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 Sarytia'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

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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

All

Not all

but 0 is "none"

NONE $\neq$ NOT ALL

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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 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