Lab 4

To Simplify Boolean Expressions and Implement Respective Digital Circuits Using Karnaugh Map

Note: For examples, refer to the following link: https://www.geeksforgeeks.org/introduction-of-k-map-karnaugh-map

Tasks

1. **Construct K-Map for the function given below. Show the simplified output expression and verify the output with the help of software simulation.**

   $Z = f(A,B) = \overline{A}\,\overline{B} + A\,\overline{B} + \overline{A}B$

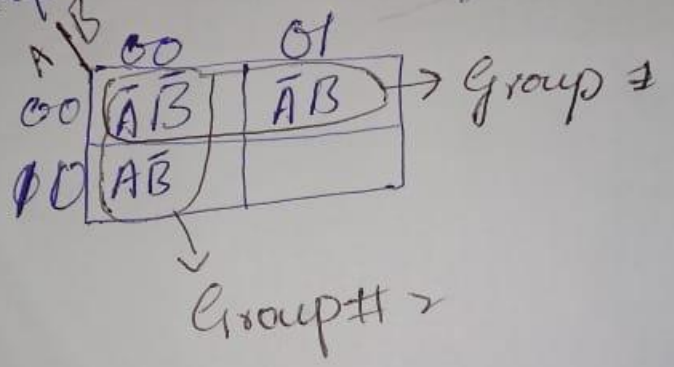
   K-Map

Q no 1

Construct K-maping table

$Z = f(A.B) = \bar{A}\bar{B} + A\bar{B} + \bar{A}C$

K-Map



group 1 = A

Group 2 = B

So, $\boxed{F = A + B}$

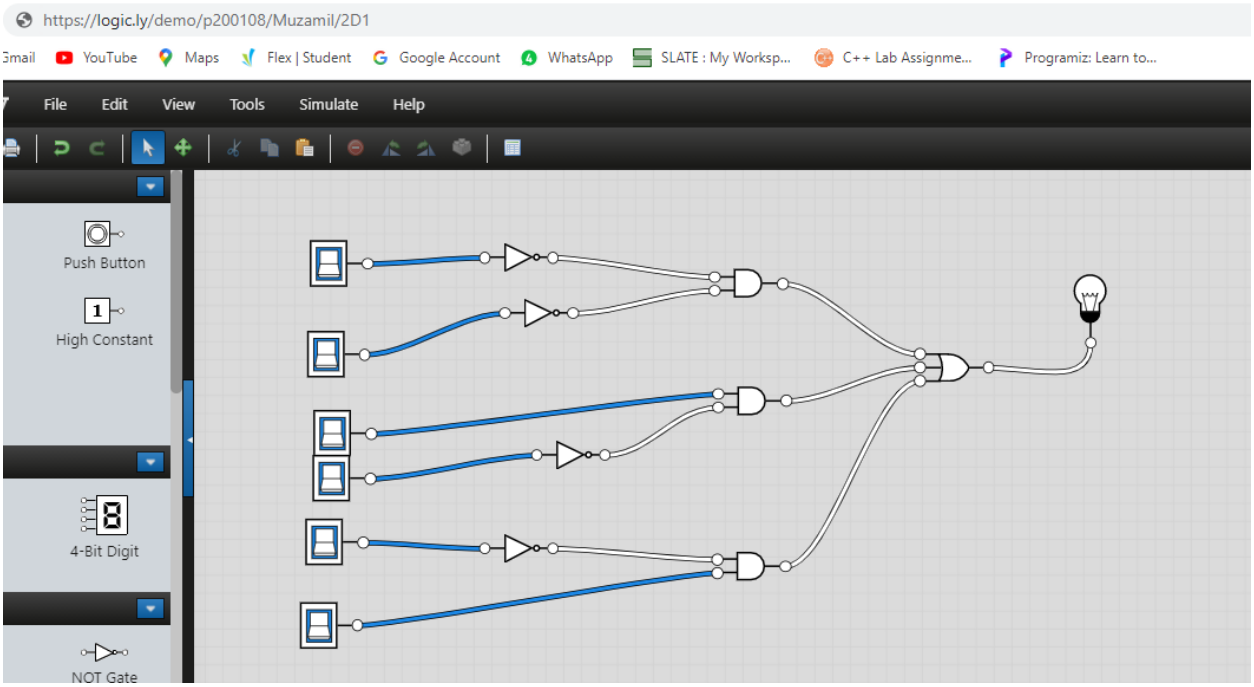
Simplified Output Function

F=A+B

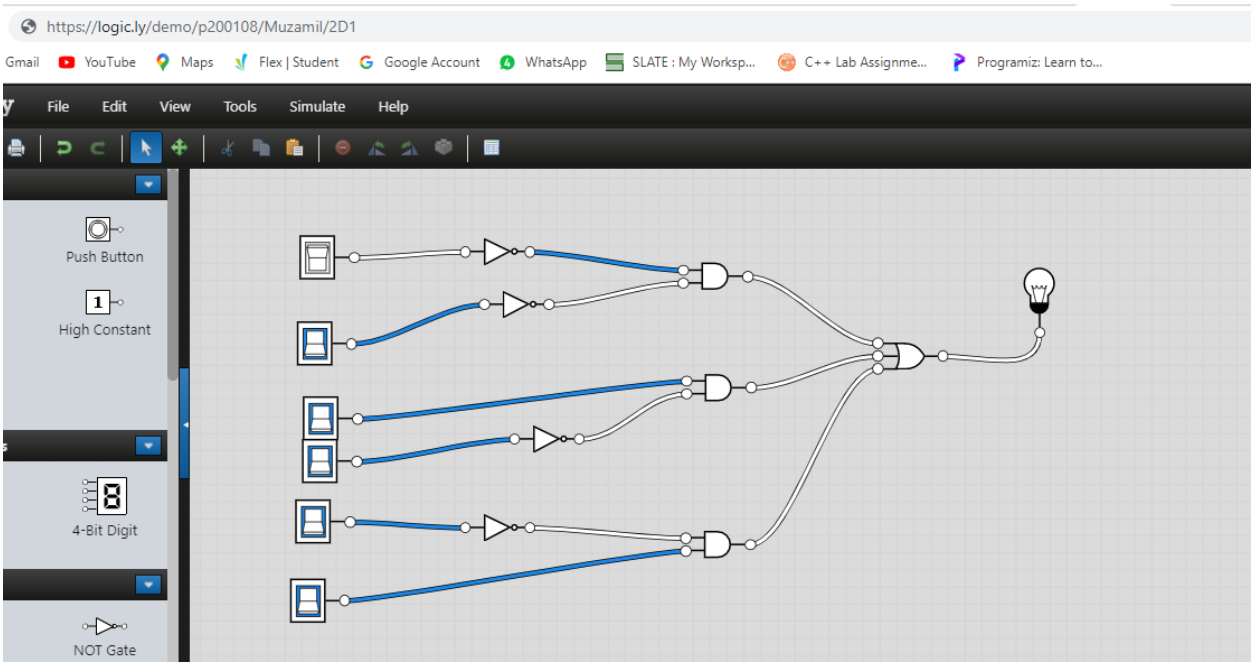
Software Simulation of Logic Circuit From Simplified Function

(Show here your results for each combination)

