F in 1.

- **Truth Table:**

a	b	c	d	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Conclusion: We can say that the result of simplified version of F in 1 is verified.