Summary

The XOR Gate

The **XOR gate** produces a HIGH output only when both inputs are at opposite logic levels. The truth table is

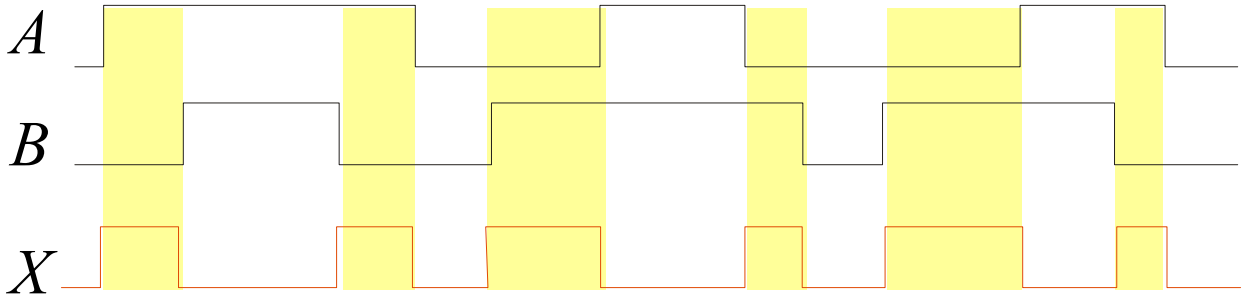
Inputs		Output
A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

The **XOR** operation is written as $X = \overline{A}B + A\overline{B}$. Alternatively, it can be written with a circled plus sign between the variables as $X = A \oplus B$.

Summary

The XOR Gate

Example waveforms:



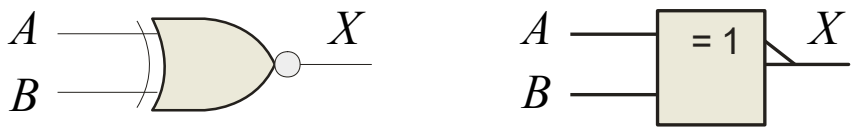
Notice that the XOR gate will produce a HIGH only when exactly one input is HIGH.

Question If the *A* and *B* waveforms are both inverted for the above waveforms, how is the output affected?

Solution

Summary

The XNOR Gate



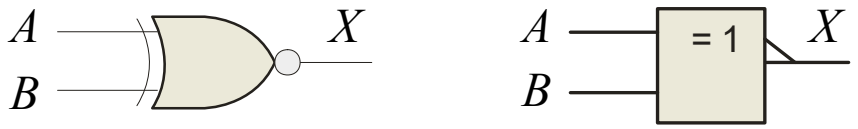
The **XNOR gate** produces a HIGH output only when both inputs are at the same logic level. The truth table is

Inputs		Output
A	B	X
0	0	1
0	1	0
1	0	0
1	1	1

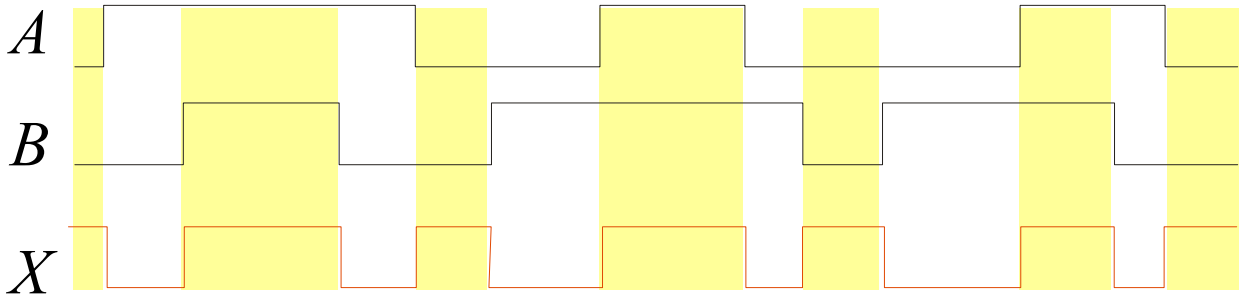
The **XNOR** operation shown as $X = \overline{A}\,\overline{B} + AB$. Alternatively, the XNOR operation can be shown with a circled dot between the variables. Thus, it can be shown as $X = A \odot B$.

Summary

The XNOR Gate



Example waveforms:



Notice that the XNOR gate will produce a HIGH when both inputs are the same. This makes it useful for comparison functions.

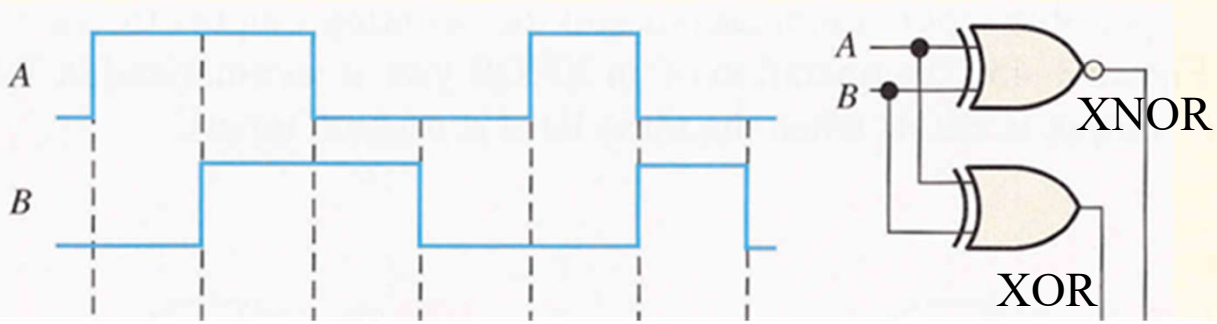
Question If the *A* waveform is inverted but *B* remains the same, how is the output affected?