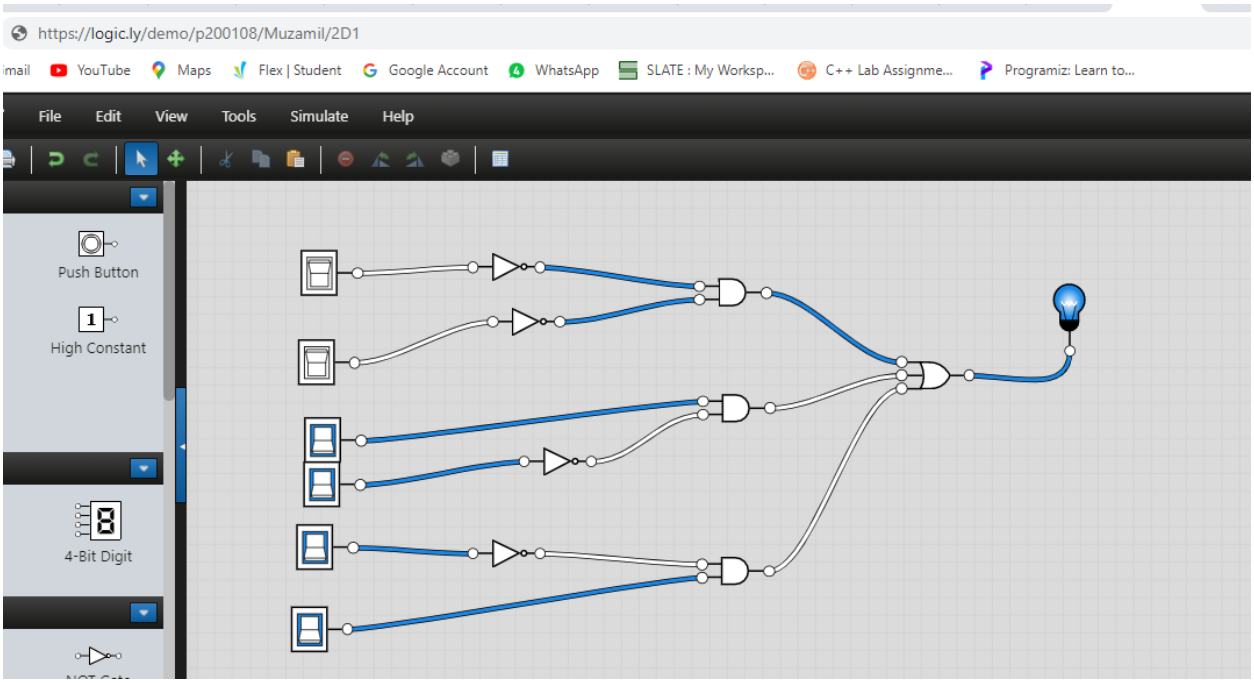
inPUts are 111111 and output is 0



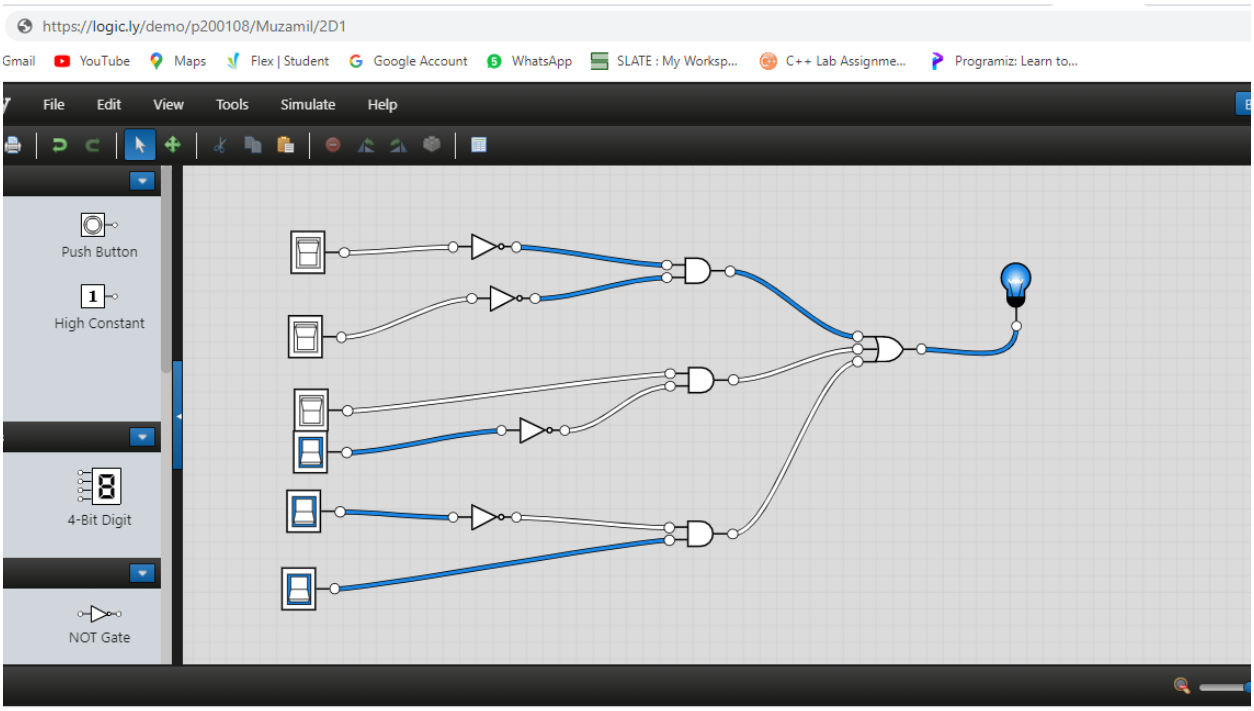
Inputs are 011111 and output is 0



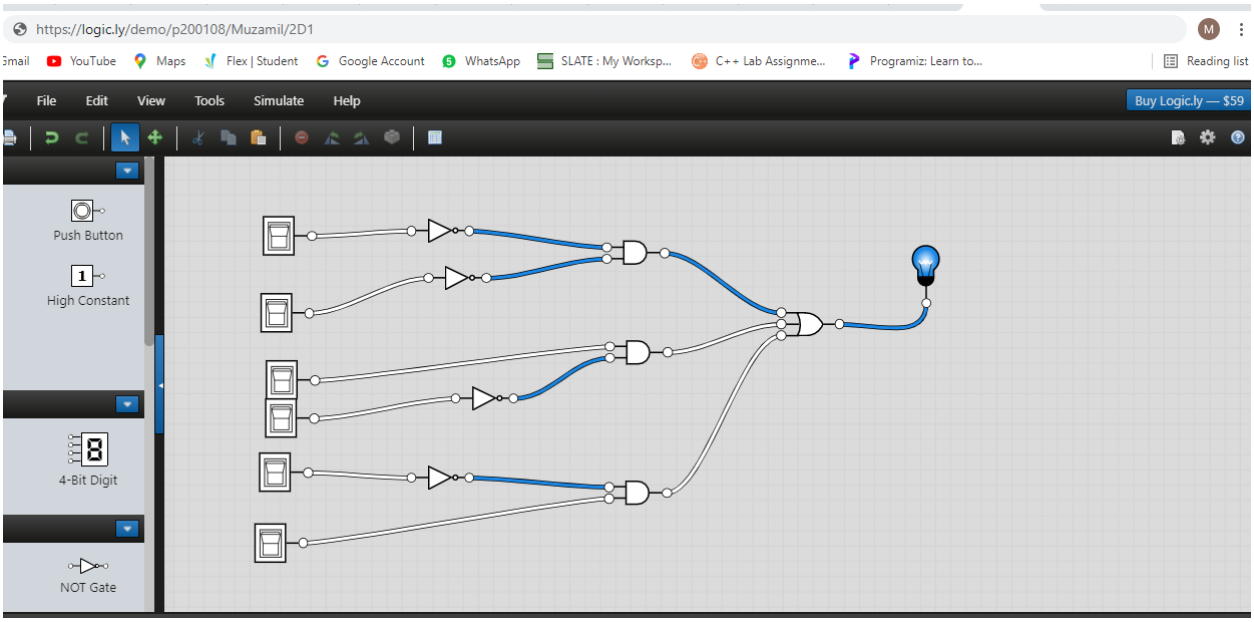
Inputs are 001111 and output is 1



Inputs are 000111 and output is 1



Inputs are 000000 and output is 1



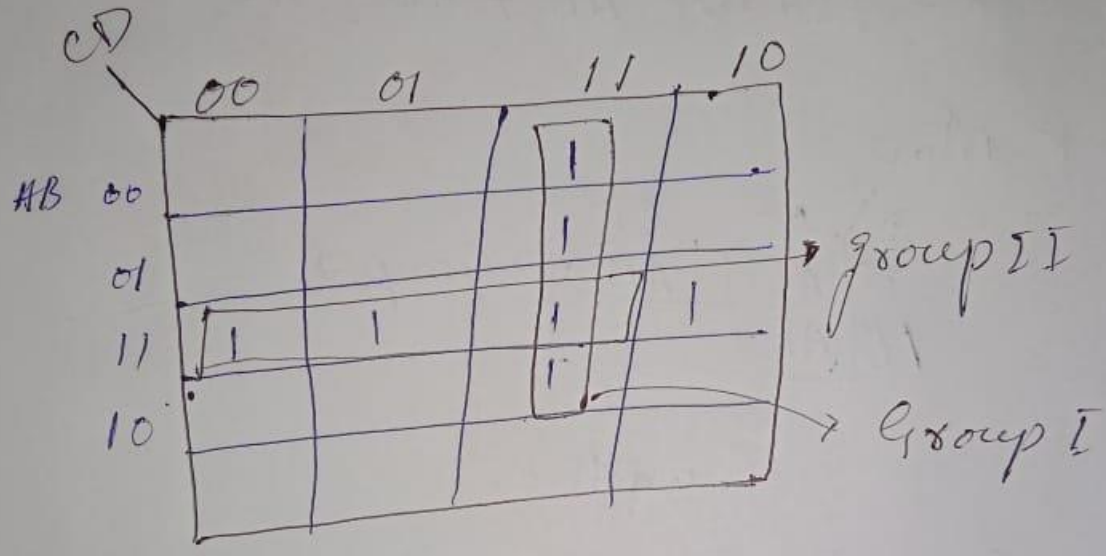
2. **Minimize the following function using K-Map. Verify the output expression with the help of simulation.**

