

Lecture 2

Atomic Propositions (primitive)

- truth or falsity is independent of truth or falsity of another proposition

Compound Proposition

- depends on another proposition \rightarrow w/connectives
- assembly of multiple atomic propositions

CONNECTIVES

- | | |
|---------------------|---|
| 1) Not (\neg) | 4) if-then (\rightarrow) |
| 2) And (\wedge) | 5) iff (if and only if) (\leftrightarrow) |
| 3) Or (\vee) | |

ex) $\overbrace{\text{if it's raining}}^{\text{A.P.}} \ \& \ \overbrace{\text{you're outside}}^{\text{A.P.}}$
then you will get wet

PROPOSITIONAL VARIABLES

- P, Q, R, etc.

P \rightarrow "it is raining"
Q \rightarrow "you're outside"
R \rightarrow "you get wet"

$$P \wedge Q \rightarrow R$$

Problems w/ Natural language

- words can mean different things
- I took a plane **and** went to Chicago

↳ 1) one led to another,
2) two different events

- use artificial language for Math & CS

Truth Tables

- Logical Operators

- negation, and, or, conditional, biconditional

1) Negation

→ * does NOT mean the opposite

P	$\neg P$
T	F
F	T

2) Double Negation

P	$\neg P$	$\neg \neg P$
T	F	T
F	T	F

Logically equivalent

Logical Equivalence

Truth values are identical

$$P \equiv Q$$

or $P \Leftrightarrow Q$

ex) $P \equiv \neg \neg P$

3) AND - both must be true

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

	Q	
P	T	F
T	T	F
F	F	F

4) OR - disjunction (inclusive)

P	Q	$P \vee Q$
T	T	T
F	T	T
T	F	T
F	F	F

↳ one OR both can be true

5) XOR - exclusive OR

P	Q	$P \oplus Q$
T	T	F
F	T	T
T	F	T
F	F	F

only one can be true