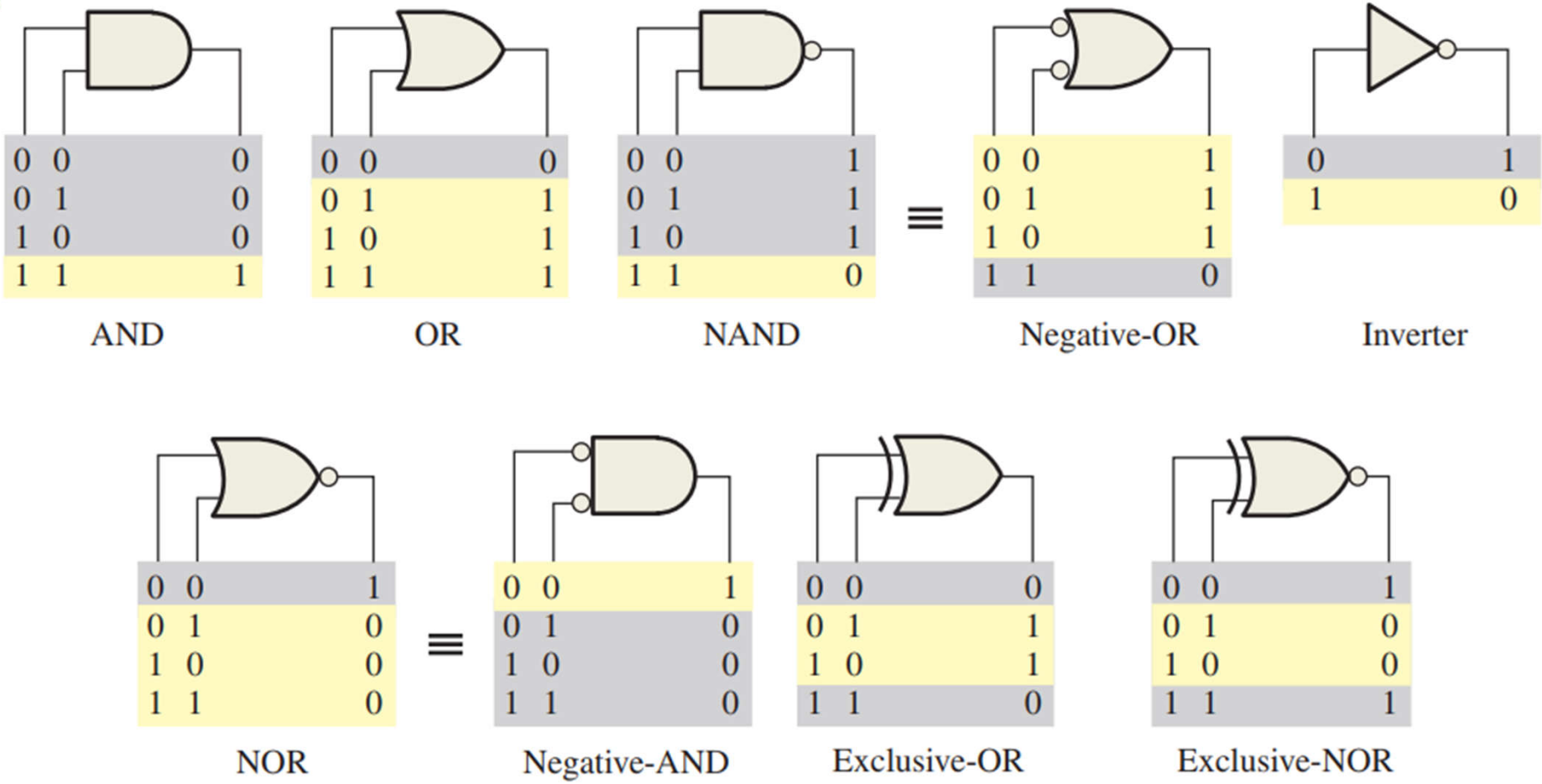
Solution

Summary

EXAMPLE 3–20

Determine the output waveforms for the XOR gate and for the XNOR gate, given the input waveforms, *A* and *B*, in Figure 3–47.





Note: Active states are shown in yellow.

Selected Key Terms

Inverter A logic circuit that inverts or complements its inputs.

Truth table A table showing the inputs and corresponding output(s) of a logic circuit.

Timing diagram A diagram of waveforms showing the proper time relationship of all of the waveforms.

Boolean algebra The mathematics of logic circuits.

AND gate A logic gate that produces a HIGH output only when all of its inputs are HIGH.

Selected Key Terms

OR gate	A logic gate that produces a HIGH output when one or more inputs are HIGH.
NAND gate	A logic gate that produces a LOW output only when all of its inputs are HIGH.
NOR gate	A logic gate that produces a LOW output when one or more inputs are HIGH.
Exclusive-OR gate	A logic gate that produces a HIGH output only when its two inputs are at opposite levels.
Exclusive-NOR gate	A logic gate that produces a LOW output only when its two inputs are at opposite levels.