

Compound Proposition

A proposition obtained from the combination of two or more primary (atomic) proposition by using some connecting words is called compound proposition.

These connecting words are called logical operators / Connective

There are basic five logical operator.

① Negation (\sim, \neg) \rightarrow p be a proposition, the negation of p is denoted by $\sim p$ or $\neg p$ and defined as

$\sim p$: Not p

$\neg p$: It is not the case that p (we will deny the statement)

Let p be a proposition. The negation of p , denoted by $\neg p$ (also denoted by \bar{p}), is the statement

"It is not the case that p ."

The proposition $\neg p$ is read "not p ." The truth value of the negation of p , $\neg p$, is the opposite of the truth value of p .

the Truth table of negation

p	$\sim p$
T	F
F	T

Ex 1) $p: 2+3 > 2$ 100% True — **T**

$\sim p: 2+3 \not> 2$ or $2+3 \leq 2$ 100% False — **F**

Ex 2) $q: \text{All the students of section D2110 are Intelligent.}$

$\sim q:$

No Student — — — is Intelligent.

Ex 3) $p: \text{Some students are not Intelligent.}$

$\sim p:$

② Conjunction \rightarrow The conjunction of p & q is denoted by $p \wedge q$ and defined as " p and q "

Let p and q be propositions. The conjunction of p and q , denoted by $p \wedge q$, is the proposition " p and q ." The conjunction $p \wedge q$ is true when both p and q are true and is false otherwise.

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

"And" \therefore

$$\begin{aligned} 1 \cdot 1 &= 1 \\ 1 \cdot 0 &= 0 \\ 0 \cdot 1 &= 0 \\ 0 \cdot 0 &= 0 \end{aligned}$$

T	T	T
T	F	F
F	T	F
F	F	F

$$\begin{array}{r} 1 \cdot 0 = 0 \\ 0 \cdot 0 = 0 \\ \hline \end{array}$$

p : Ram is Healthy q : He has blue Eyes.

$p \wedge q$: Ram is Health and has blue Eyes.

③ Disjunction: $\rightarrow p \text{ OR } q \quad p \vee q$

Let p and q be propositions. The *disjunction* of p and q , denoted by $p \vee q$, is the proposition " p or q ." The disjunction $p \vee q$ is false when both p and q are false and is true otherwise.

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

'OR' Union

In Disjunction if at least one is True then Result is True

p : He will go to Delhi q : He will go to Calcutta

$p \vee q = p \text{ OR } q = \underline{\text{OR}}$
He will go to Delhi OR Calcutta

Set
Complement (-)
Intersection \cap
(And)
Union (OR) \cup

Logic
Negation \sim
Conjunction (And) \wedge
Disjunction (OR) \vee

What is the negation of each of these propositions?

- Mei has an MP3 player.
- There is no pollution in New Jersey.
- $2 + 1 = 3$.
- The summer in Maine is hot and sunny.

$$2 + 1 \neq 3$$

Let p and q be the propositions "The election is decided" and "The votes have been counted," respectively. Express each of these compound propositions as an English sentence.

- ① $\sim p$ ② $\sim q$ ③ $p \vee q$
④ $\sim p \vee q$ ⑤ $p \wedge q$ ⑥ $\sim p \wedge \sim q$

p : The Election is decided

q : The votes have been counted.