

Lecture 1

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Unit I: Logics and Proofs

Text Book: Chapter 1

The rules of logic gives precise meaning to mathematical statement. These rules are used to distinguish between valid and invalid statement. Logic has numerous applications in computer science.

Programming

Proposition

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

Examples:

Today is Friday.	✓	T
Sun rises from west.	✓	F
A. Republic day is celebrated on 26 January.	✓	T
B. $3+2=7$.	✓	F
C. Covid-19 was first identified in China.	✓	T
D. A triangle is made of 4 sides.	✓	F
E. Sit down!	X	} Not declarative sentence
F. What a beautiful morning!	X	
G. $x + 2 = 8$	X	} can be true or can be false
H. $x^2 > 5$	X	

The truth value of proposition is denoted by

- T, if it is true proposition.

The truth value of proposition is denoted by

- T, if it is true proposition.
- F, if it is false proposition.

Compound Proposition

We are going to deal with more than one statement.

Logical Operators

1. **Negation:** Let p be a proposition. The negation of p , denoted by $\neg p$ or \bar{p} . This operator constructs a new proposition from single existing proposition.

It is read as not p .

It is written as "It is not the case that p "

Example:

p : Today is Thursday.

$\neg p$: It is not the case that Today is Thursday.

$\neg p$: Today is not Thursday.

q : There is no pollution in New Jersey.

$\neg q$: This is not the case that There is no pollution in New Jersey.

$\neg q$: There is pollution in New Jersey.

r : At least 10 inches of rain fell today in Namchi.

$\neg r$: It is not the case that at least 10 inches of rain fell today in Namchi.

$\neg r$:

It is false that _____

There is at least 10 inches of rain fell today

There is almost 10 inches of rain fell Nohy in Namachi.

p	$\neg p$
T	F
F	T

2. **Conjunction:** Let p and q be propositions. The conjunction of p and q is denoted by $p \wedge q$. The conjunction is true when both p and q are true and is false otherwise.

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

Examples:

p : Rebacca's PC has more than 16 GB free hard disk space.

q : The processor in Rebacca's PC runs faster than 1GHz.

$p \wedge q$: Rebacca's PC has more than 16 GB free hard disk space and The processor in Rebacca's PC runs faster than 1GHz.

p : Delhi is capital of India. T

q : $4+5=7$ F

What is truth value of $p \wedge q$?

(A) F ✓

(B)

3. **Disjunction:** Let p and q be propositions. The disjunction of p and q is denoted by $p \vee q$. The disjunction is false when both p and q are false and is true otherwise.

is denoted by $p \vee q$. The disjunction 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

Either, or / at least

Example:

p : I bought a lottery ticket this week.

q : I won a million dollar jackpot on Friday.

$p \vee q$: Either I bought a lottery ———. or I
won a million dollar jackpot on
Friday