



Propositional Logic

Next Chapter:

Atomic & Compound Propositions

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Propositional Logic

Next Topic:

Atomic & Compound Proposition



“proposition” is any statement that can have
one of the truth values, true or false.





Atomic Proposition:

An 'Atomic Proposition' is one whose truth or falsity does not depend on the truth or falsity of any other proposition.

CLASSES



4 is a prime number.

New Delhi is the capital of India.

Atomic Prop.

4 is a prime number, and New Delhi is the capital of India.

Not Atomic Prop

Proposition 1

①

4 is a prime number.

Atomic
proposition

New Delhi is the capital of India.

③

4 is a prime number, and New Delhi is the capital of India.



Atomic Proposition:

T
o
F

An 'Atomic Proposition' is one whose truth or falsity does
not depend on the truth or falsity of any other proposition.

Atomic proposition is, by itself, true or false. We cannot
determine its truth value using some other proposition.



NOTE:

Atomic Propositions are represented using
Propositional Variable.

A single Boolean(propositional) variable p is referred to as an
atomic proposition, since it does not reduce further to other more
basic propositions.



A : 4 is a prime number.

B : New Delhi is the capital of India.



} Axiomatic Prop.



Mathematics

↓
Algebra:

x, y

✓
Atomic
Variables

$2x + y^3$
operator

Prop. logic :

{Atomic
proposition}

Prop. Variables
 p, q, r, \dots

New
propositions

p and q
operator



NOTE:

New Propositions (statements) can be created
from Atomic Propositions with the help of Logical
Connectives.

Operators

Compound Prop.



P : 4 is a prime number.

Q : New Delhi is the capital of India.

Atomic Prop.

4 is a prime number, AND New Delhi is the capital of India.

P

Q

4 is NOT a prime number.

4 is a prime number, OR New Delhi is the capital of India.

P

Q

4 is a prime number, OR New Delhi is the capital of India, BUT NOT BOTH.

IF 4 is a prime number, THEN New Delhi is the capital of India.



Consider "Grass is green and snow is white".

3

This is a proposition, since it makes a claim that is either true or false (in our world, it is true, but in other logically possible worlds, it might be false).



However, this statement is not an atomic proposition, since it has a part (e.g. "Grass is green") that is a proposition.



"Grass is green" itself is an atomic proposition, since there is no smaller part that is still a proposition (e.g. "Grass" is not a proposition).



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Bram28

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Consider "Grass is green and snow is white".

proposition

3 This is a proposition, since it makes a claim that is either true or false (in our world, it is true, but in other logically possible worlds, it might be false).

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Bram28

94.9k ●5 ■62 ▲109

A : This book is interesting.

B : I am staying at home.

Atomic prop.

This book is interesting, and I am staying at home.

This book is not interesting.

This book is interesting, or I am staying at home.

This book is interesting, or I am staying at home but not both.

If this book is interesting, then I am staying at home.



An atomic proposition is one whose truth or falsity does not depend on the truth or falsity of any other proposition.

Compound propositions :

We can produce new propositions from those that we already have.

Many mathematical statements are constructed by combining one or more propositions.

New propositions, called compound propositions, are formed from existing propositions using logical operators.

Prop. logic:

Basic building block

• Atomic Prop \equiv Prop-variable
 P, Q, R, \dots

Combine Prop. with the help of variables

of logical operators

Compound prop

P or Q

Not P

Standard Logical Connectives(Operators):

1. NOT
2. AND
3. OR
4. Exclusive OR
5. Implication
6. Bi-Implication

→ *Unary operator*

7. NAND

8. NOR

→ *Binary operators*

P AND Q



Next Lecture:

Logical Connectives - Negation