LAB REPORT NO 2

Spring 2020

CSE-202L Digital logic design lab

Submitted by: **Muhammad Ali**

Registration No:- **19PWCSE1801**

Class Section: A

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Submitted to:

Engr. Abdullah Hamid

(December 19, 2020)

Department of Computer Systems Engineering

University of Engineering and Technology, Peshawar

Lab 3

De-Morgan’s Theorem

OBJECTIVE

After completing this experiment, you will be able to:

- Experimentally verify the De-Morgan’s theorems using two input variables

COMPONENTS REQUIRED

- 7432 quad 2-input OR gate
- 7404 hex inverter
- LED
- 7430 quad 2-input AND gate
- DIP switch
- Three 1 kΩ resistors

DE-MORGAN’S THEOREM

- $(X + Y)' = X'. Y'$ .... (a)
- $(X. Y)' = X' + Y'$............ (b)

PROCEDURE

- Build the circuit for left part of equation (a) as shown in figure 3.1 and monitor the behavior of LED for different test inputs
- Then complete the circuit of figure 3.2 for the right part of equation (a) and complete the truth table 3.1 by testing each combination of inputs of appropriate switches
- Compare both the column results and check whether equation (a) is verified or not
- Repeat the above process by building the circuits of figure 3.3 and 3.4 and comparing its results for De-Morgan's theorem verification of equation (b) .

DE-MORGAN'S THEOREM

(X+Y)'= X'. Y' ………………….. eq. A

For left hand side of equation (A):-

logic circuit diagrams:-

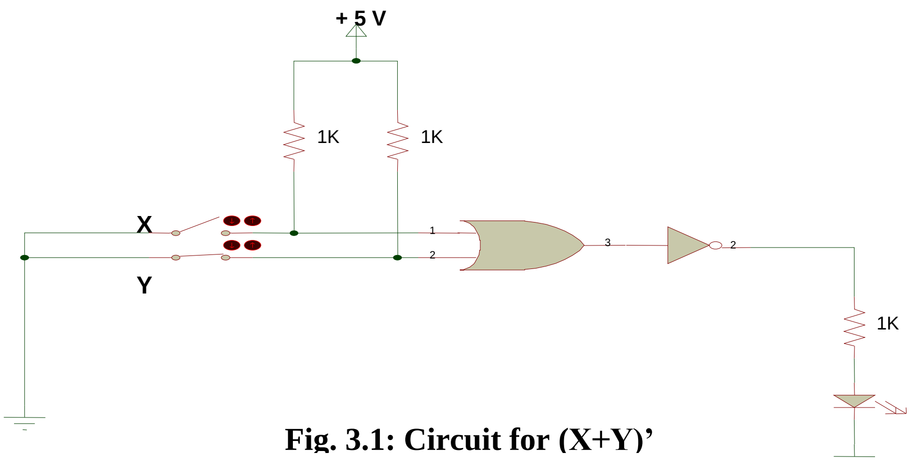
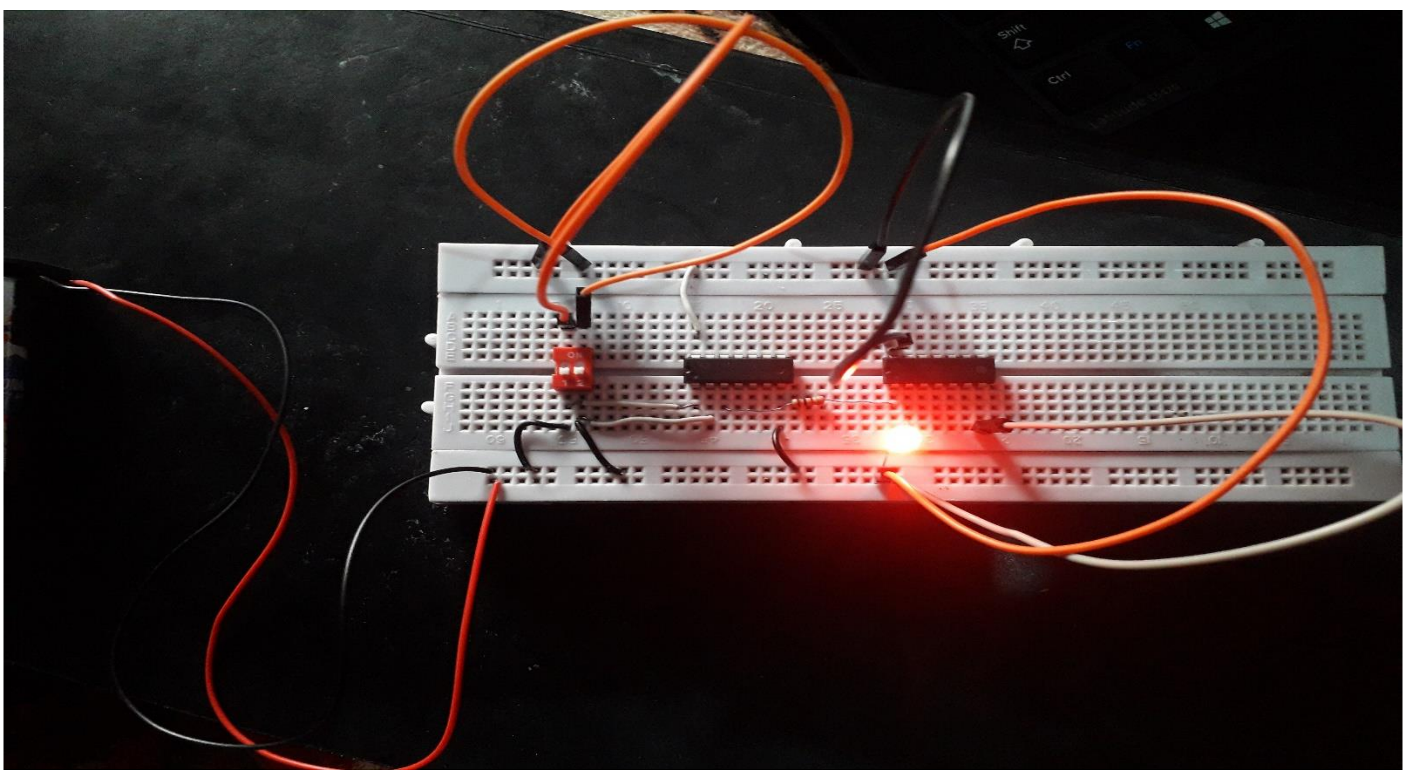


