NE-3102: Electronics-II Laboratory

Roll _____ Date _____ Experiment No. _____

Name of the experiment

Design an Ex-OR gate using NAND gates.

Contents

1 Objective

1. To design an Ex-OR using only NAND gates.

2 Theory

The full form of Ex-OR gate is Exclusive-OR gate. Its function is the same as that of OR gate except for the case when the inputs have an even number of ones. The logic circuit of Ex-OR gate is given in Figure 1 (a). The accompanying truth table shows that $x = 1$ for two cases: $A = 0, B = 1$ (the $\bar{A}B$ term) and $A = 1, B = 0$ (the $A\bar{B}$ term).

This particular combination of logic gates occurs quite often and is very useful in certain applications. In fact, the Ex-OR circuit has been given a symbol of its own, shown in Figure 1 (b). This symbol is assumed to contain all of the logic contained in the Ex-OR circuit and therefore has the same logic expression and truth table. This Ex-OR circuit is commonly referred to as an Ex-OR gate, and we consider it as another type of logic gate. The IEEE/ANSI symbol for an Ex-OR gate is shown in Figure Figure 1 (c). The dependency notation (=1) inside the block indicates that the output will be active-HIGH only when a single input is HIGH.

An Ex-OR gate has only two inputs; there are no three-input or four-input Ex-OR gates. The two inputs are combined so that $x = \bar{A}B + A\bar{B}$. A shorthand way that is sometimes used to indicate the Ex-OR output expression is

$$x = \mathrm{A} \oplus B$$

where the symbol $\oplus$ represents the XOR gate operation. The characteristics of an Ex-OR gate are summarized as follows:

1. It has only two inputs and its output is

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

2. Its output is HIGH only when the two inputs are at different levels.

3 Components and apparatus

1. 74LS00 TTL integrated circuit (quad NAND)
2. Passive components
3. Breadboard and connecting wires
4. Bench power supply

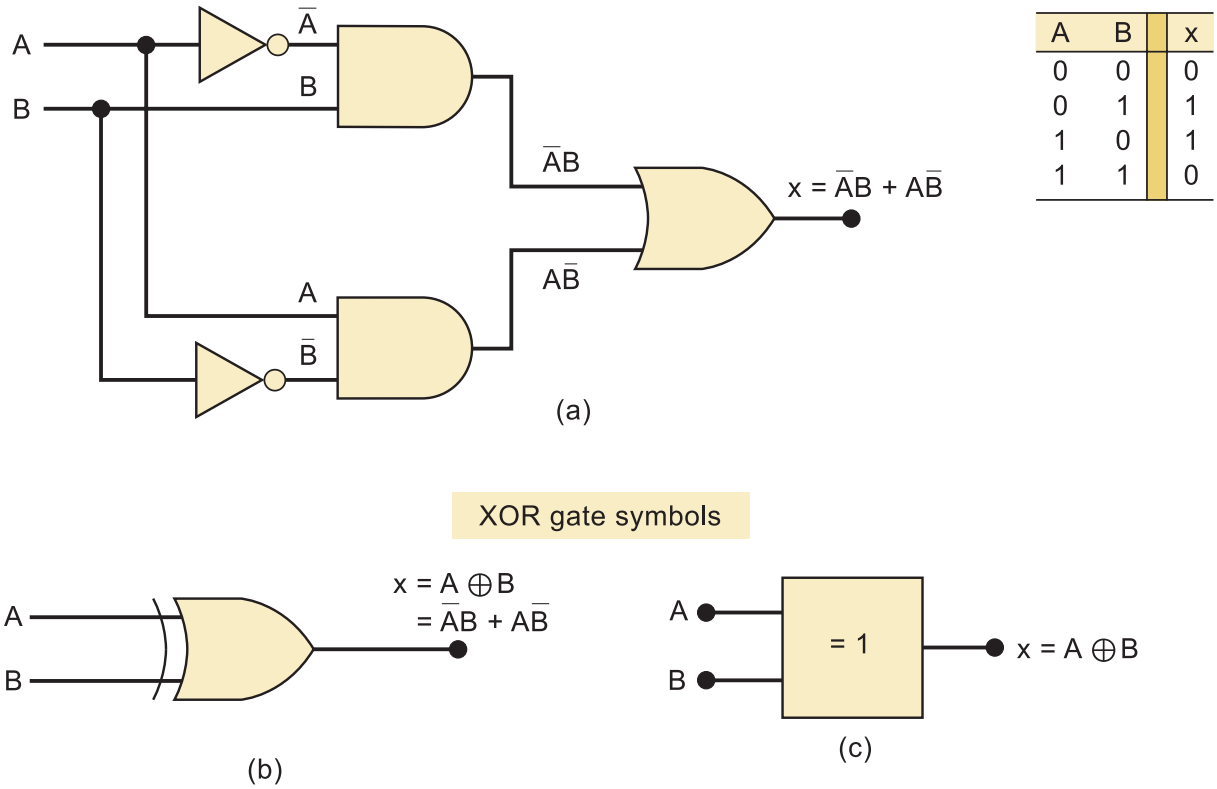

Figure 1: (a) Ex-OR circuit and truth table; (b) traditional Ex-OR gate symbol; (c) IEEE/ANSI symbol or Ex-OR gate.

4 Data collection and analysis

Input		Output	
A	B	$Y = A \oplus B$	Voltage, $V_0(v)$
0	0	0	0
0	1	1	4.90
1	0	1	4.91
1	1	0	0

Table 1: Truth table for Ex-OR gate.

5 Result

6 Discussion

7 References

1. Tocci Ronald J, Neal W, Greg M. Digital Systems Principles and Applications.

Appendix