$f(a,b,c,d) = \sum m(3,7,11,12,13,14,15)$

K-Map

Question # 2

$f(a, b, c, d) = \Sigma m(3, 7, 11, 12, 13, 14, 15)$



$F = AB + CD$

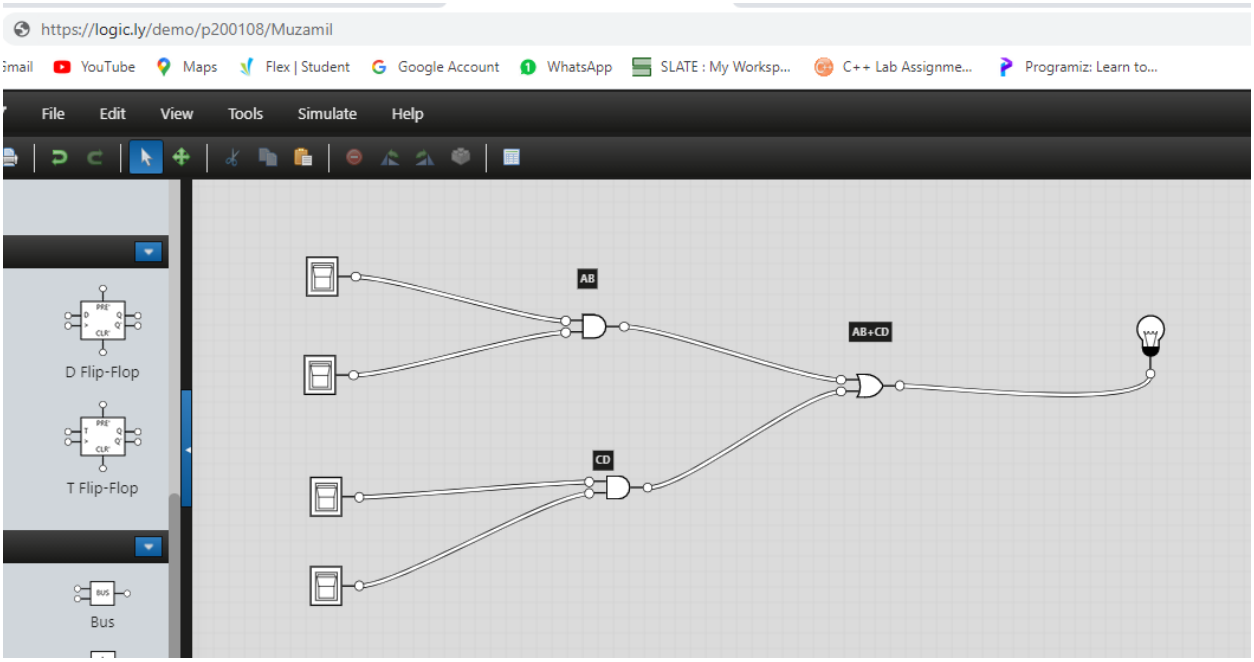
$F = \bar{A}\bar{B}CD + \bar{A}B\bar{C}D + A\bar{B}CD + AB\bar{C}D + ABC\bar{D}$

