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) .

LOGIC CIRCUIT DIAGRAMS

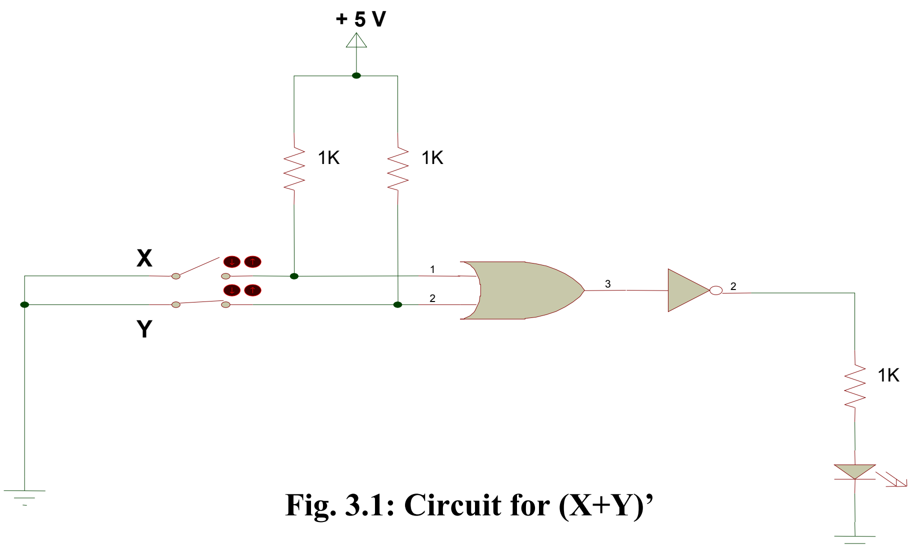

Fig. 3.1: Circuit for (X+Y)’

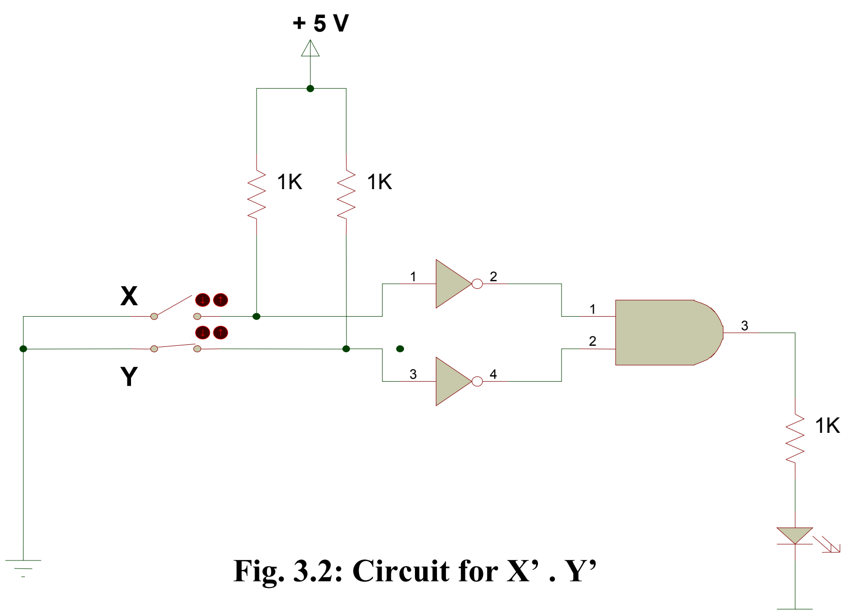

Fig. 3.2: Circuit for X’ . Y’

Truth Table 3.1

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

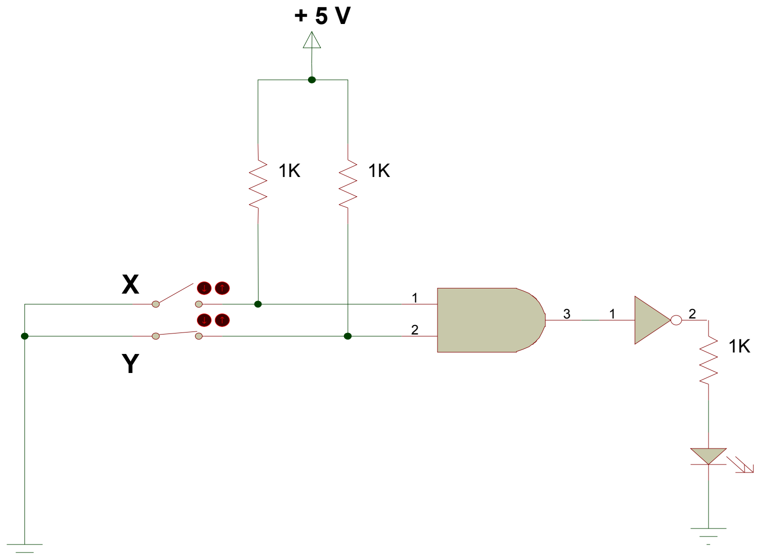

Fig. 3.3: Circuit for (X.Y)’

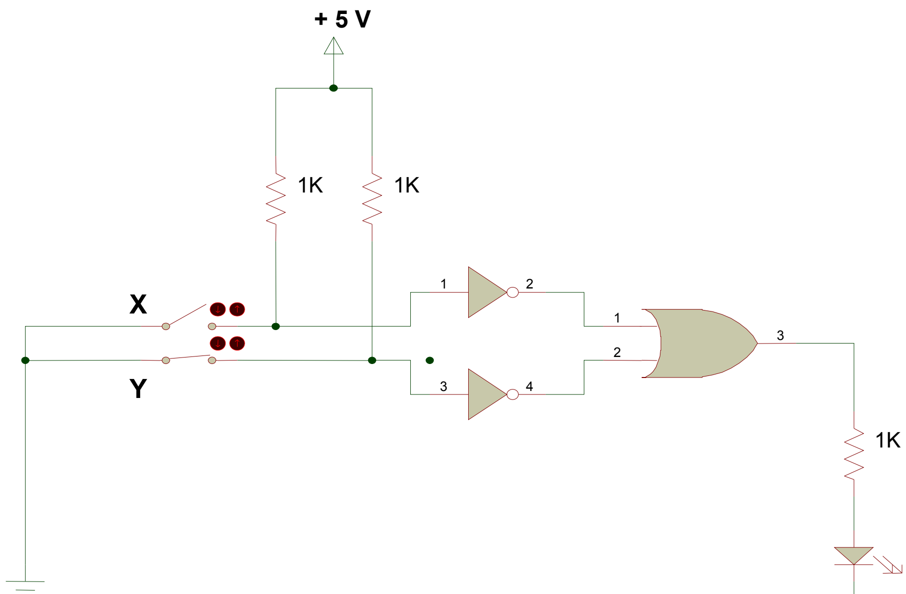

Fig. 3.4: Circuit for (X’ + Y’)

Truth Table 3.2

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

REVIEW QUESTIONS

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

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

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