Fig. 3.1: Circuit for (X+Y)'

+ 5 V

Experimental circuit:-



For right hand side of equation (A):-

logic circuit diagrams:-

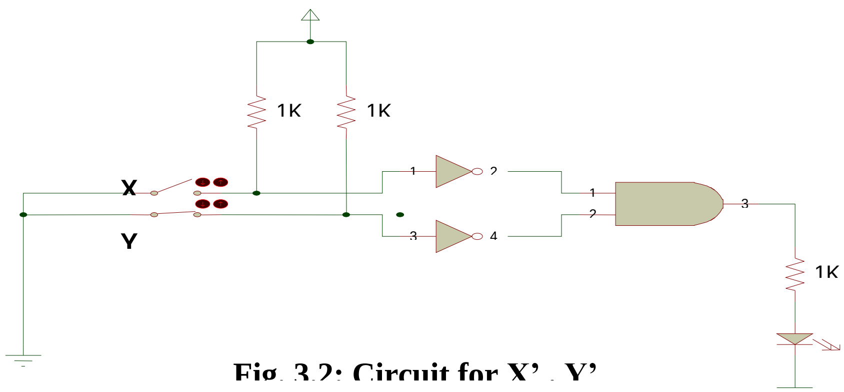
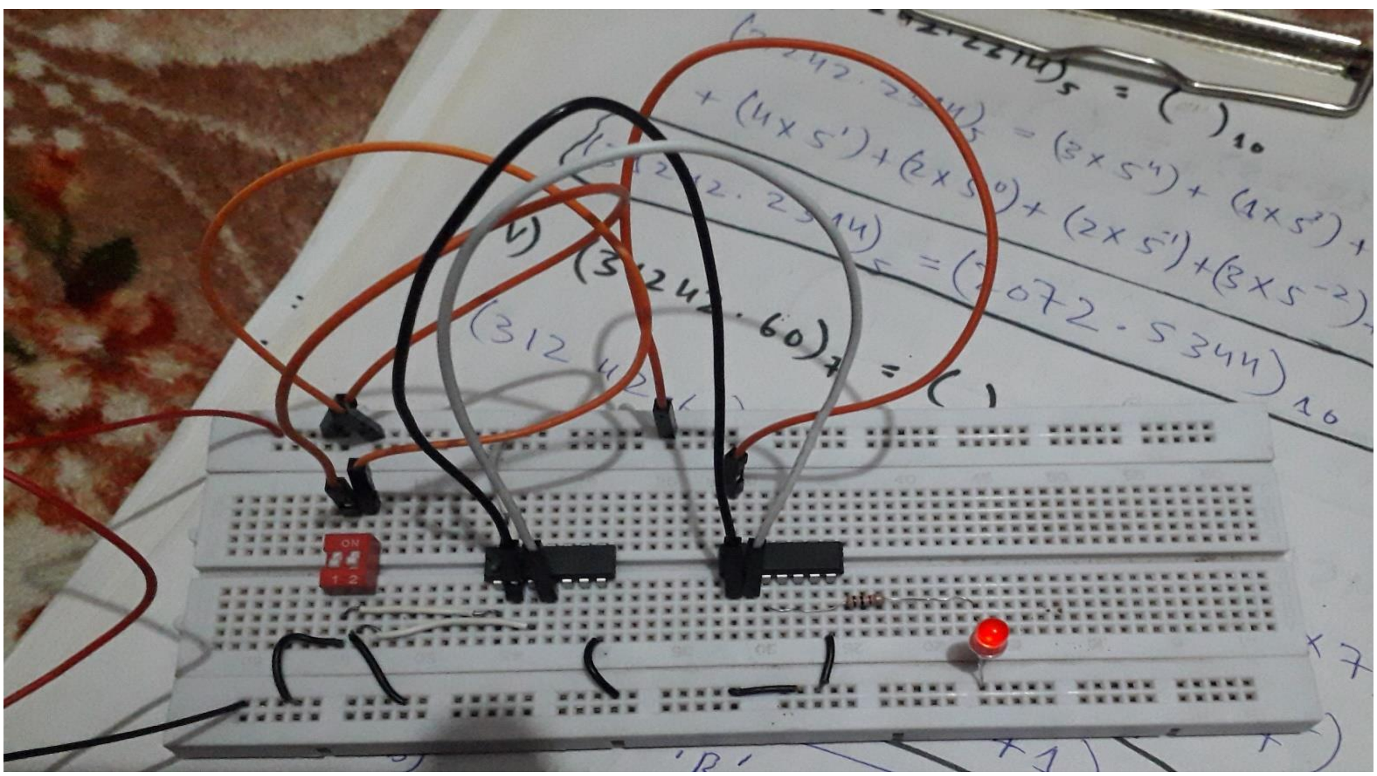


Fig. 3.2: Circuit for X' . Y'

