RAJSHAHI UNIVERSITY OF ENGINEERING AND TECHNOLOGY

LAB FINAL REPORT

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

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1) Experiment Name: F = POS (2, 6, 8, 9, 10, 12, 14)

Objectives:

- To learn about Boolean algebra.
- To understand what are combinational logic circuits.
- To learn about canonical & standard form.
- To learn about using the product-of-sums 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.

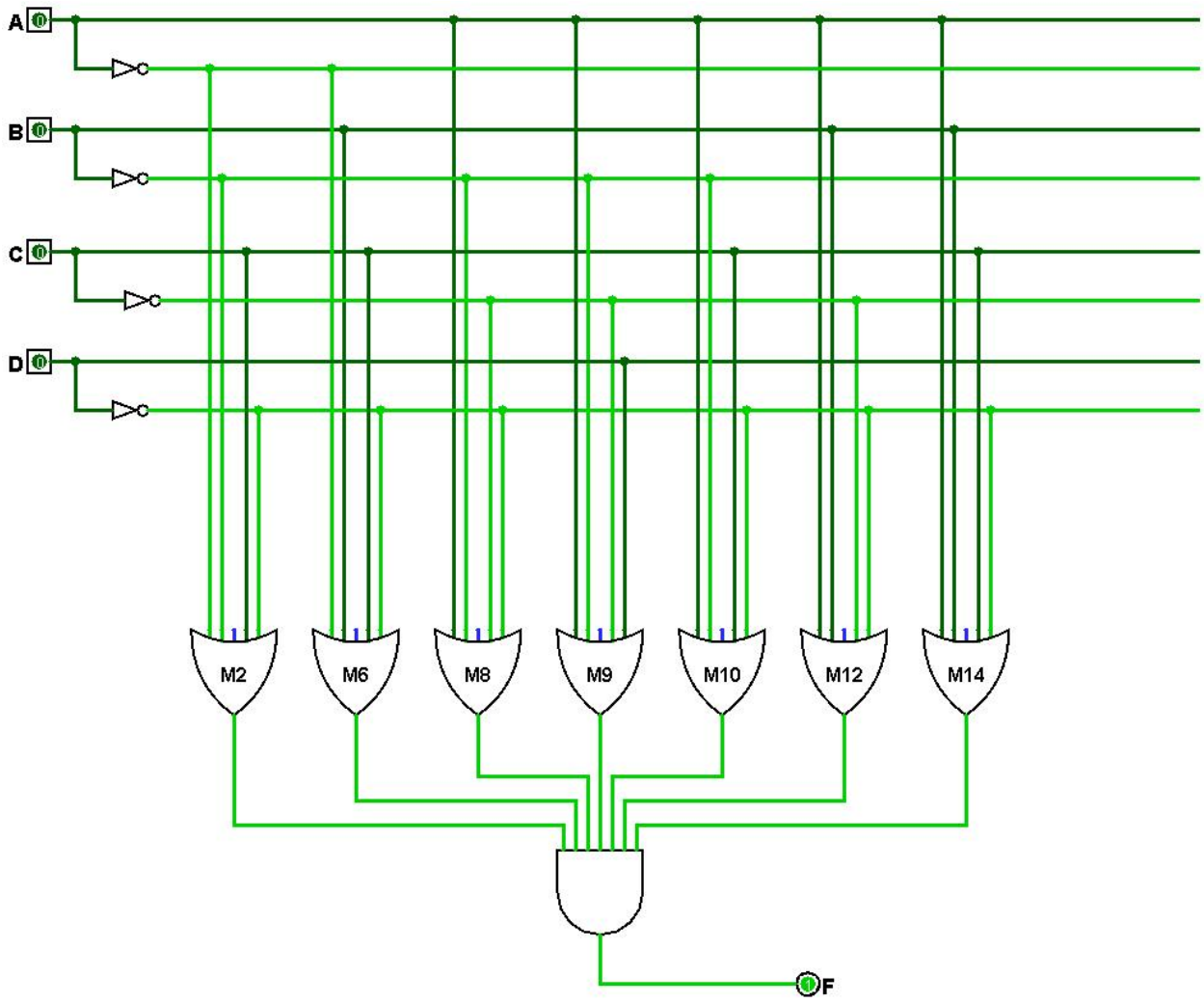
Theory: Digital circuit operates using digital signals.These signals have discrete binary values: zero and one.Zero signifies the false state while one signifies the true state.Boolean algebra is a type of algebra that helps to represent binary numbers and binary variables. Canonical form is a method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

Experimental Analysis:

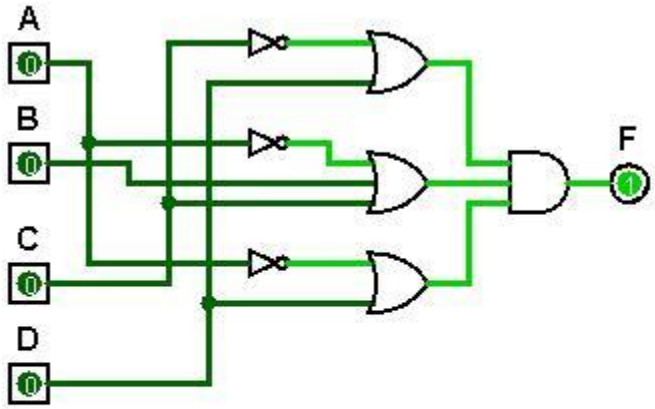
- **Circuit Diagram:**

1.1- (Drag & drop) F = POS (2, 6, 8, 9, 10, 12, 14):



1. (Drag & drop) F = POS(2,6,8,9,10,12,14)

1.2- (Analyse Circuit) F = POS (2, 6, 8, 9, 10, 12, 14):



1. (Analyse) F = POS(2,6,8,9,10,12,14)

- **Truth Table:**

A	B	C	D	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Conclusion: In this experiment,we discussed about canonical form (Product of sums-POS) ,it's characteristics and diagram.

2) Experiment Name: Simplified version of F.

Objectives:

- To learn about how to simplify Boolean expression.
- To learn about karnaugh map.

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

Karnaugh map simplification:

CD \ BA	00	01	11	10
00	m_0	m_4	m_{12} 0	m_8 0
01	m_1	m_5	m_{13}	m_9 0
11	m_3	m_7	m_{15}	m_{11}
10	m_2 0	m_6 0	m_{14} 0	m_{10} 0

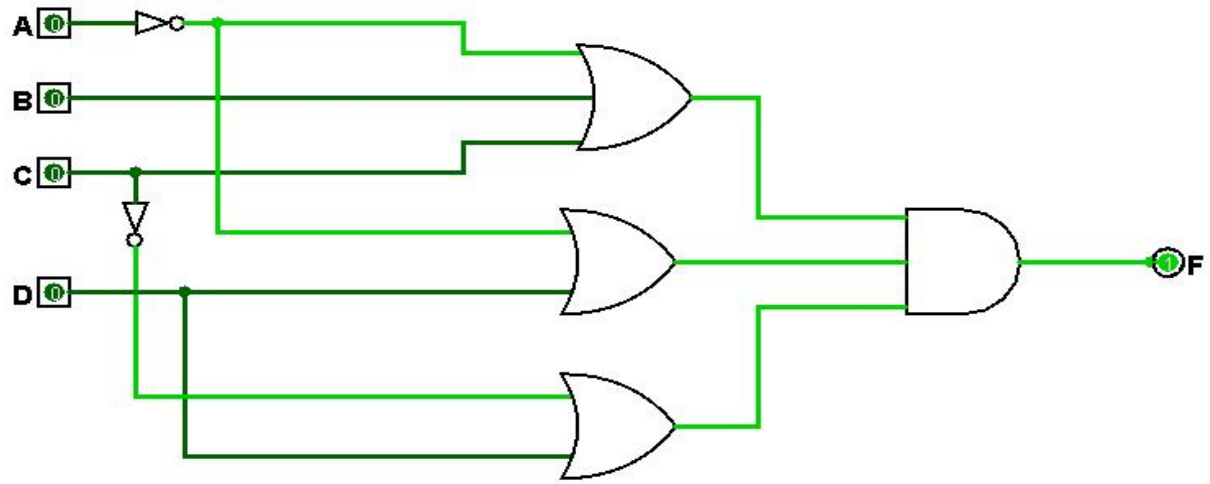
From Karnaugh map solution we get:

F =$(\bar{A} + B + C)(\bar{A} + D)(\bar{C} + D)$

Experimental Analysis:

- **Circuit Diagram:**

2- Simplified Version of F:



2. Simplified version of F

- **Truth Table:**

A	B	C	D	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

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

3) Experiment Name: Design a counter that counts 1, 5, 3, 2, 4, 1 by using T flip-flops.

Objectives:

- To know the characteristics of a Counter
- To know how to draw a Counter by using T Flip-Flops.
- To generate the truth table of Counter by using T Flip-Flops.
- To verify the output of Counter.

Theory: A Counter is a device which stores the number of times a particular event or process has occurred, often in relationship to a clock signal. Counters are used in digital electronics for counting purpose, they can count specific event happening in the circuit.

A flip flop is an electronic circuit with two stable states that can be used to store binary data. A T flip-flop is like a JK flip-flop. These are basically a single input version of JK flip-flops. This modified form of JK flip-flop is obtained by connecting both inputs J and K together. It has only one input along with the clock input.

