

Proposition - a sentence that declares a fact that can be either true or false [but not both]

Some examples

- A) London is the capital of United Kingdom (true)
- B) All humans are immortal (false)
- C) $1 + 2 = 3$ (true)
- D) $2 + 3 = 4$ (false)

Propositional variables can be represented by letters p, q, r, s, \dots

The **truth value** of a proposition p if it is true, is true T
if it is false, is false F or \perp

The negation of p is $\neg p$ (not p)

It is not the case that all humans are immortal
all humans are not immortal
mortal

TRUTH TABLES

not \neg

p	$\neg p$
T	F
F	T

Inclusive OR \vee

either p or q or both true (true)

p	q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

disjunction

AND \wedge

both p and q

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

conjunction

$\neg p$	$\neg q$	$\neg p \vee \neg q$	$\neg(\neg p \vee \neg q) \equiv p \wedge q$
F	F	F	T
F	T	T	F
T	F	T	F
T	T	T	F

De Morgan's Rule

Exclusive OR

"Do you want tea or coffee?"
Usually this means "either .. or" .
but not both

p	q	$p \oplus q$
T	T	F
T	F	T
F	T	T
F	F	F

Conditional statements

Combines propositions if p then q $p \rightarrow q$

q true if p true

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

if p then q

p implies q

a sufficient condition for

q is p .

q whenever p

q follows from p

p is sufficient for q

p	$\neg p$	q	$\neg p \vee q$
T	F	T	T
T	F	F	F
F	T	T	T
F	T	F	T

Notice $p \rightarrow q \equiv \neg p \vee q$