Experimental circuit:-



Experimental verified truth table:-

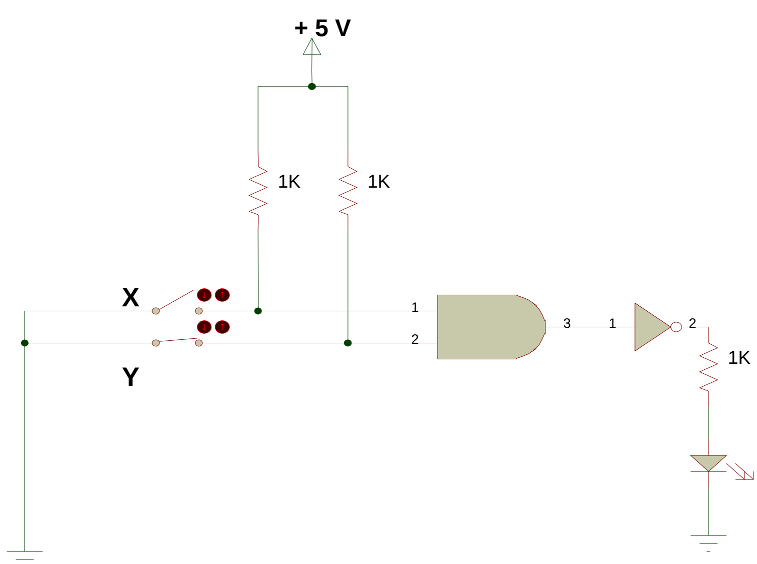
X	Y	(X + Y)’	(X’ . Y’)
0	**0**	1	1
0	**1**	0	0
1	**0**	0	0
1	**1**	0	0

