Boolean Logic deals with expressions and operations on variables that can have only two values: True or False. A Boolean operator is a comparison between one or more boolean values There are one or more inputs (all either True or False) and one single output (either True or False). Consider the following truth tables:



| **a** | **Not a** |
| --- | --- |
| T | *T* |
| T | *T* |

1. For the following table, provide the boolean value (True or False) for each comparison

| **Values** | **a AND b** | **a OR b** | **a XOR b** | **NOT a** |
| --- | --- | --- | --- | --- |
| a = TRUE,  b = TRUE | TRUE | TRUE | FALSE | FALSE |
| a = FALSE,  b = TRUE | FALSE | TRUE | TRUE | TRUE |
| a = TRUE,  b = FALSE | FALSE | TRUE | TRUE | FALSE |
| a = FALSE,  b = FALSE | FALSE | FALSE | FALSE | TRUE |

1. For the following table, provide the boolean value (True or False) for each comparison

| **Values** | **a = TRUE,**  **b = TRUE** | **a = FALSE,**  **b = TRUE** | **a = TRUE,**  **b = FALSE** | **a = FALSE,**  **b = FALSE** |
| --- | --- | --- | --- | --- |
| **a AND (NOT b)** | TRUE AND (NOT TRUE)  TRUE AND FALSE  FALSE | FALSE AND (NOT FALSE)  FALSE AND FALSE  FALSE | TRUE AND (NOT FALSE)  TRUE AND TRUE  TRUE | FALSE AND (NOT FALSE)  FALSE AND TRUE  FALSE |
| **NOT(a OR b)** | NOT(TRUE OR TRUE)  NOT(TRUE)  FALSE | NOT(FALSE OR TRUE)  NOT(TRUE)  FALSE | NOT(TRUE OR FALSE)  NOT(TRUE)  FALSE | NOT(FALSE OR FALSE)  NOT(FALSE)  TRUE |
| **(a XOR b) AND a** | (TRUE XOR TRUE) AND TRUE  FALSE AND TRUE  FALSE | (FALSE XOR TRUE) AND FALSE  TRUE AND FALSE  FALSE | (TRUE XOR FALSE) AND TRUE  TRUE AND TRUE  TRUE | (FALSE XOR FALSE) AND FALSE  FALSE AND FALSE  FALSE |
| **(NOT a) OR (NOT b)** | (NOT TRUE) OR (NOT TRUE)  FALSE OR FALSE  FALSE | (NOT FALSE) OR (NOT TRUE)  TRUE OR FALSE  TRUE | (NOT TRUE) OR (NOT FALSE)  FALSE OR TRUE  FALSE | (NOT FALSE) OR (NOT FALSE)  TRUE OR TRUE  TRUE |

1. Boolean logic corresponds closely to the idea of union and intersection in set theory. This can be visually shown using Venn-like diagrams .In the three 5x5 grids on the right hand side, draw what the union (“OR”), the intersection (“AND”), and the difference (“XOR”) of each cell would look like. The first row has been done for you.

| A | | | | |  | B | | | | |  | A OR B | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| F | F | T | F | F |  | T | F | F | F | T |  | T | F | T | F | T |
| F | F | T | F | F | F | T | F | T | F | F |  |  |  |  |
| T | T | T | T | T | F | F | T | F | F |  |  |  |  |  |
| F | F | T | F | F | F | T | F | T | F |  |  |  |  |  |
| F | F | T | F | F | T | F | F | F | T |  |  |  |  |  |
| A | | | | | B | | | | | A AND B | | | | |
| T | F | T | F | T | T | T | T | T | T |  |  |  |  |  |
| T | F | T | F | T | F | F | F | F | F |  |  |  |  |  |
| T | F | T | F | T | T | T | T | T | T |  |  |  |  |  |
| T | F | T | F | T | F | F | F | F | F |  |  |  |  |  |
| T | F | T | F | T | T | T | T | T | T |  |  |  |  |  |
| A | | | | | B | | | | | A XOR B | | | | |
| F | T | T | T | F | F | F | F | F | F |  |  |  |  |  |
| F | T | T | T | F | T | T | T | T | T |  |  |  |  |  |
| F | T | T | T | F | T | T | T | T | T |  |  |  |  |  |
| F | T | T | T | F | T | T | T | T | T |  |  |  |  |  |
| F | T | T | T | F | F | F | F | F | F |  |  |  |  |  |