Simplified Output Function

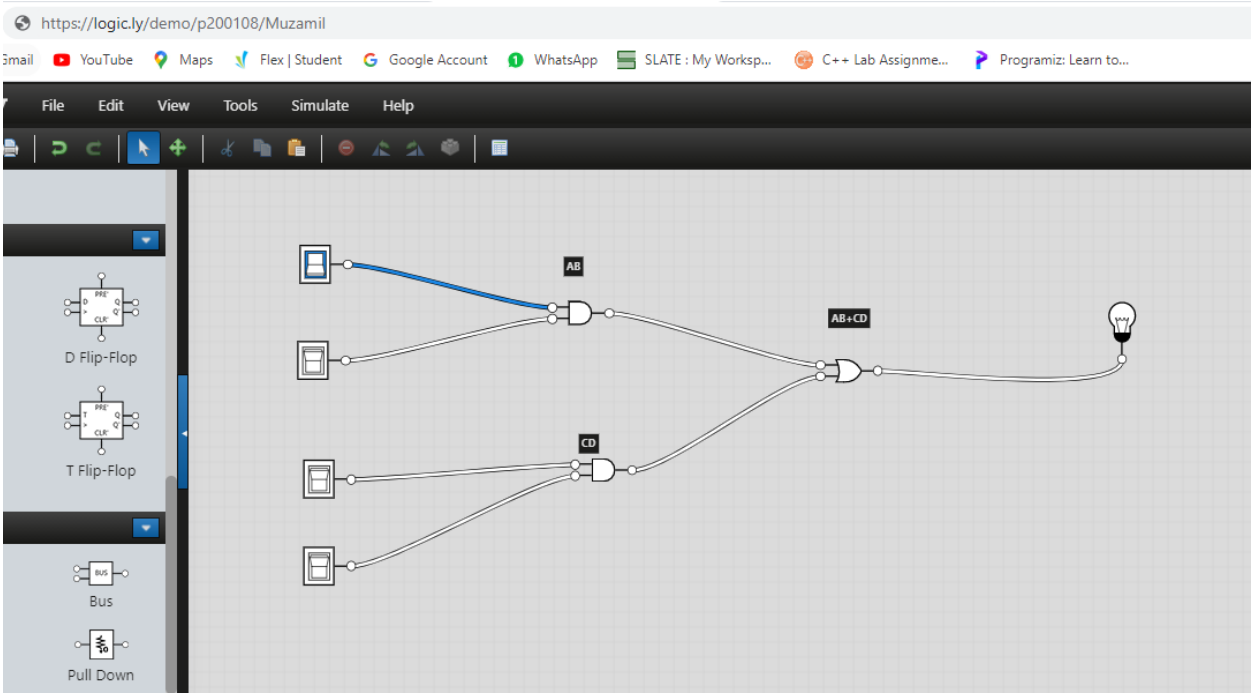
F=AB+CD

Software Simulation of Logic Circuit From Simplified Function

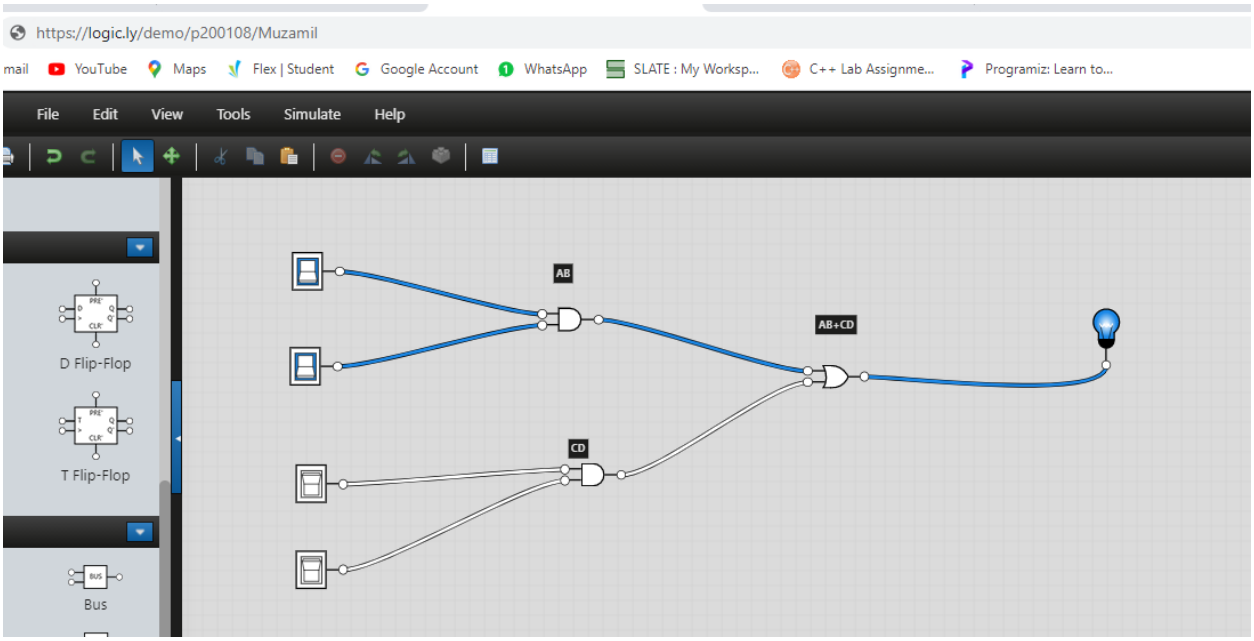
Inputs are 0000 and output is 0



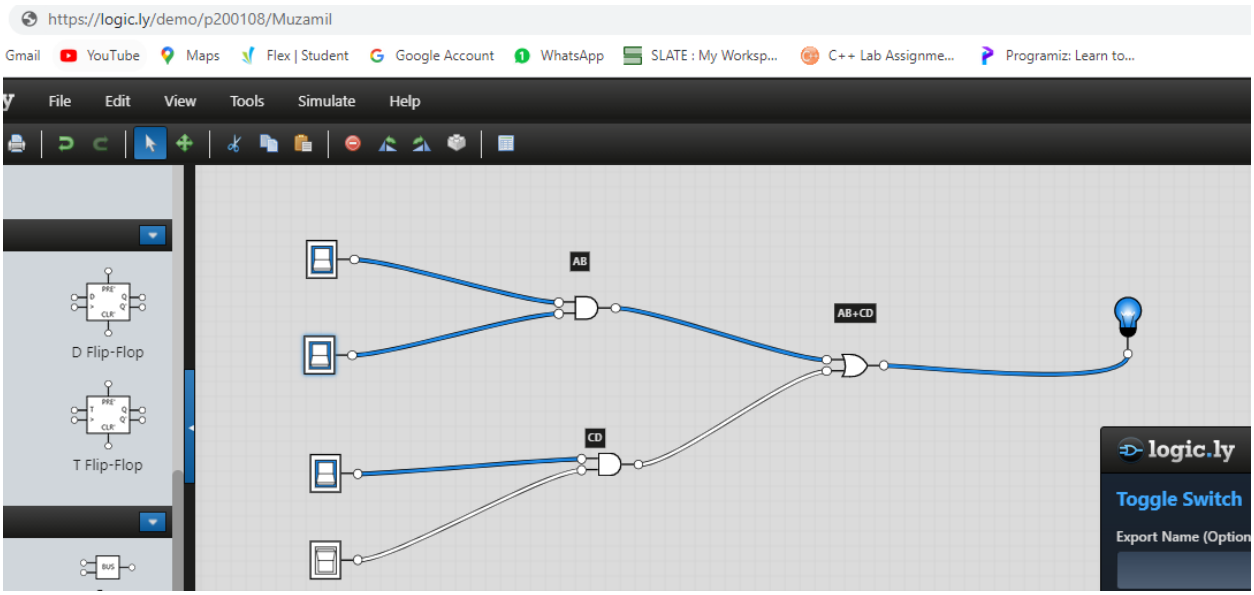
Inputs are 1000 and output is 0



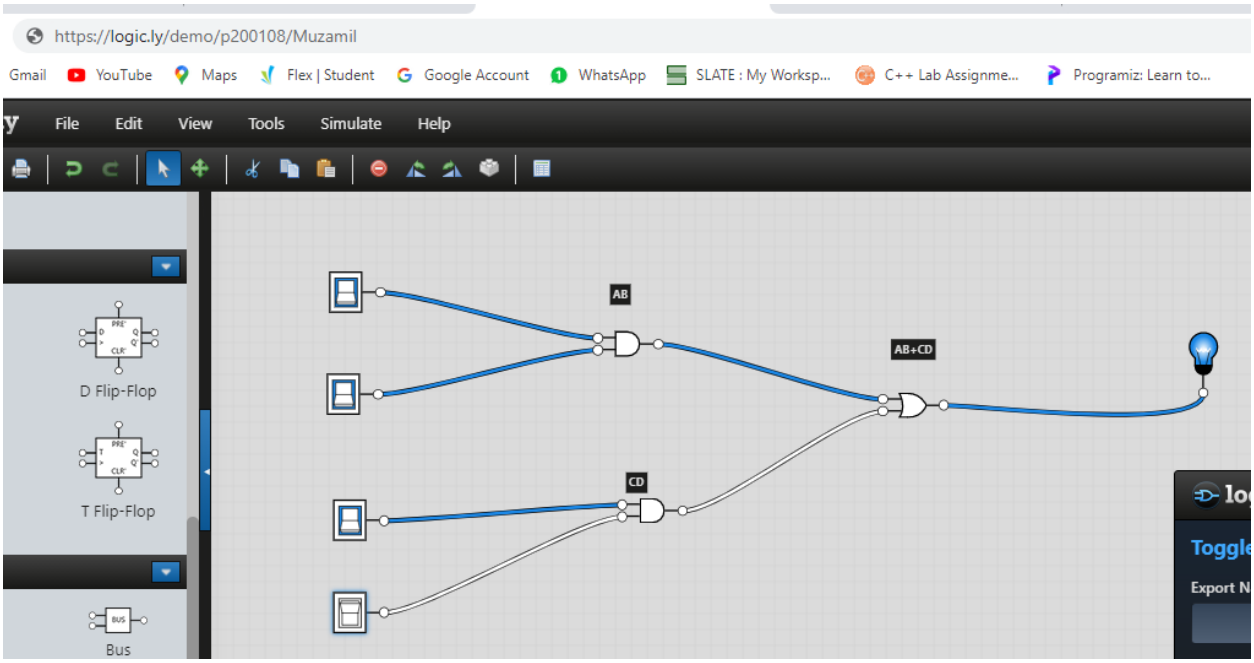
Inputs are 1100 and output is 1



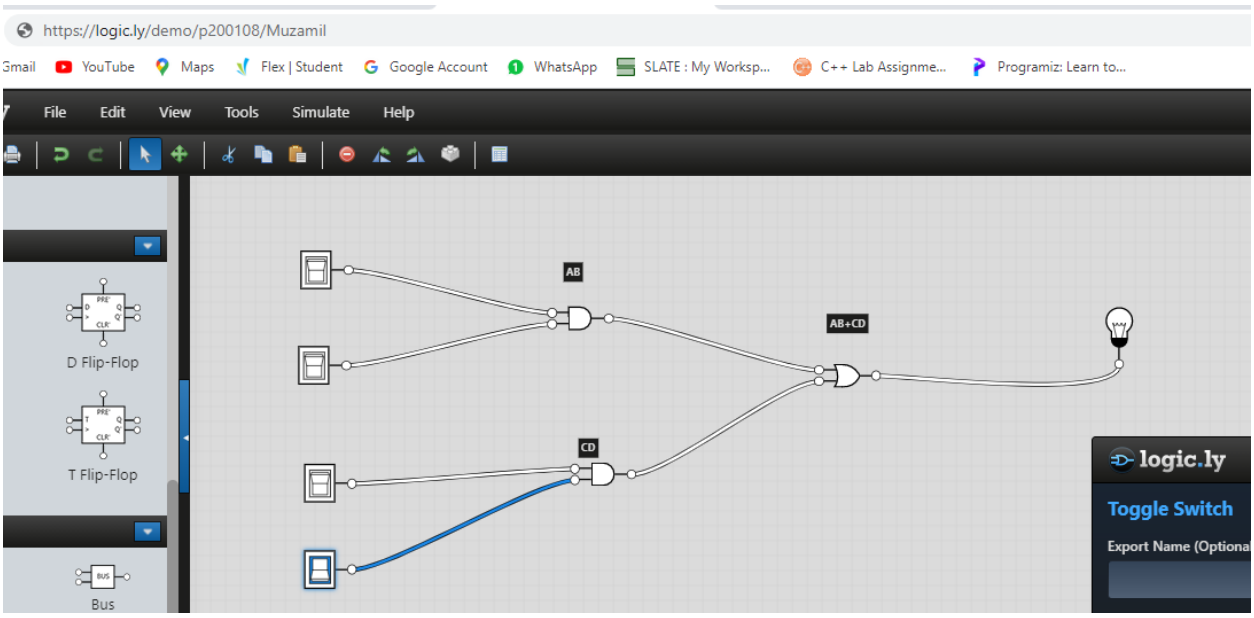
Inputs are 1110 and output is 1



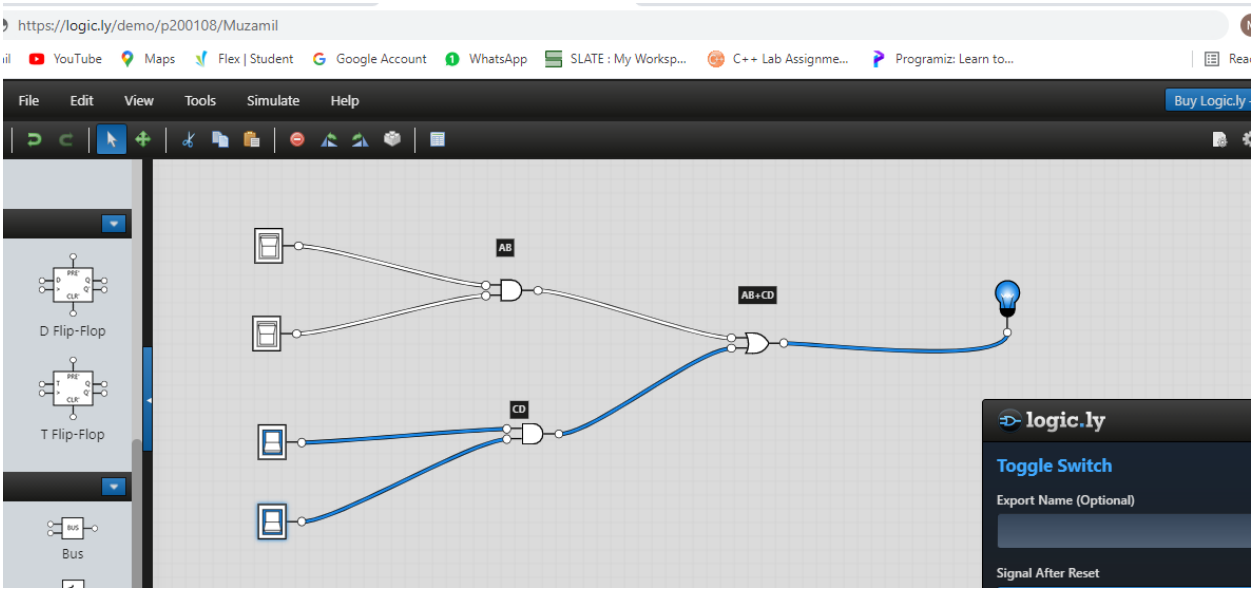
Inputs are 1111 and output is 1



