Formulary

Languages and Algorithms for Artificial Intelligence

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1 Propositional logic

$\Gamma = F_1, \ldots, F_n$ (*promises*); F *conclusion*; $\mathbf{\Gamma \vDash F} \iff F$ is a **logical consequence** of Γ.
Valid formula $\iff$ Tautology $\iff$ True in any circumstance.
Inconsistent formula $\iff$ Unsatisfiable formula $\iff$ False in any circumstance.
G valid $\iff \neg G$ inconsistent.

Truth table of main logical connectives						
P_1	P_2	$\neg P_1$	$P_1 \wedge P_2$	$P_1 \vee P_2$	$P_1 \rightarrow P_2$	$P_1 \leftrightarrow P_2$
T	T	F	T	T	T	T
T	F	F	F	T	F	F
F	T	T	F	T	T	F
F	F	T	F	F	T	T

$F \equiv G \iff F \vDash G$ and $G \vDash F \iff F$ logically equivalent to G.

Logical equivalence rules			
$P \wedge Q$	$\equiv$	$Q \wedge P$	Commutativity of AND
$P \vee Q$	$\equiv$	$Q \vee P$	Commutativity of OR
$(P \wedge Q) \wedge R$	$\equiv$	$P \wedge (Q \wedge R)$	Associativity of AND
$(P \vee Q) \vee R$	$\equiv$	$P \vee (Q \vee R)$	Associativity of OR
$\neg(\neg P)$	$\equiv$	P	Double-negation elimination
$P \rightarrow Q$	$\equiv$	$\neg P \rightarrow \neg Q$	Contraposition
$P \rightarrow Q$	$\equiv$	$\neg P \wedge Q$	Implication elimination
$P \leftrightarrow Q$	$\equiv$	$(P \rightarrow Q) \wedge (Q \rightarrow P)$	Biconditional elimination
$\neg(P \wedge Q)$	$\equiv$	$\neg P \vee \neg Q$	De Morgan
$\neg(P \vee Q)$	$\equiv$	$\neg P \wedge \neg Q$	De Morgan
$P \wedge (Q \vee R)$	$\equiv$	$(P \wedge Q) \vee (P \wedge R)$	Distributivity of AND over OR
$P \vee (Q \wedge R)$	$\equiv$	$(P \vee Q) \wedge (P \vee R)$	Distributivity of OR over AND