DE-MORGAN’S THEOREM:-

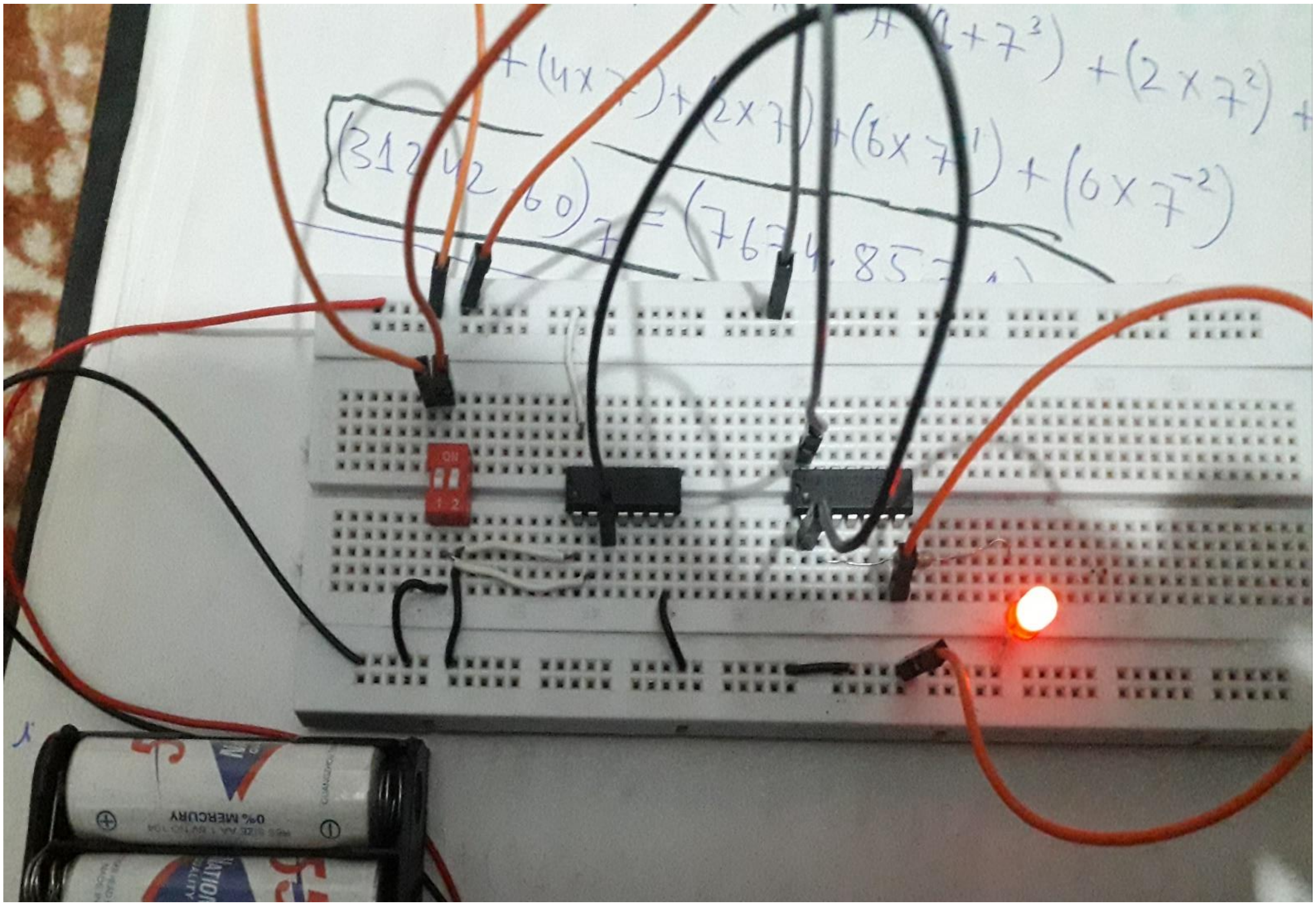
(X.Y)’= X’+Y’ ………………….. eq. B

For left hand side of equation (B):-

logic circuit diagrams:-



Experimental circuit:-