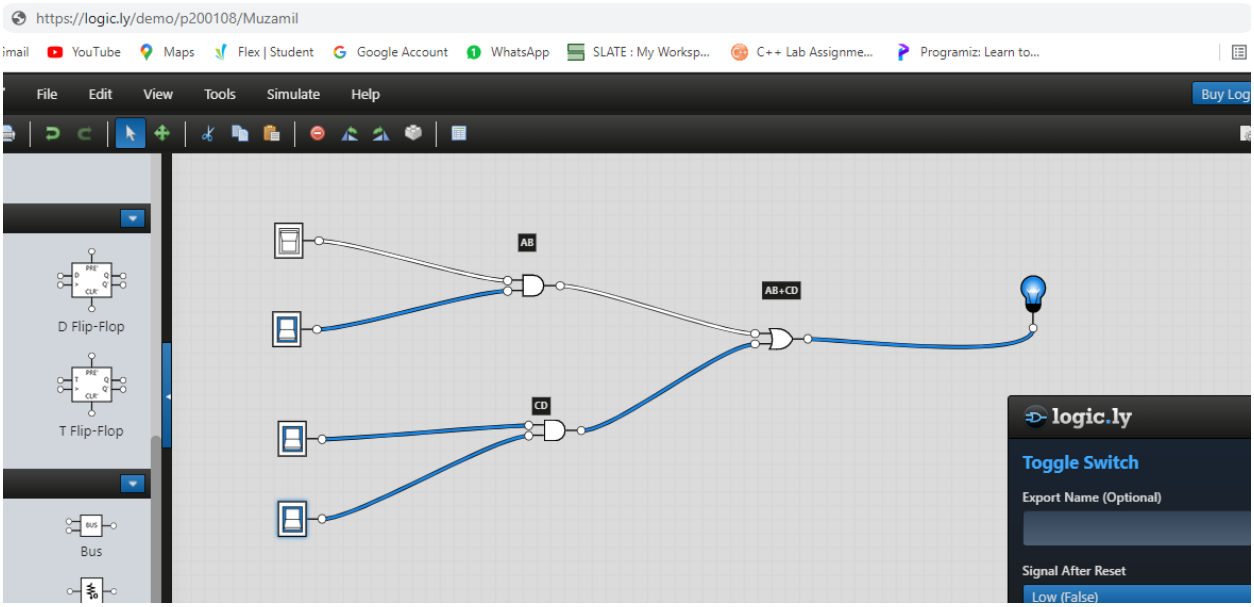
Inputs are 0001 and output is 0



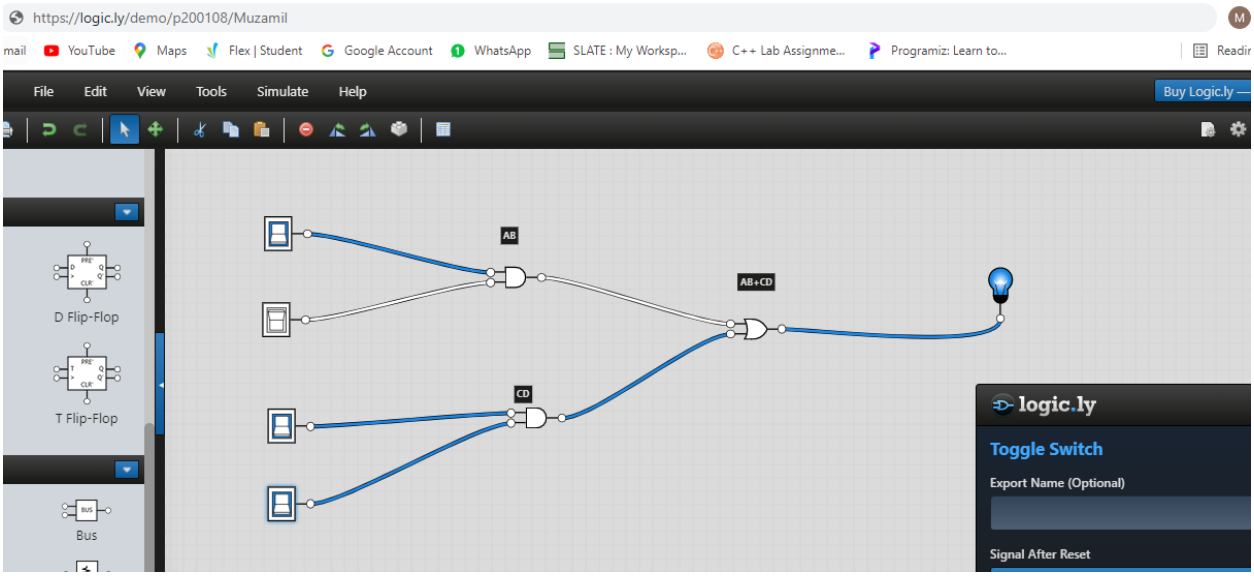
Inputs are 0011 and output is 1



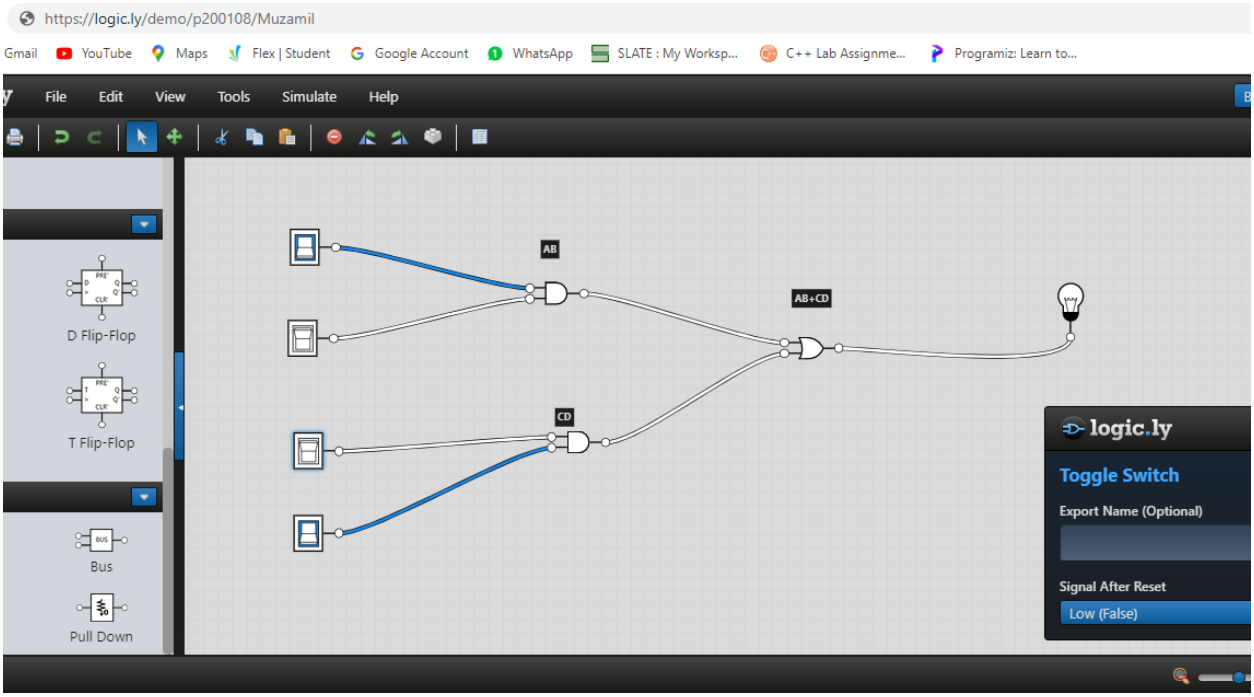
Inputs are 0111 and ouput is 1



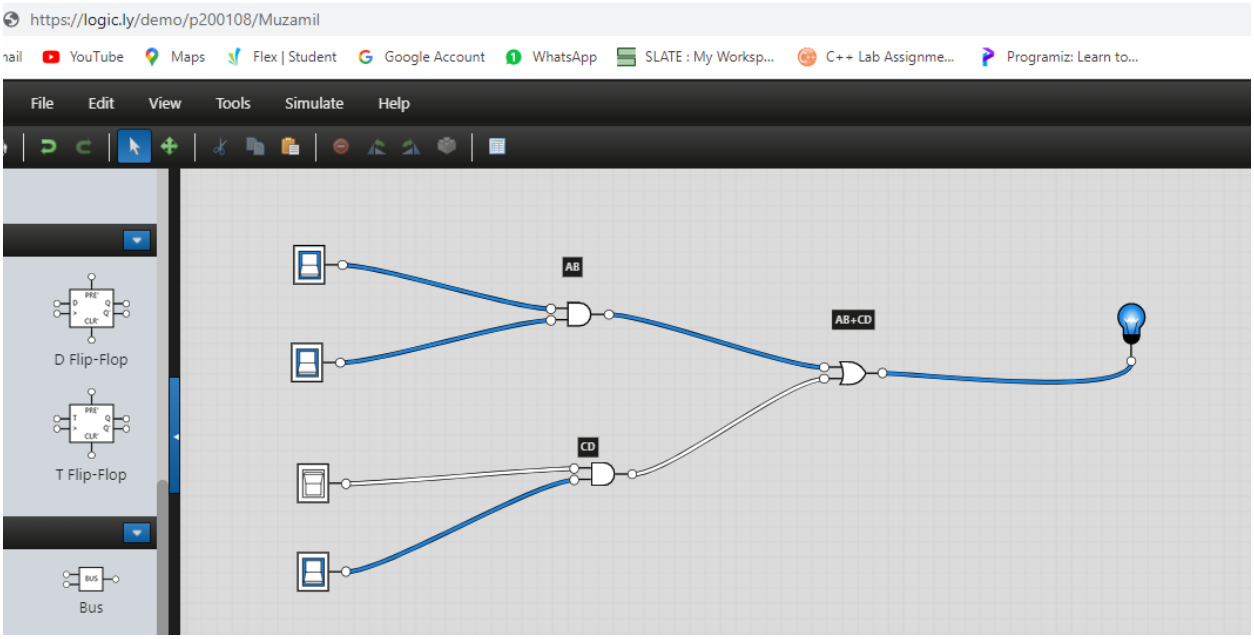
Inputs are 1011 and output is 1



Inputs are 1001 and output is 0



Inputs are 1101 and output is 1



Etc…

3. **Construct K-Map for the given POS form given below. Simulate your final expression (reduced) and show the results.**

F(A,B,C,D)=**π**(3,5,7,8,10,11,12,13)

