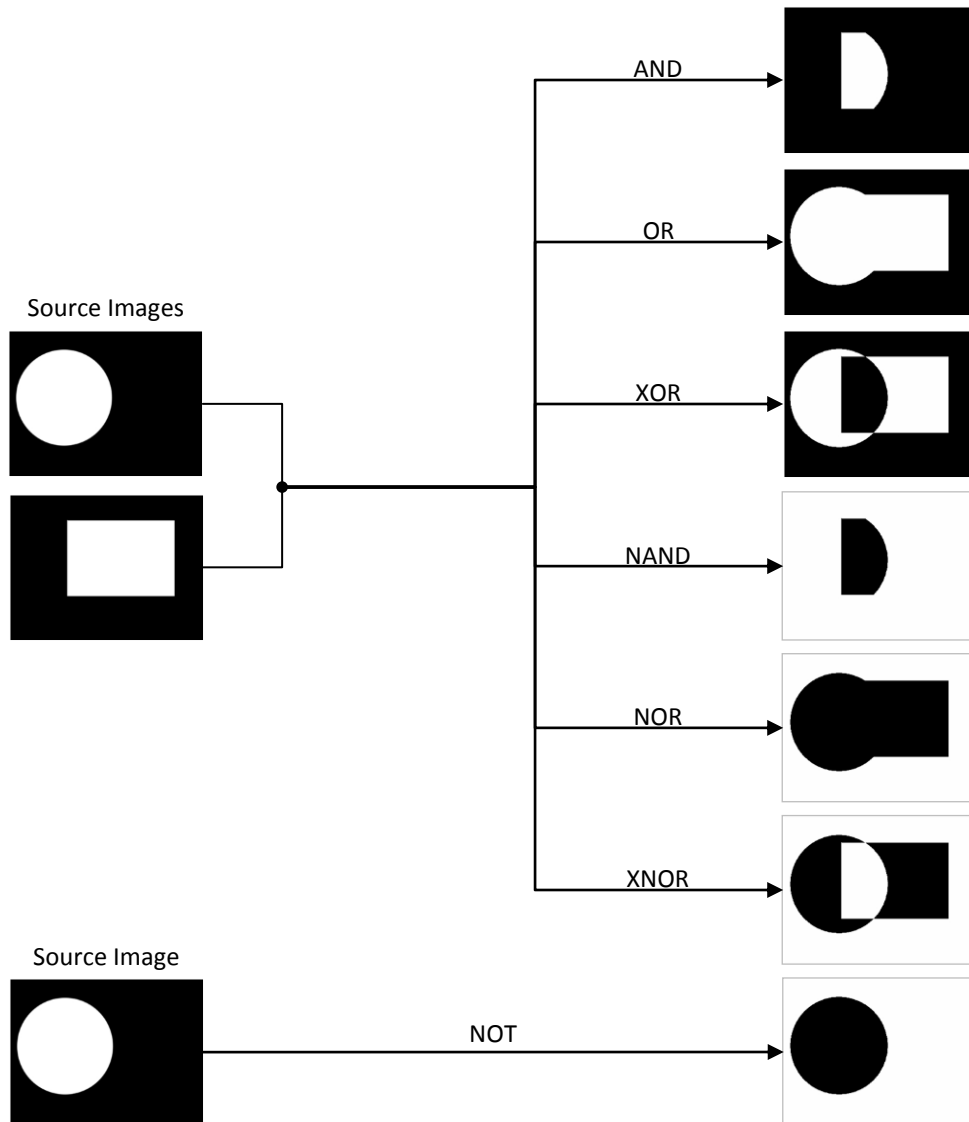


## Logical Operators

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Boolean logic is a system of logical operations defined by George Boole in the mid 19<sup>th</sup> century to apply algebraic operations on binary values. These operations consist of 4 basic binary operations: AND, OR, and XOR and a unary operator NOT. Secondary operators can be created by combining the three binary operators with the unary operator, yielding: NAND, NOR, and XNOR.

For the Boolean mask operations described in this section, the binary operators are applied per-pixel to a pair of logical images to create a new image. The unary operator is applied per-pixel to the single logical image to create a new image. The figure below shows the results of each of the operations from two logical start images. In these examples black pixels indicate false, white indicate true.



Logical Operation Examples

**Logical Operation Truth Table**

Operation	Mathematical Notation	Truth Table															
AND	$C = A \wedge B$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td>T</td> </tr> <tr> <td>T</td> <td>F</td> <td>F</td> </tr> <tr> <td>F</td> <td>T</td> <td>F</td> </tr> <tr> <td>F</td> <td>F</td> <td>F</td> </tr> </tbody> </table>	A	B	C	T	T	T	T	F	F	F	T	F	F	F	F
A	B	C															
T	T	T															
T	F	F															
F	T	F															
F	F	F															
OR	$C = A \vee B$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td>T</td> </tr> <tr> <td>T</td> <td>F</td> <td>T</td> </tr> <tr> <td>F</td> <td>T</td> <td>T</td> </tr> <tr> <td>F</td> <td>F</td> <td>F</td> </tr> </tbody> </table>	A	B	C	T	T	T	T	F	T	F	T	T	F	F	F
A	B	C															
T	T	T															
T	F	T															
F	T	T															
F	F	F															
XOR	$C = (A \wedge !B) \vee (!A \wedge B)$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td>F</td> </tr> <tr> <td>T</td> <td>F</td> <td>T</td> </tr> <tr> <td>F</td> <td>T</td> <td>T</td> </tr> <tr> <td>F</td> <td>F</td> <td>F</td> </tr> </tbody> </table>	A	B	C	T	T	F	T	F	T	F	T	T	F	F	F
A	B	C															
T	T	F															
T	F	T															
F	T	T															
F	F	F															
NAND	$C = !(A \wedge B)$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td>F</td> </tr> <tr> <td>T</td> <td>F</td> <td>T</td> </tr> <tr> <td>F</td> <td>T</td> <td>T</td> </tr> <tr> <td>F</td> <td>F</td> <td>T</td> </tr> </tbody> </table>	A	B	C	T	T	F	T	F	T	F	T	T	F	F	T
A	B	C															
T	T	F															
T	F	T															
F	T	T															
F	F	T															
NOR	$C = !(A \vee B)$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td>F</td> </tr> <tr> <td>T</td> <td>F</td> <td>F</td> </tr> <tr> <td>F</td> <td>T</td> <td>F</td> </tr> <tr> <td>F</td> <td>F</td> <td>T</td> </tr> </tbody> </table>	A	B	C	T	T	F	T	F	F	F	T	F	F	F	T
A	B	C															
T	T	F															
T	F	F															
F	T	F															
F	F	T															
XNOR	$C = (A \wedge B) \vee (!A \wedge !B)$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>T</td> <td>T</td> </tr> <tr> <td>T</td> <td>F</td> <td>F</td> </tr> <tr> <td>F</td> <td>T</td> <td>F</td> </tr> <tr> <td>F</td> <td>F</td> <td>T</td> </tr> </tbody> </table>	A	B	C	T	T	T	T	F	F	F	T	F	F	F	T
A	B	C															
T	T	T															
T	F	F															
F	T	F															
F	F	T															
NOT	$B = !A$	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr> <td>T</td> <td>F</td> </tr> <tr> <td>F</td> <td>T</td> </tr> </tbody> </table>	A	B	T	F	F	T									
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