For right hand side of equation (B):-

logic circuit diagrams:-

Fig. 3.3: Circuit for (X.Y)'

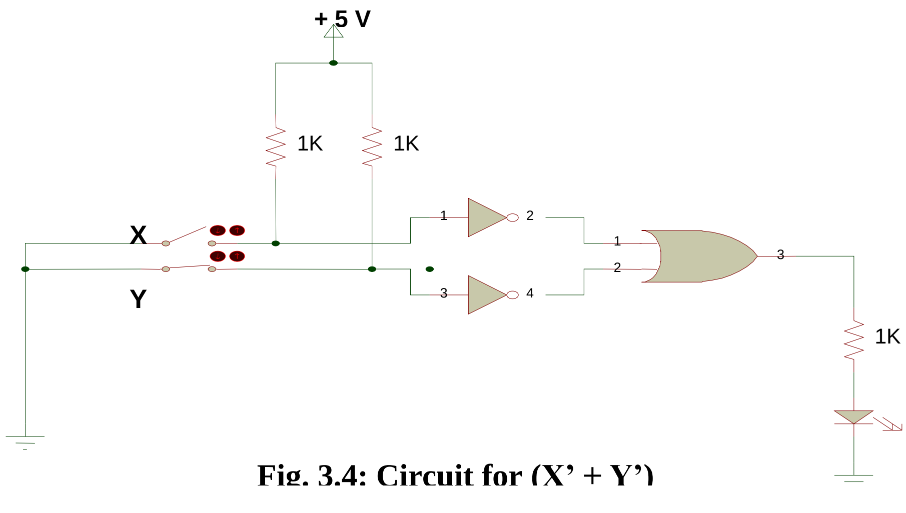
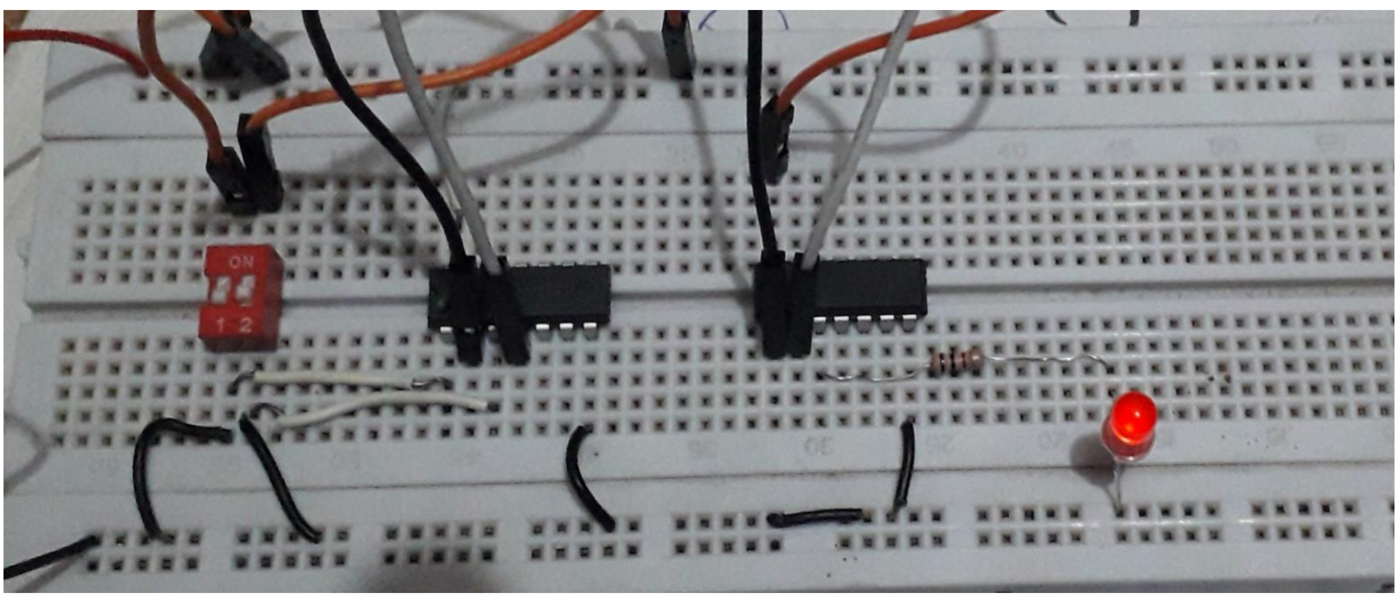