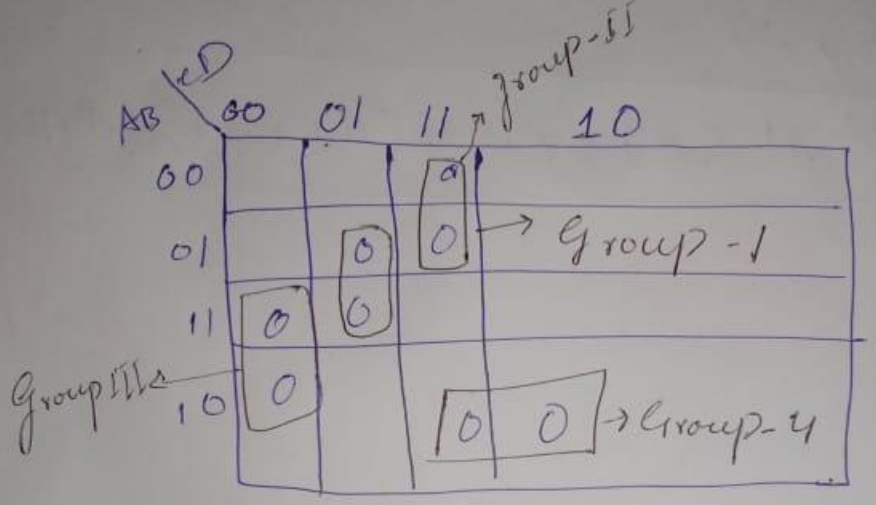
K-Map

Question # 3

By using POS form

$F(A,B,C,D) = \pi(3,5,7,8,10,11,12,13)$

K. Map :-



From group-1

$\Rightarrow CDA$ take complement and add them

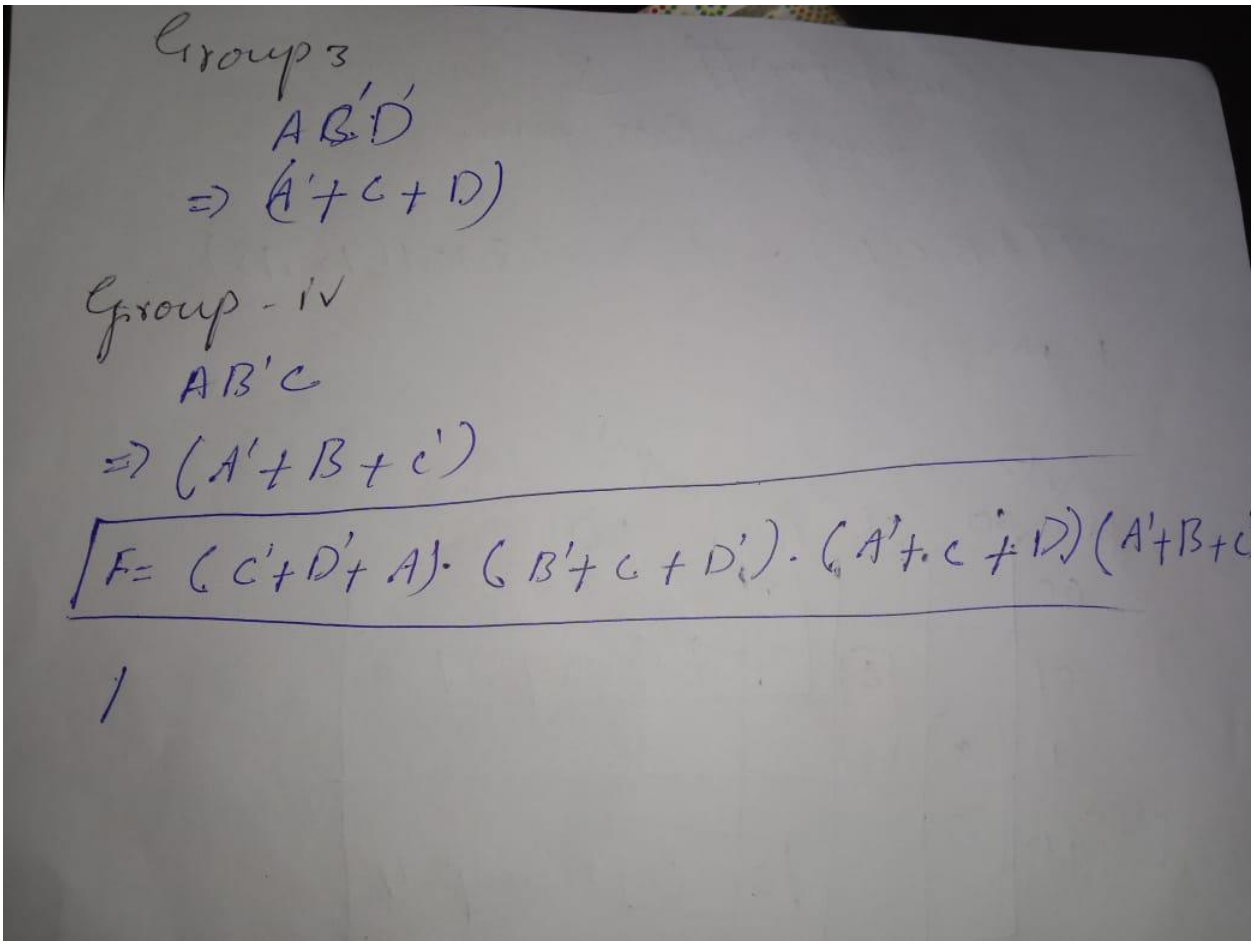
$(C' + D' + A)$

Group-II

~~$(C' + B' + A')$~~

BCD

$\Rightarrow (B' + C + D')$

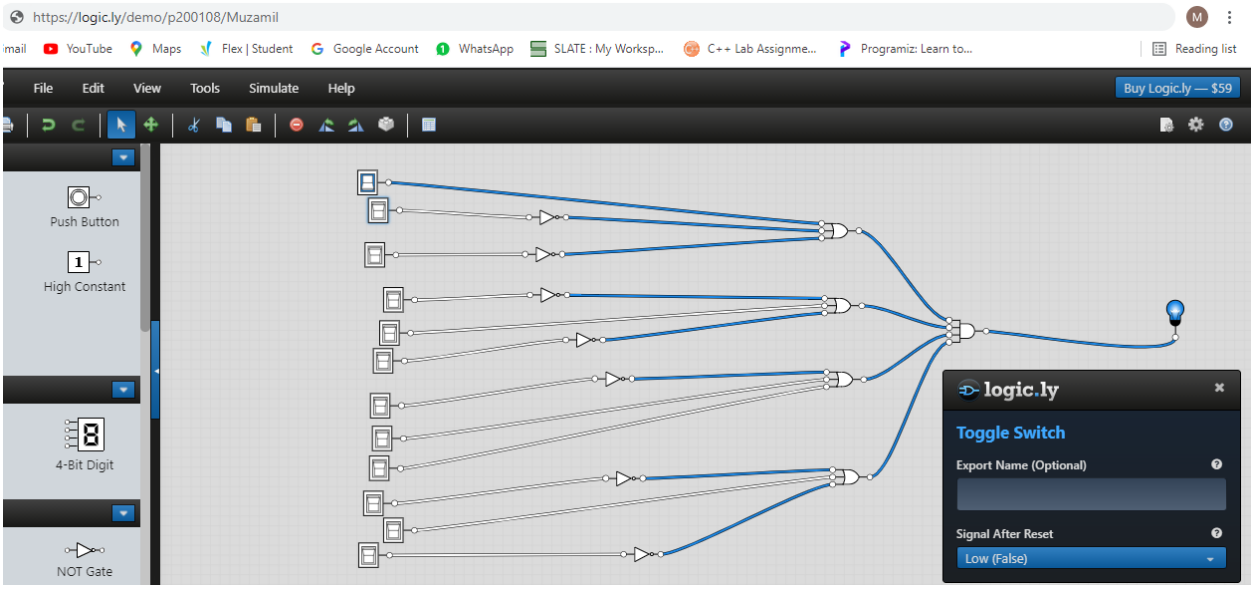


Simplified Output Function

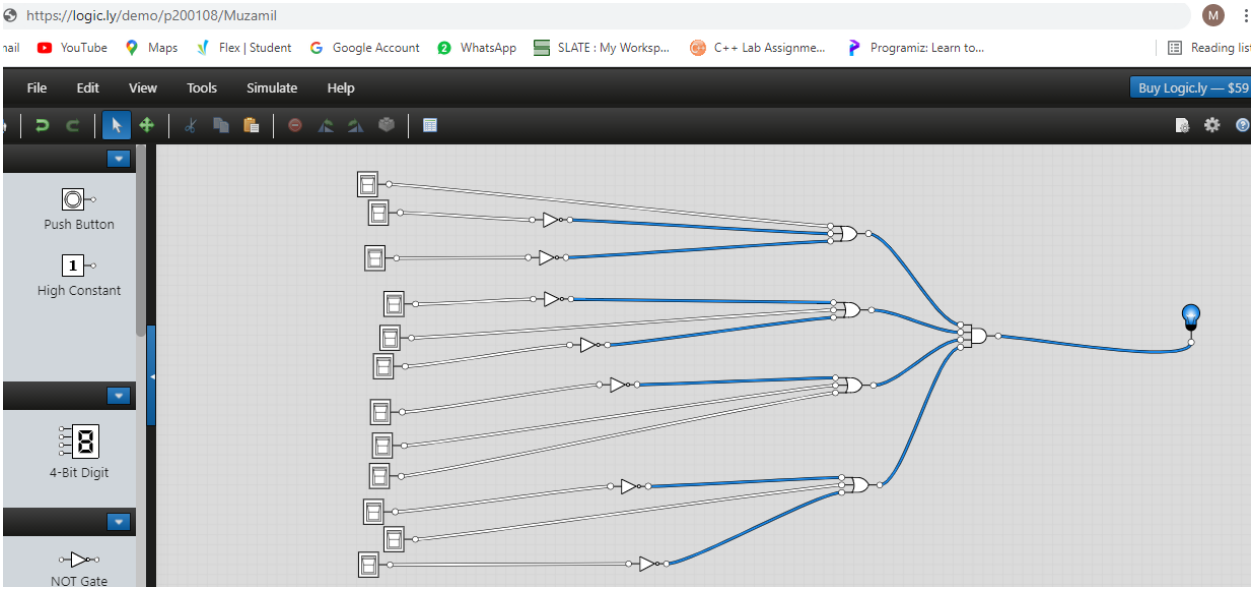
F=(C'+D'+A).(B'+C+D').(A'+C+D).(A'+B+C')

