and	$\wedge$	conjunction
or	$\vee$	disjunction
not	$\sim$	negation

$$\sim(p \wedge q) \equiv (\sim p \vee \sim q)$$ DeMorgan's Law

p	q	① $p \wedge q$	$\sim$①	② $\sim p$	③ $\sim q$	② $\vee$ ③
T	T	T	F	F	F	F
T	F	F	T	F	T	T
F	T	F	T	T	F	T
F	F	F	T	T	T	T

LHS RHS

$$\sim(p \vee q) \equiv (\sim p \wedge \sim q)$$

$$a \wedge (b \vee c) \equiv (a \wedge b) \vee (a \wedge c)$$

a	b	c	$b \vee c$	$a \wedge (b \vee c)$	① $a \wedge b$	② $a \wedge c$	① $\vee$ ②
T	T	T	T	T	T	T	T
T	T	F	T	T	T	F	T
T	F	T	T	T	F	T	T
T	F	F	F	F	F	F	F
F	T	T	T	F	F	F	F
F	T	F	T	F	F	F	F
F	F	T	T	F	F	F	F
F	F	F	F	F	F	F	F

$$a \vee (b \wedge c) \equiv (a \vee b) \wedge (a \vee c)$$

a	b	c
T	T	T
T	T	F
T	F	T
T	F	F
F	T	T
F	T	F
F	F	T
F	F	F

a	b	f(a,b)
T	T	F
T	F	T
F	T	F
F	F	T

a	b	c		
T	T	T	F	T
T	T	F	F	T
T	F	T	F	T
T	F	F	F	T
F	T	T	F	T
F	T	F	F	T
F	F	T	F	T
F	F	F	F	T

tautology

contradiction

p: It is raining.

$p \vee \sim p$

p	$\sim p$	$p \vee \sim p$
T	F	T
F	T	T

exclusive or $\oplus$

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

$\equiv (p \wedge \sim q) \vee (\sim p \wedge q)$

if you get all A's, then you will pass this course.

p: you get all A's

q: you pass the course

p	q	p → q
T	T	T
T	F	F
F	T	T
F	T	T

conditional

$p \rightarrow q$

if p then q

p implies q

$\sim p \vee q$

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

$\sim p$: stop

q: I'll shoot

$p \rightarrow q$

p: you miss class
q: you fail

$p \to q$ if you miss class, then you fail.

$\sim p \vee q$

$\sim(p \to q) \equiv \sim(\sim p \vee q)$

$\equiv \sim\sim p \wedge \sim q$

$\equiv p \wedge \sim q$