Fig. 3.4: Circuit for (X' + Y')



Experimental circuit:-

X	Y	(X . Y)’	(X’ + Y’)
0	**0**	1	1
0	**1**	1	1
1	**0**	1	1
1	**1**	0	0

REVIEW QUESTIONS

- Simplify the expression using De-Morgan's theorems and verify the two expressions experimentally.

$$F= ((A . B)' + A)'$$

Simplification:-

$$F= ((A . B)' + A)'$$

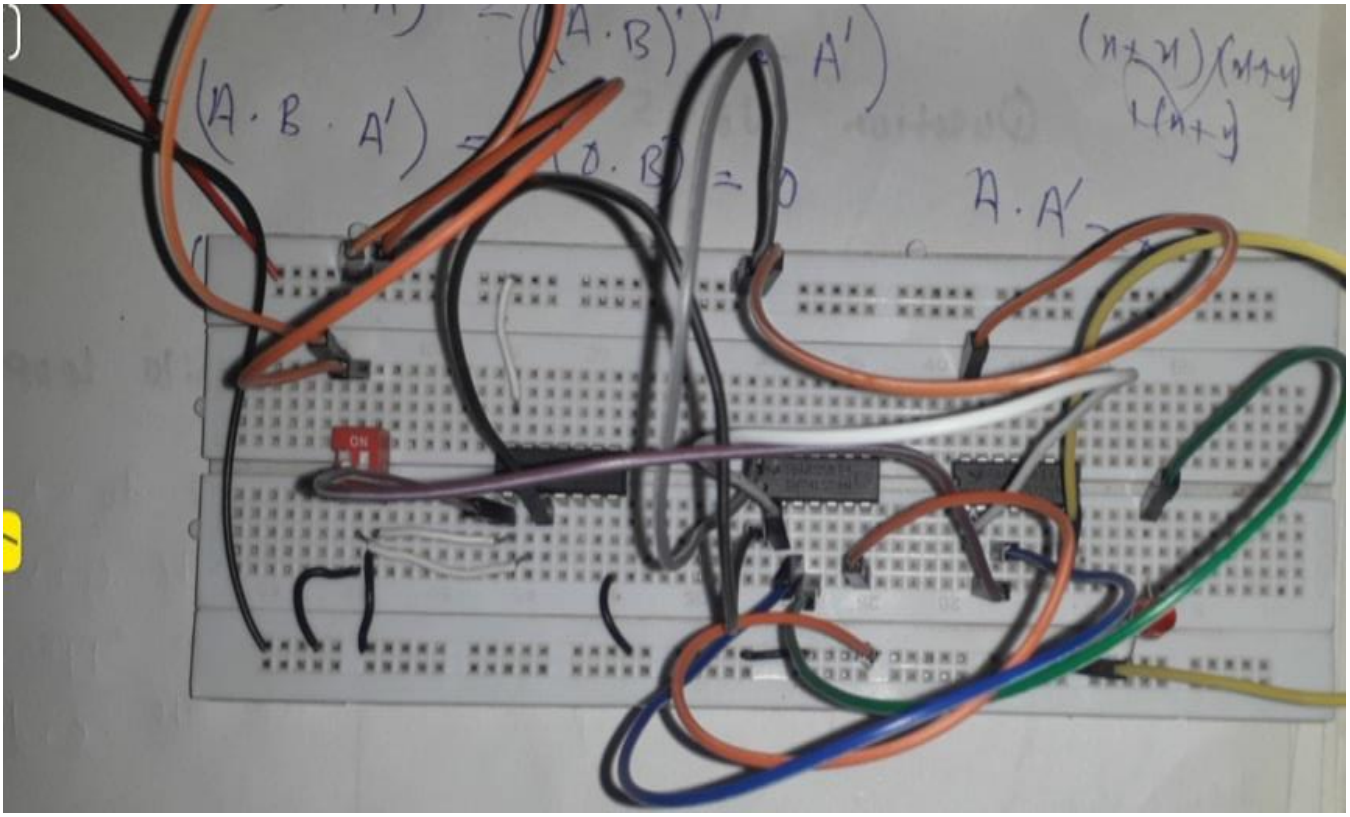
$= ((A.B)')'.A')$

$= A.B.A'$ (A.A’=0)

