

21st
NOV

Logic, Induction & Reasoning

Proposition

↳ It is a declarative sentence that
is
↳ either true or false
but not both

Eg:

- i) Today is Monday
- ii) Sun rises from the east
- iii) Pokhara is capital of Nepal
- iv) $1+2=3$
- v) If x is integer, x^2 is positive integer

Following aren't proposition

1) $x+2=3$

(x is unknown)

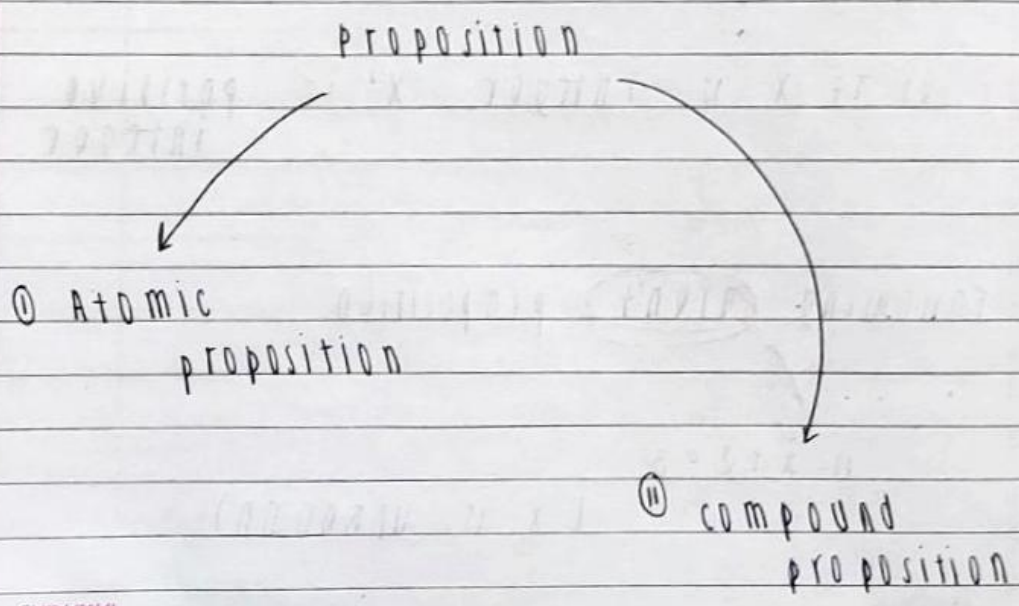
ii) Let him go!
(Exclamation)

iii) Do your work
(Imperative)

iv) Obama was a great president of USA
(Opinion)

v) Close the window
(Command)

vi) What is your mobile no?
(Interrogation)



① Atomic Proposition

- ↳ can't be broken down further
- ↳ a single statement proposition
- ↳ doesn't contain negation

② Compound Proposition

- ↳ combination of ~~one~~ two or more atomic proposition

$$p \wedge q$$

$$p \vee q$$

$$p \rightarrow q$$

$$p \leftrightarrow q$$

$$\neg p$$

logical

operator connection

• Truth Table

- ↳ shows how variables can combine & their results.

CONNECTIVES

↳ those notations which are used to get new propositions from given propositions

↳ common used connectives are:

(i) conjunction (AND)

also BUT
denoted by

\wedge

(ii) Disjunction (OR)

denoted by

\vee

(iii) Negation (NOT)

denoted by

\neg

(iv) Implication (If ... then ...)

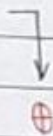
denoted by

\rightarrow

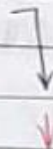
(vi) double implication (If & only if)



(vii) EXCLUSIVE OR (X-OR)

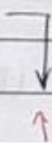


(vii) ~~EXCLUSIVE~~ NOR (X-NOR)



NOR*

(viii) NOT AND (NAND)



ii CONJUNCTION (Λ)

Let p & q be two propositions.

The proposition ' p ' & ' q ' is denoted by $p \wedge q$

true only when p and q are true

Truth Table

P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

• NOTE:

AND ko satta but ni hunda
sarkka

• Eg: The sun is shining but it is raining

{ p: The sun is shining
q: It is raining

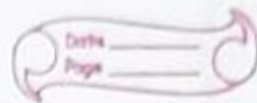
iii Disjunction (V)

Let p & q be two propositions.

The proposition 'p or q' is denoted by $p \vee q$



otherwise true



Truth table

P	q	$P \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

iii) Negation (\neg)

Let p be the proposition.

The statement "It is not the case p "
is negation of p .

It is denoted by $\neg p$

Truth Table

P	$\neg p$
T	F
F	T

• EG:

p : today is monday

$\neg p$: It is not the case that today is
monday.

iv) Implication (\rightarrow)

(conditional implication)

Let p & q be two propositions

The conditional statement $p \rightarrow q$ is the proposition

'If p then q '
necessary

q | focus | q | p | sufficient

laptop | p | q | (conclusion)
pave | p | pugya | q

Proposition $p \rightarrow q$ is false only when
 p is true & q is false
otherwise true

Truth Table

p	q	$p \rightarrow q$
T	T	T
T	F	(F)

F	T	T
F	F	T

- **Ex:** If I become HOD, I will give laptop to every student

p : I became HOD

q : I will give laptop to every student

$p \rightarrow q$

- ways to express conditional statement

i) If p then q

ii) If p , q

iii) p is sufficient for q

iv) q if p

v) q when p

vi) p implies q

vii) p only if $q \rightarrow p \rightarrow q, q \leftarrow p$ (both)

viii) q necessary condition

for p is q

ix) a sufficient condition

for q is p

x) q whenever p

xii) q is necessary for p .

xiii) q follows from p

xiiii) q unless (p)

Eg:

① It snows whenever wind blows from the northeast.

yesko paxadi ko is hypothesis
(p)

agadi ko is

& conclusion
(q)

p: The wind blows from the northeast.

② To get tenure as a professor, it is sufficient to be world famous.

$p \rightarrow q$

p : you ~~can~~ are world famous

q : you can get tenure as a professor

③ The automated reply can not be sent when the file system is full.

p : The file system is full

q : The automated reply cannot be sent.

$p \rightarrow \neg q$

• Denotation in terms of compound proposition

① Ram is either smart or honest but Ram is not honest if he is smart

p : Ram is smart

q : Ram is honest

$(p \vee q) \wedge (p \rightarrow \neg q)$