

Section 2.1: Intro to Logic

Tuesday, September 10, 2019 10:57 AM

logical proposition: a statement that is either true or false

examples:

- ① Java is a computer language.
- ② Bill Gates cofounded Microsoft.
- ③ The number seven is an even integer.

non-examples:

- ④ Please put your books away.
- ⑤ Where is Saryta's office?
- ⑥ He is six feet tall.
who is he?

note: if the statement contains a variable (he) and that variable is undefined, then not a proposition

but "Paul is Pat's neighbour and he is six feet tall."
is a proposition

notation: use letters $p, q, r, s,$ and t for propositions

example: let $p =$ "Pat drinks coffee"

operators :

"not" - negation

for p , the negation can be written as

\bar{p} ← we will use this
 $\sim p$ (symbolic logic)
 $\neg p$ (Wolfram Alpha)
 p'
 $!p$ (computing)

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When are two statements true negations of each other?

- when exactly one of them can be true at a time (if one is true, the other must be false)

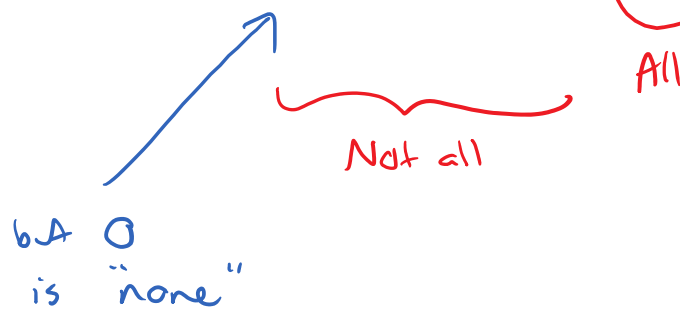
⇒ no overlap - the two statements also between them cover all possibilities

all vs. none :

the negation of "Everyone is ..."
is "At least one person is not ..."

for example: suppose you have 3 coins
how many of them are quarters?

possibilities: 0, 1, 2, 3



NONE \neq NOT ALL

logical connectives

"and" (conjunction) joins two propositions

notation: $p \wedge q$

$p \wedge q$ is true when both p and q are true

$p \wedge q$ is false when at least one of them is false

"or"

(inclusive disjunction)

you can call this the "inclusive or"

notation:

$$p \vee q$$

$p \vee q$ is true when at least one of them is true

(one or the other or both)

$p \vee q$ is false when both p and q are false (none are true)

"exclusive or"

(exclusive disjunction)

notation:

$$p \oplus q$$

$$p \text{ xor } q$$

$p \oplus q$ is true when one or the other but not both are true

$p \oplus q$ is false when p and q
are the same (both true
or both false)

problem: in English, the word "or"
can mean either the inclusive
or exclusive and we tell the
difference by context