Software Simulation of Logic Circuit From Simplified Function

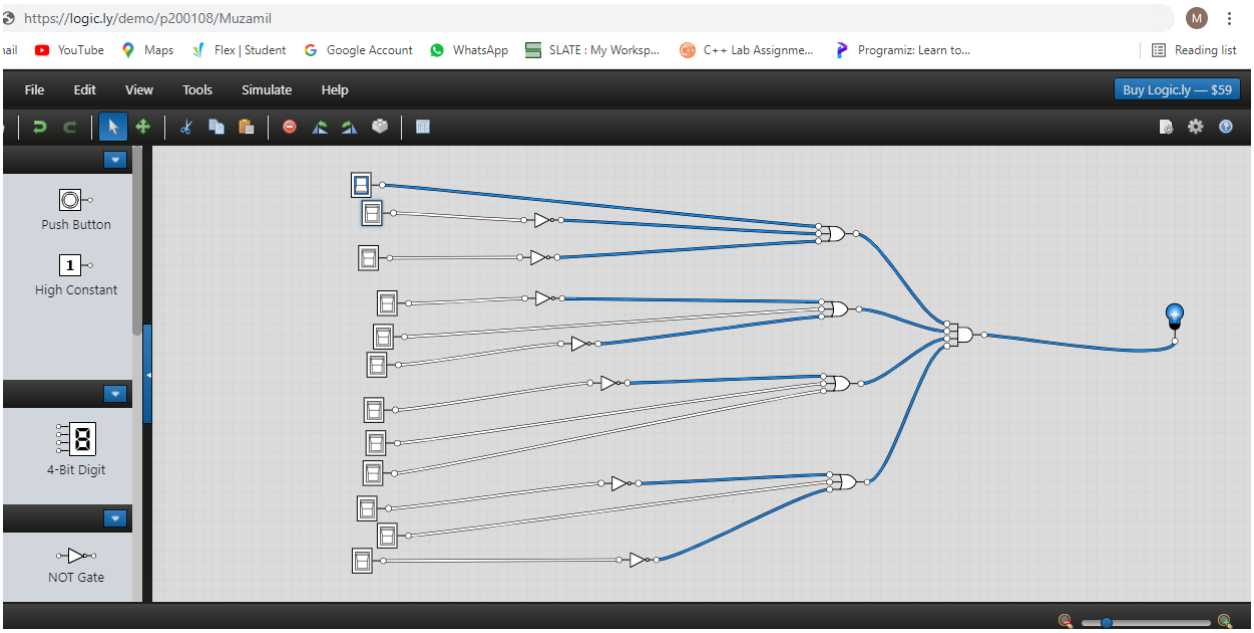
INPUTS Are 100000000000 and Output is 1



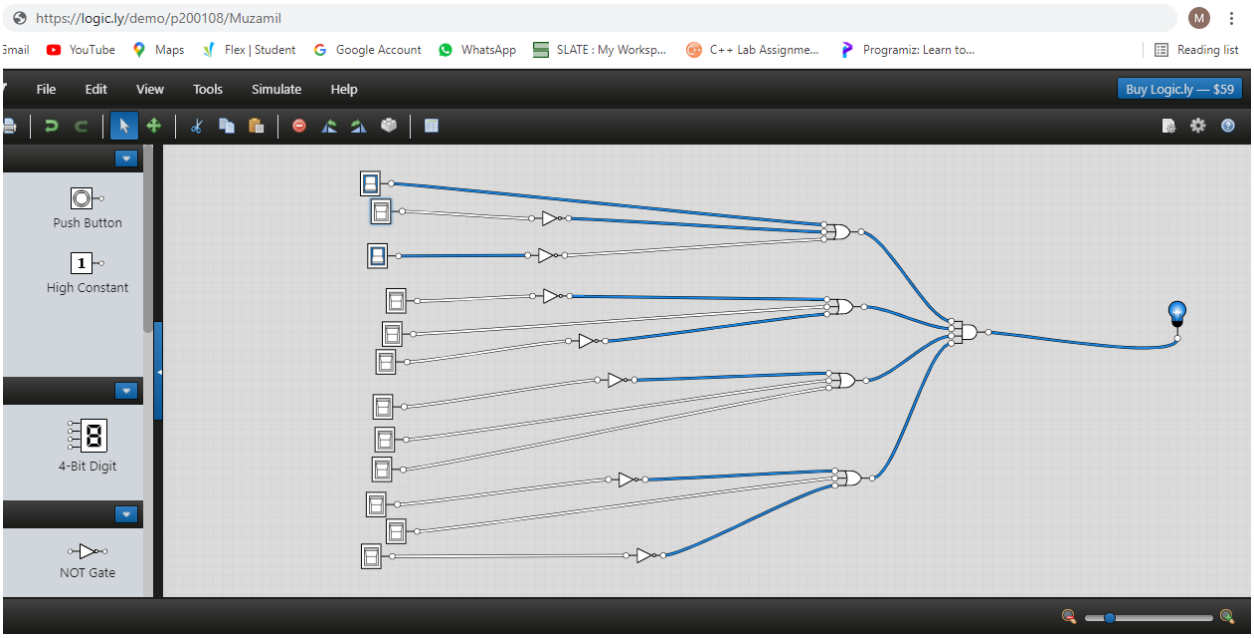
INPUTS Are 000000000000 and Output is 1



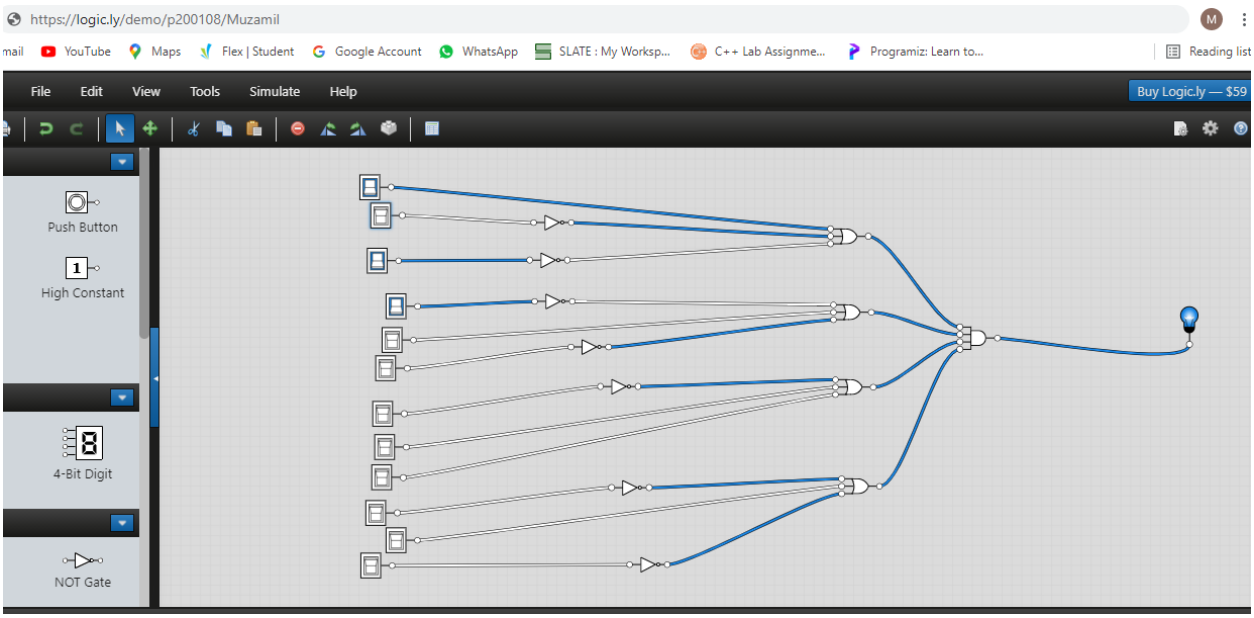
INPUTS Are 100000000000 and Output is 1



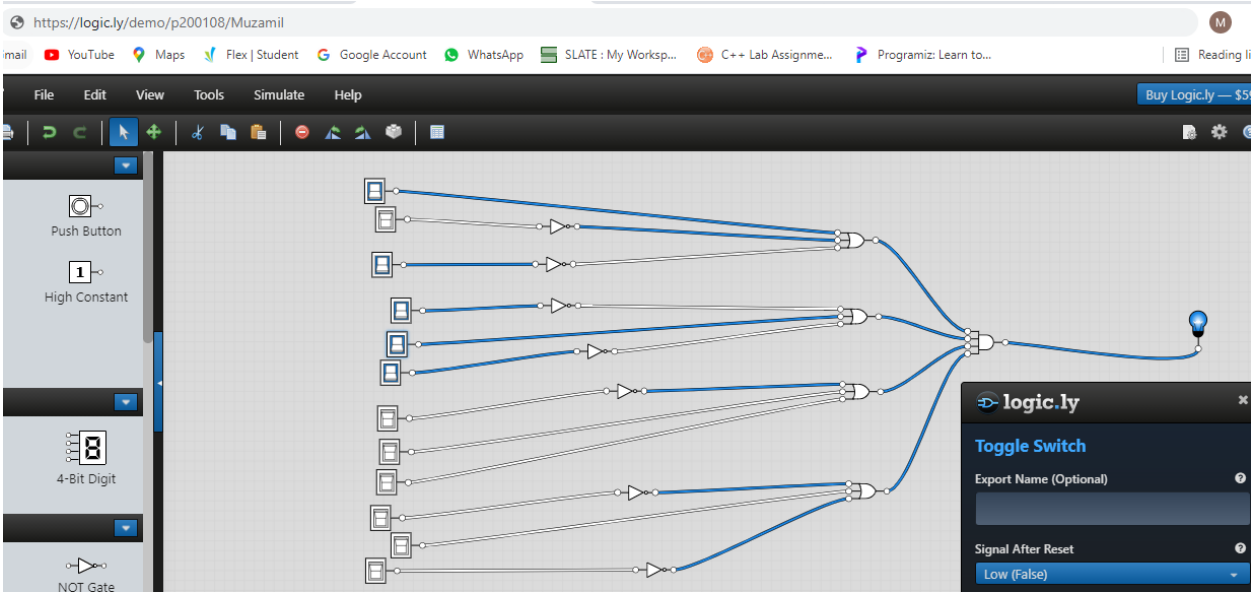
INPUTS Are 111000000000 and Output is 1



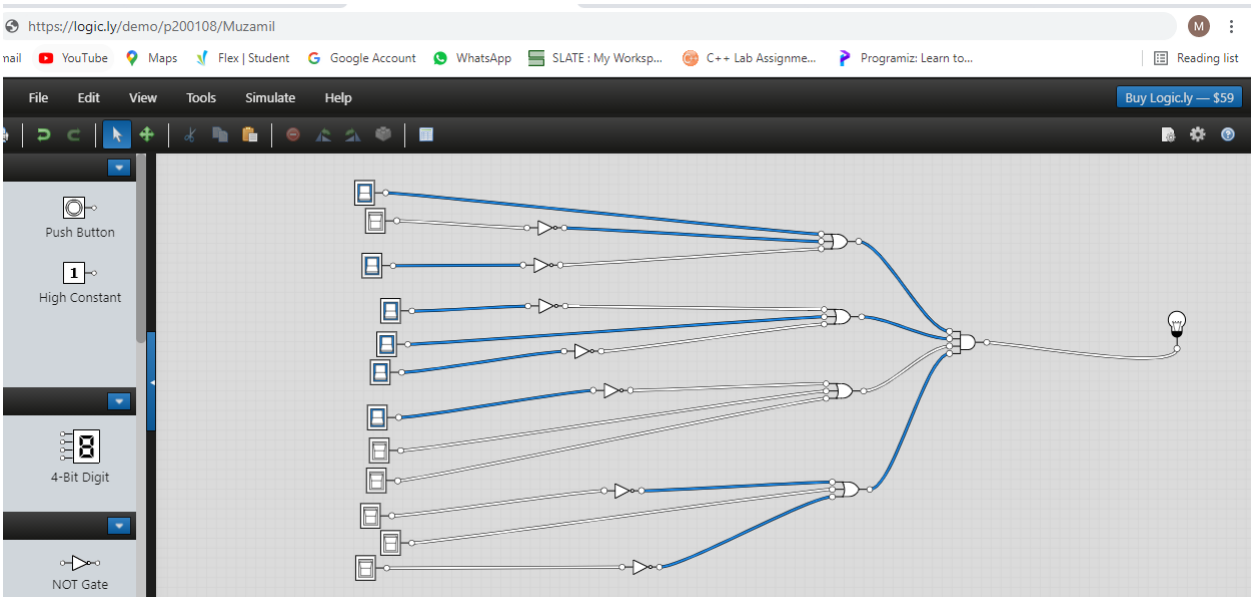
INPUTS Are 111100000000 and Output is 1



INPUTS Are 1111110000000 and Output is 1



INPUTS Are 1111111000000 and Output is 0



4. **Devise a minimized expression for the given truth table using K-Map (SOP form).**

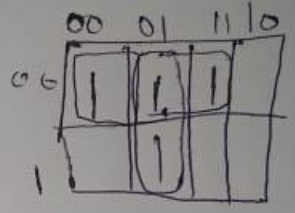
   a)

A	B	C	Out
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

K-Map

k-map

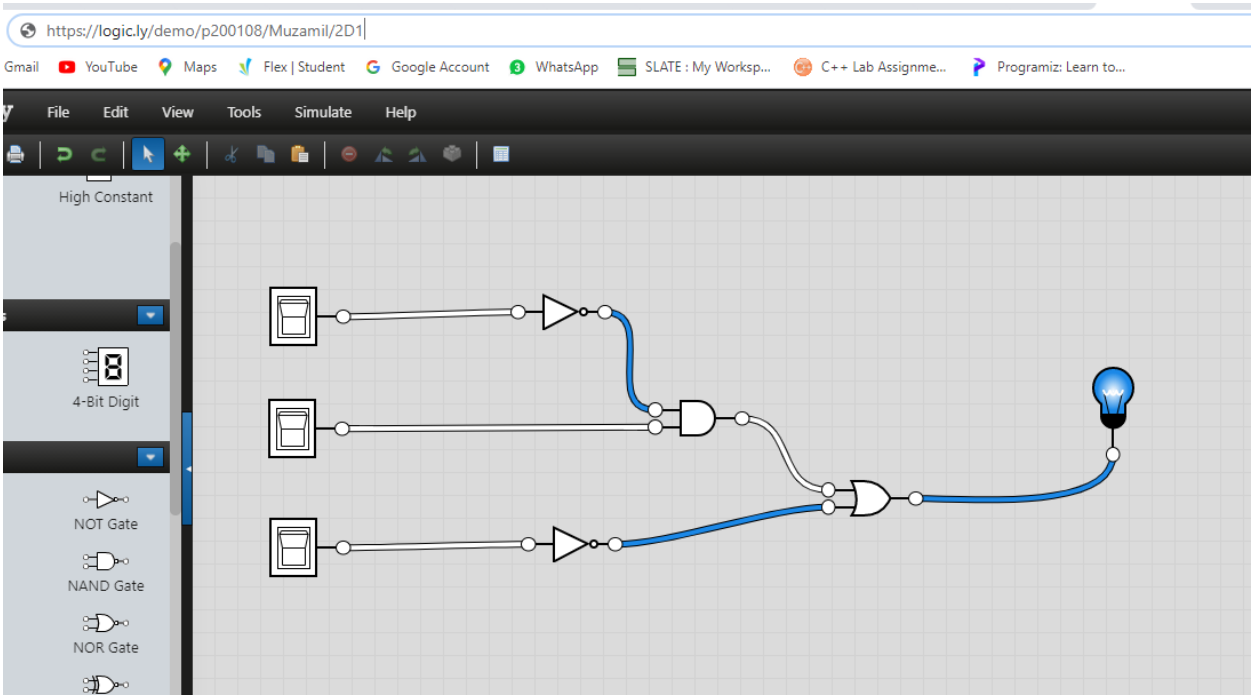
A	B	C	x
