|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name | Logic | Logic gate | Notation | Alternative notation | Example | Truth table |
| Conjunction | **AND** | and | ∧ | ·\* | A ∧ BA AND B |

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **Output** |
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

 |
| Disjunction | **OR** | or | ∨ | + | A ∨ BA OR B |

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **Output** |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

 |
| Exclusive Disjunction | **XOR** | xor | ⊕ | ∨ | A ∨ BA XOR B |

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **Output** |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

 |
| Negation | **NOT** | not | ¬ | \_!~ | ¬ANOT A |

|  |  |
| --- | --- |
| **A** | **Output** |
| 0 | 1 |
| 1 | 0 |

 |
| Equivalence | **The same as** |  | ≡ | ↔ | A ≡ BA is the same as B |

|  |  |
| --- | --- |
| **A** | **Output** |
| 0 | 0 |
| 1 | 1 |

 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name | Logic | Logic gate | Notation | Alternative notation | Example | Truth table |
| Universal gate | **NAND** |  | | | ↑ | A | BA NAND B |

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **Output** |
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

 |
| Universal gate | **NOR** |  | ∨ | $$\overbar{+}$$ | A ∨ BA OR B |

|  |  |  |
| --- | --- | --- |
| **A** | **B** | **Output** |
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

 |

|  |  |  |  |
| --- | --- | --- | --- |
| Rule | Purpose | Example | English example |
| De Morgan’s law | AND / OR can be replaced by the other given changes to the equation. | **¬(A ∨ B) ≡ ¬A ∧ ¬B**NOT (A OR B) is the same as NOT A AND NOT B**¬(A ∧ B) ≡ ¬A ∨ ¬B**NOT (A AND B) is the same as NOT A OR NOT B | “It cannot be both winter AND summer at the same point in time.”Is the same as:“At any point in time it is NOT winter OR it is NOT summer.” |
| Distribution | Allows for the multiplying or factoring out of an expression. | **A ∨ (B ∧ C) ≡ (A ∨ B) ∧ (A ∨ C)**A OR (B AND C) is the same as (A OR B) AND (A OR C)**A ∧ (B ∨ C) ≡ (A ∧ B) ∨ (A ∧ C)**A AND (B OR C) is the same as (A AND B) OR (A AND C) | “You can choose one main course and either a starter or dessert.”Is the same as:“You can choose one main and one starter or one main and one dessert.” |
| Association | Allows for the removal of brackets and the regrouping of variables. | **A ∨ (B ∨ C) ≡ A ∨ B ∨ C**A OR (B OR C) is the same as A OR B OR C**A ∧ (B ∧ C) ≡ A ∧ B ∧ C**A AND (B AND C) is the same as A AND B AND C | “Craig and his friends Dave and Sam are coming to the party.” Is the same as:“Craig, Dave and Sam are coming to the party.” |
| Commutation | The order of application of two separate terms is not important. | **A ∨ B ≡ B ∨ A**A OR B is the same as B OR A**A ∧ B ≡ B ∧ A**A AND B is the same as B AND A | “Tom and Jane are going shopping.”Is the same as:“Jane and Tom are going shopping.” |
| Double negation | Double false means it is true. | **¬ ¬A ≡ A**NOT NOT A is the same as A | “It’s not as if I don’t like you,”Is the same as:“I do like you.” |
| Absorption | A variable both outside and inside a bracket in the same expression removes the other variable. | **A ∨ (A ∧ B) ≡ A**A OR (A AND B) is the same as A**A ∧ (A ∨ B) ≡ A**A AND (A OR B) is the same as A | “You can have oranges or oranges and lemons.” means I will always have oranges regardless of whether I have lemons. |