CS 225

Symbols and Formulas

Fall 2020

Logic

Symbols: $\geq$ $\leq$ $\neq$ $\neg$ $\sim$ $\wedge$ $\vee$ $\oplus$ $\equiv$ $\rightarrow$ $\leftrightarrow$ $\square$ $\exists$ $\forall$

Identities:

$\sim(\sim p) \equiv p$	Double Negation
$p \wedge \mathbb{T} \equiv p \quad p \vee \mathbb{F} \equiv p$	Identity
$p \vee \mathbb{T} \equiv \mathbb{T} \quad p \wedge \mathbb{F} \equiv \mathbb{F}$	Domination
$p \wedge p \equiv p \quad p \vee p \equiv p$	Idempotent
$p \vee q \equiv q \vee p \quad p \wedge q \equiv q \wedge p$	Commutative
$(p \vee q) \vee r \equiv p \vee (q \vee r)$	Associative
$(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$	Associative
$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$	Distributive
$p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$	Distributive
$\sim(p \wedge q) \equiv \sim p \vee \sim q$	DeMorgan's
$\sim(p \vee q) \equiv \sim p \wedge \sim q$	Demorgan's
$p \vee (p \wedge q) \equiv p$	Absorption
$p \wedge (p \vee q) \equiv p$	Absorption
$p \rightarrow q \equiv \sim q \rightarrow \sim p$	Contrapositive
$p \oplus q \equiv q \oplus p$	Contrapositive
$p \rightarrow q \equiv \sim p \vee q$	Implication
$p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$	Biconditional Equivalence
$(p \wedge q) \rightarrow r \equiv p \rightarrow (q \rightarrow r)$	Exporation
$(p \rightarrow q) \wedge (p \rightarrow \sim q) \equiv \sim p$	Absurdity
$p \vee q \equiv \sim p \rightarrow q$	Alternate Implication
$p \wedge q \equiv \sim (p \rightarrow \sim q)$	Alternate Implication
$\sim(p \rightarrow q) \equiv p \wedge \sim q$	Alternate Implication
$\sim\ \forall\, xP(x) \equiv\ \exists\, x \sim P(x)$	DeMorgan's for Quantifiers
$\sim\ \exists\, xQ(x) \equiv\ \forall\, x \sim Q(x)$	DeMorgan's for Quantifiers

A conditional statement $p \rightarrow q$ can also be read as:

- If p then q
- p implies q
- If p, q
- p only if q
- q if p
- q unless $\sim p$
- q when p
- q whenever p
- q follows from p
- p is a sufficient condition for q (p is sufficient for q)
- q is a necessary condition for p (q is necessary for p)