

1.3.11. Algebra of Logical Proposition

The logical equivalences below are important equivalences that should be memorized.

- 1-Identity Laws: $p \wedge T \equiv p$.
 $p \vee F \equiv p$.
- 2-Domination Laws: $p \vee T \equiv T$.
 $p \wedge F \equiv F$.
- 3-Idempotent Laws: $p \vee p \equiv p$.
 $p \wedge p \equiv p$.
- 4- Double Negation Law: $\sim(\sim p) \equiv p$.
- 5- Commutative Laws: $p \vee q \equiv q \vee p$.
 $p \wedge q \equiv q \wedge p$.
- 6- Associative Laws: $(p \vee q) \vee r \equiv p \vee (q \vee r)$.
 $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$.
- 7- Distributive Laws: $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$.
 $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$.
- 8- De Morgan's Laws: $\sim(p \wedge q) \equiv \sim p \vee \sim q$.
 $\sim(p \vee q) \equiv \sim p \wedge \sim q$.
- 9- Absorption Laws: $p \wedge (p \vee q) \equiv p$.
 $p \vee (p \wedge q) \equiv p$.
 $p \wedge (\sim p \vee q) \equiv p \wedge q$.
 $p \vee (\sim p \wedge q) \equiv p \vee q$.
- 10-Implication Law: $(p \rightarrow q) \equiv (\sim p \vee q)$.
- 11- Contrapositive Law: $(p \rightarrow q) \equiv (\sim q \rightarrow \sim p)$.
- 12- Tautology: $p \vee \sim p \equiv T$.
- 13- Contradiction: $p \wedge \sim p \equiv F$.
- 14- Equivalence: $(p \rightarrow q) \wedge (q \rightarrow p) \equiv (p \leftrightarrow q)$.
- 15- $p \vee q \equiv (p \vee q) \wedge \sim(p \wedge q)$.