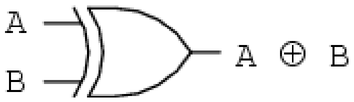
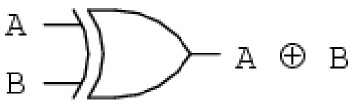
THE EXCLUSIVE-OR FUNCTION

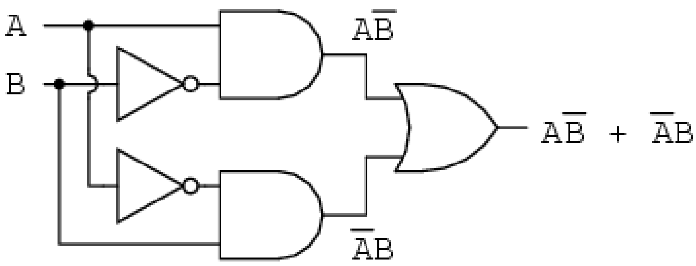
One element conspicuously missing from the set of Boolean operations is that of Exclusive-OR. Whereas the OR function is equivalent to Boolean addition, the AND function to Boolean multiplication, and the NOT function (inverter) to Boolean complementation, there is no direct Boolean equivalent for Exclusive-OR. This hasn't stopped people from developing a symbol to represent it, though:



This symbol is seldom used in Boolean expressions because the identities, laws, and rules of simplification involving addition, multiplication, and complementation do not apply to it. However, there is a way to represent the Exclusive-OR function in terms of OR and AND, as has been shown in previous chapters: AB' + A'B



. . . is equivalent to . . .



$$\mathbf{A \oplus B = A\overline{B} + \overline{A}B}$$

As a Boolean equivalency, this rule may be helpful in simplifying some Boolean expressions. Any expression following the AB' + A'B form (two AND gates and an OR gate) may be replaced by a single Exclusive-OR gate.

PROPERTIES OF EXCLUSIVE-OR GATES

The exclusion-OR (XOR) gate has a high output only when an odd number of inputs us high. The truth tables for two-input and three-input XOR gate are as follows:

A	B	Y=A XOR B
0	0	0
0	1	1

Table 1: Truth table for two-input XOR operation

A	B	C	Y= (A XOR B) XOR C
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0

Table 2: Truth table for three-input XOR operation

The XOR operation, in Boolean expression is represented using the ⊕ symbol.

Therefore, A XOR B = $A \oplus B$

The SOP equation for XOR output for two input variable is

$$Y = A \oplus B = \overline{A}.B + A.\overline{B}$$

The symbol for XOR gate is shown fig.3.

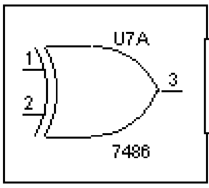


Fig.3: XOR gate symbol.

The combinational logic circuit for two input variable XOR gate is shown in fig

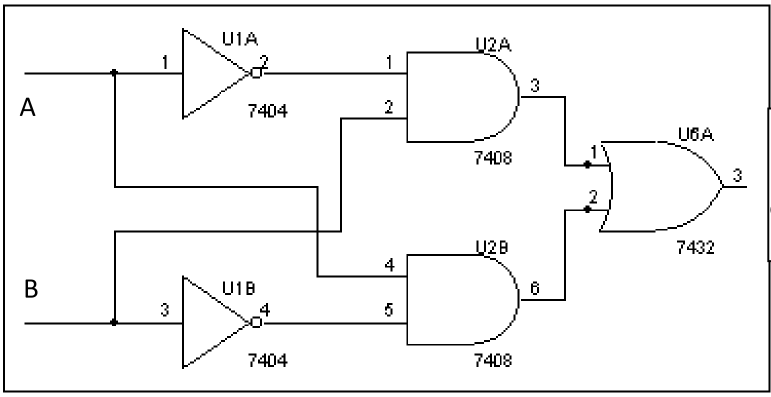


Fig.4: The combinational logic circuit for XOR operation.