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0



$$F = A + \bar{B}C$$

Expression

Output =F=A+B’C



b) For the above truth table, devise an expression in POS form using KMap.

K-Map

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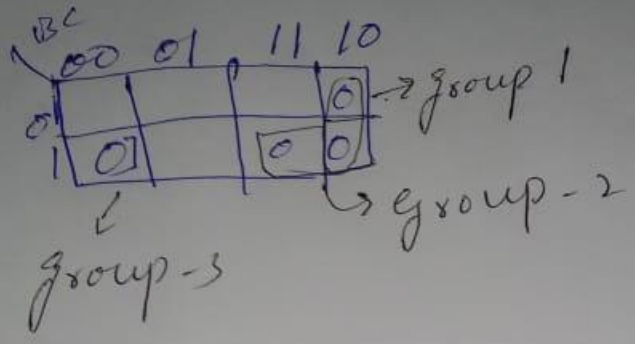


Group-1 = BC'

take complement and add them

$= \bar{B} + C$

Group-2 = AB

$= \bar{A} + \bar{B}$

Group 3 = AC'

$= \bar{A} + C$

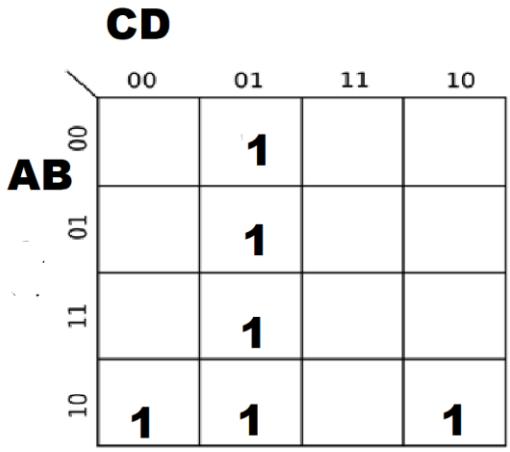
$\therefore F = (B' + C) \cdot (A' + B') \cdot (A' + C)$

Expression

Expression

F=(B’+C)(A’+B’)(A’+C)

c) Devise a truth table and Boolean expression for the given K-Map.



Truth Table

Truth Table

A	B	C	D	OUTPUT
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1

1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Expression

F= AB’C+C’D+AB’D

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