



**TRINITY COLLEGE FOR WOMEN
NAMAKKAL
Department of Mathematics**

**DISCRETE MATHEMATICS
23PMAE08 - EVEN Semester**

Propositional Logic

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Proposition

Definition:

A proposition is a declarative sentence or statement has a truth value. It is a statement which is either true or false.

Each proposition has a truth value

Either true or false

Examples

Socrates was a human

Socrates was a pigeon

It is raining today

The logo of starbucks is a green mermaid

$1+1 = 2$

$1 + 1 = 4$

Propositions only need to be declarative. Their truth value may be true or false.

Examples that are not propositions

Do you have a dog?

Let's go!

Some coffee mug with mermaid on it

$$X + 3 = 3$$

$$Y = x + 1$$

We know propositions do not have any variables, quantifiers, parameters.

Constructing Propositions

An entire proposition is often denoted by a single propositional variable.

Propositional variables are typically among p, q, r, s, t, \dots

We also denote truth values in particular ways,

True may be denoted by T

False may be denoted by F

When a proposition is known to
always be true,

we can replace it by T.

When a proposition is known to be
always be false,

we can replace it by F

We can combine propositions into
compound propositions or propositional
formulas.

Example

p: The sky is blue

q: The sun rises from the west

The proposition p is always true
i.e., p is true

The proposition q is always false
i.e., q is false

Connectives

We can combine propositions into compound propositions or propositional formulas.

This is akin to compound sentences and other logical connectives in natural language.

In propositional logic, we have five main connectives

The connectives are

Negation: \neg

Conjunction: \wedge

Disjunction: \vee

Implication: \rightarrow

Biconditional: \leftrightarrow

Logical connectives are arithmetic operators (+, -, \times , \div)

THANK YOU

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