$= 0.A$

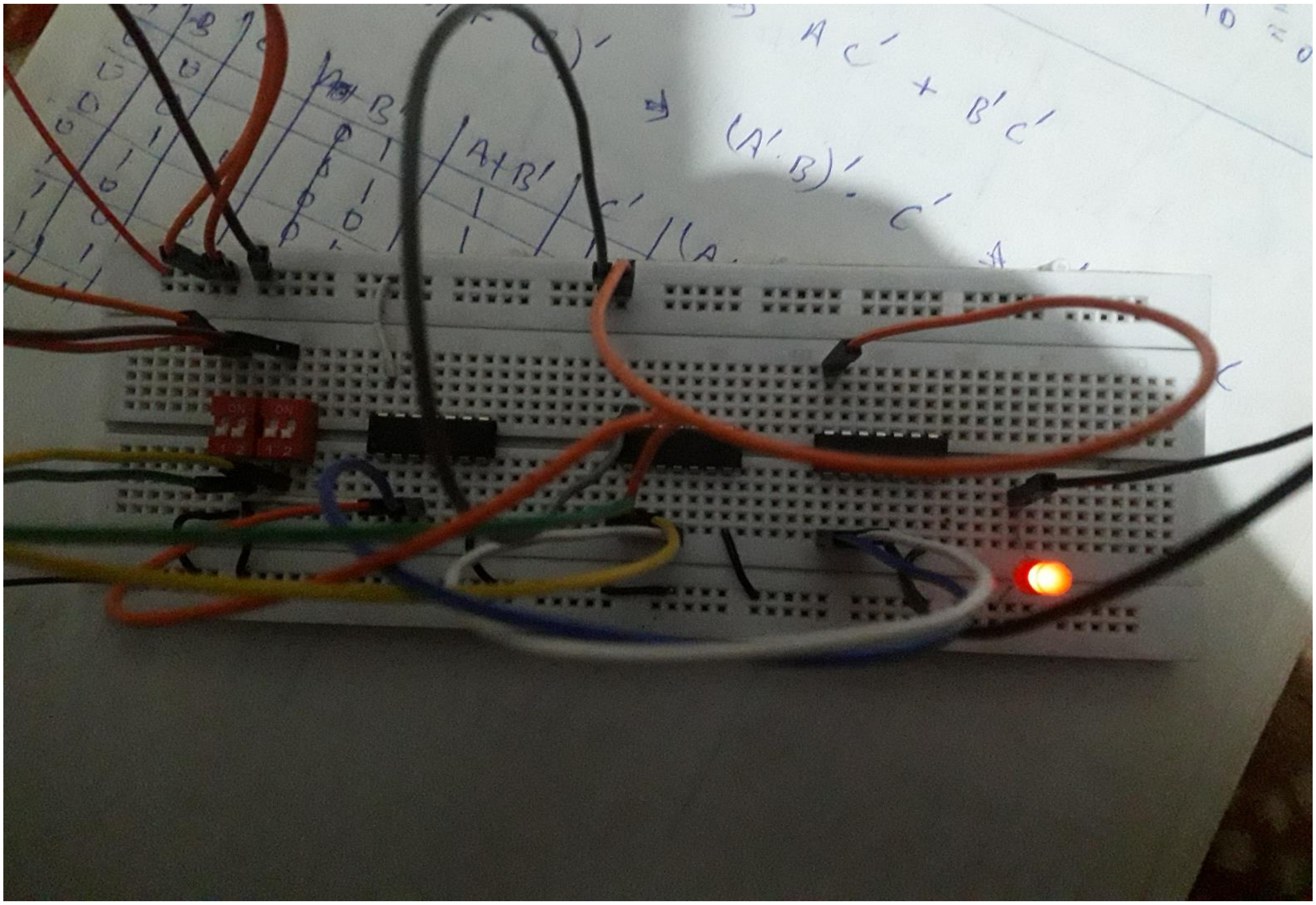
$=0$

Experimental citcuit:-



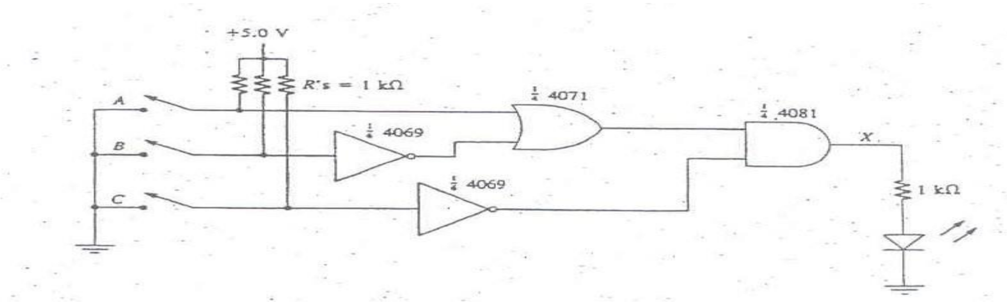
- Determine experimentally whether the given circuits are equivalent. Then use DeMorgan's theorem to prove your answer algebraically.

Experimental circuit:-

