

Mathematical logic

1. Logic and propositional calculus

A **proposition** (or *statement*) is a declarative statement which is true or false, but not both. Example: the following six sentences:

- (1) Ice floats in water.
- (2) China is in Europe.
- (3) $2 + 2 = 4$
- (4) $2 + 2 = 5$
- (5) Where are you going?
- (6) Do your homework.

The first four are propositions, the last two are not. Also, (1) and (3) are true, but (2) and (4) are false.

2. Compound Propositions

It is the proposition that composed of sub propositions and various connectives.

Primitive proposition is the proposition that cannot be broken down into simpler propositions.

For example, the above propositions are primitive propositions, while:

"Roses are red and violets are blue." and

"John is smart or he studies every night.", Are compound.

3. Basic Logical Operations

1. Conjunction, $p \wedge q$
2. Disjunction, $p \vee q$
3. Negation, $\neg p$, or $\sim p$, or $-p$, or p^-

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

(a) "p and q"

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

(b) "p or q"

p	$\neg p$
T	F
F	T

(c) "not p"

