digits, the borrow obtained from the subtraction of two bits is subtracted from the next higher-order pair of significant bits. Here the subtraction operation involves three bits—the minuend bit, subtrahend bit, and the borrow bit, and produces a different result as well as a borrow. The combinational circuit that performs this type of addition operation is called a *full-subtractor*. Similar to an adder circuit, a full-subtractor combinational circuit can be developed by using two half-subtractors.

4.4.1 Design of Half-subtractors

A half-subtractor has two inputs and two outputs. Let the input variables minuend and subtrahend be designated as X and Y respectively, and output functions be designated as D for difference and B for borrow. The truth table of the functions is as follows.

Input variables		*Output variables*	
X	*Y*	*D*	*B*
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Figure (4-8)

By considering the minterms of the truth table in Figure 4.8, the Boolean expressions of the outputs D and B functions can be written as

$D = X'Y + XY'$ and

$B = X'Y$.

Figure 4.9 shows the logic diagram to realize the half-subtractor circuit.

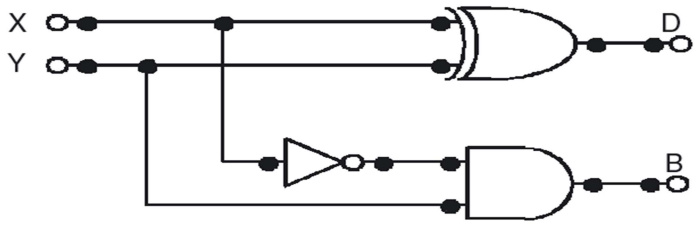

Figure (4-9)