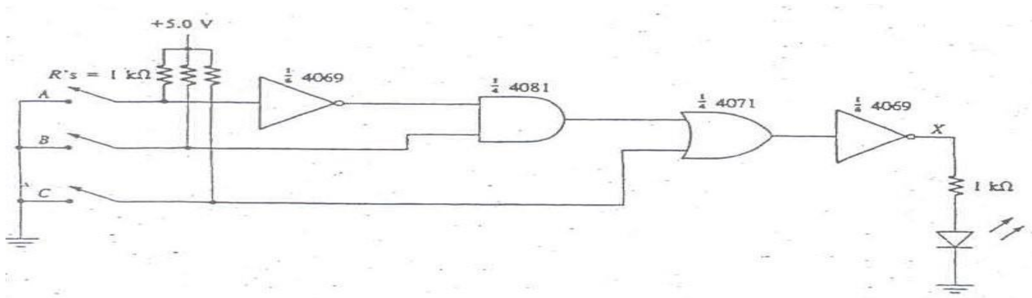


Expressions:-

1. **(A+B’).C’**



2. ((A’.B)+C)’



Algebraically:-

1st expression:-

$(A+B').C' = A.C'+B'.C'$…………….A

2nd expression:-

$((A'.B)+C)' = (A'.B)'.C'$

$= A+B'.C'$

$((A'.B)+C)' = A.C'+B'C'$ ………………….B

Hence proved both equations are equals algebraically.