

Propositions: building blocks of logic

Proposition

A statement that has a truth value (i.e. is true or false) and is "well-formed"

Propositions are the basic building blocks in symbolic logic.

Here are two propositions.

All cats are mammals

True, (and a proposition)

All mammals are cats

False, but is well-formed and has a truth value, so still a proposition.

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Are These Propositions?

$2 + 2 = 5$

$x + 2 = 5$

Akjsdf!

Who are you?

There is life on Mars.

Proposition

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Implication ($p \rightarrow q$)

"If it's raining, then I have my umbrella"

It's useful to think of implications as promises. An implication is false exactly when you can **demonstrate** I'm lying.

| p | q | $p \rightarrow q$ |
|-----|-----|-------------------|
| T | T | T |
| T | F | F |
| F | T | T |
| F | F | T |

| | It's raining | It's not raining |
|---------------------------|-----------------------------|------------------|
| I have my umbrella | No lie. True | No lie. True |
| I do not have my umbrella | LIE! False | No lie. True |

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$p \rightarrow q$ wordings

Implication:

p implies q

whenever p is true q must be true

if p then q

q if p

p is sufficient for q

p only if q

q is necessary for p

| p | q | $p \rightarrow q$ |
|-----|-----|-------------------|
| T | T | T |
| T | F | F |
| F | T | T |
| F | F | T |

Implications are super useful, so there are LOTS of translations. You'll learn these in detail in section.

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