BECOME A MEMBER

ON STEADY

The Bright Side of Mathematics

Start Learning Logic – Part 3

Logical operations:

Conditional: For two logical statements A, B,

$A \to B$ denotes the conditional.

Truth table

A	B	$A \to B$
T	T	T
T	F	F
F	T	T
F	F	T

$\Rightarrow$ means $\to$ gives tautology

tautology

A	B	$A \wedge B$	$A \wedge B \to B$
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	T

We can write:

$$A \wedge B \Rightarrow B$$

Biconditional: For two logical statements A, B,

$A \leftrightarrow B$ denotes the biconditional.

Truth table

A	B	$A \leftrightarrow B$
T	T	T
T	F	F
F	T	F
F	F	T

$\Leftrightarrow$ means $\leftrightarrow$ gives tautology

Example: (a) $A \leftrightarrow B \quad \Leftrightarrow \quad (A \to B) \wedge (B \to A)$

(b) $A \to B \quad \Leftrightarrow \quad \neg B \to \neg A$ (contraposition)

If there is fog, then we have poor visibility

If we don't have poor visibility, there is no fog.

Deduction rules: (how to get new true propositions from other true propositions)

Modus ponens: If $A \to B$ true and A true, then: B true

A	B	$A \to B$
T	T	T
T	F	F
F	T	T
F	F	T

Chain syllogism: If $A \to B$ true and $B \to C$ true, then: $A \to C$ true

Reductio ad absurdum: If $A \to B$ true and $A \to \neg B$ true, then: $\neg A$ true