T	Q	Q (t+1)
0	0	0
1	0	1
0	1	1
1	1	0

For the problem we get from karnaugh map:

T_C:

C \ BA	00	01	11	10
0	X	1	0	1
1	1	1	X	X

T_B:

C \ BA	00	01	11	10
0	X	0	0	1
1	0	1	X	X

T_A:

C \ BA	00	01	11	10
0	X	0	1	0
1	1	0	X	X

From kmap solution we get-

T_A: $\bar{B}\bar{A}$ + AB

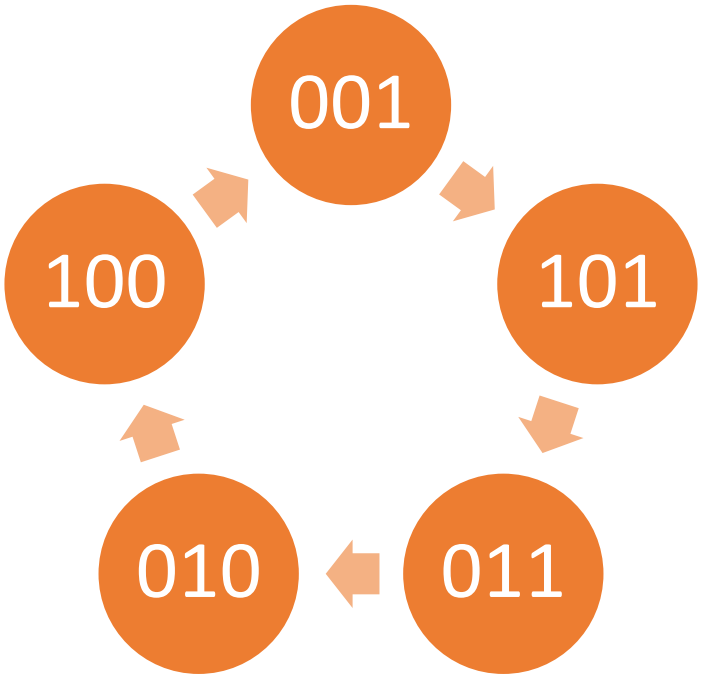
T_B: CA + B$\bar{A}$

T_C: $\bar{B}$ + $\bar{A}$

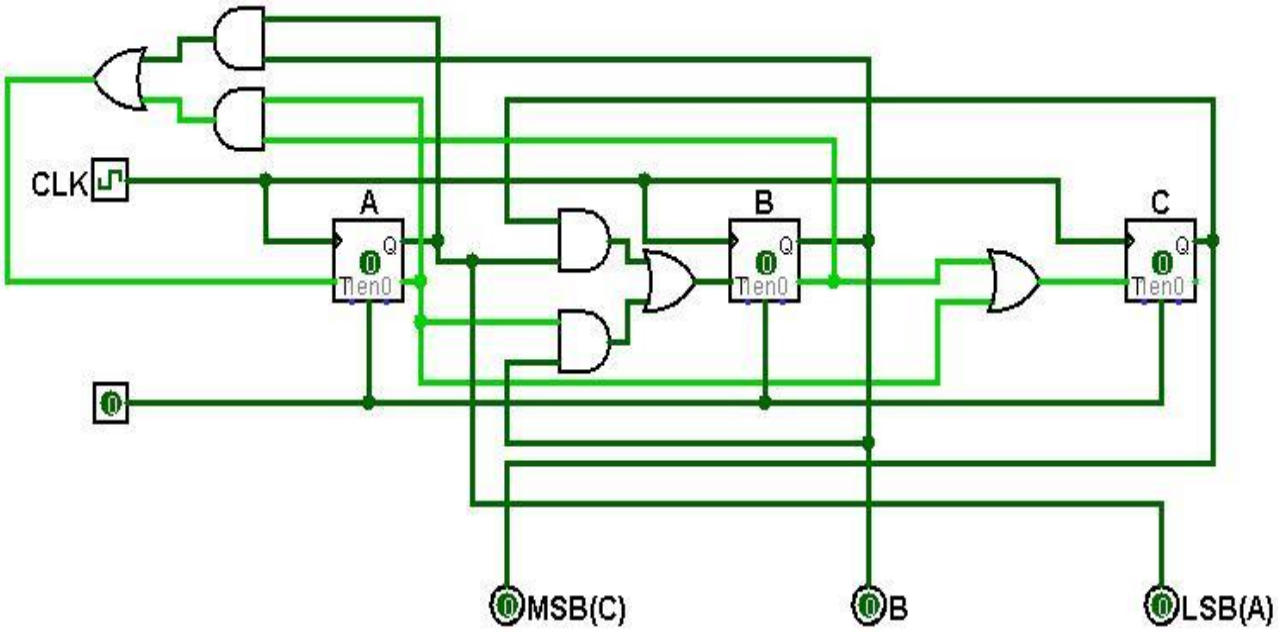
Experimental Analysis:

- **Circuit Diagram:**

State transition diagram:



3- Design a counter that counts 1, 5, 3, 2, 4, 1 by using T flip-flops:



3.Design a counter that counts 1,5,3,2,4,1 by using T flip-flops

- **Circuit Excitation Table:**

Q_T			Q_{T+1}			T_C	T_B	T_A
0	0	1	1	0	1	1	0	0
1	0	1	0	1	1	1	1	0
0	1	1	0	1	0	0	0	1
0	1	0	1	0	0	1	1	0
1	0	0	0	0	1	1	0	1

Conclusion: In this experiment,we discussed about a Counter by using T Flip-Flops.