Introduction to Predicate Logic

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## Predicate logic

Sentences are broken further down into

-- constants

-- variables

-- predicates

-- quantifiers

## Singular sentences

A singular sentence is built from a constant and a predicate

-- the constant refers to a thing

-- the predicate indicates a property

Such a sentence says that the thing referred to has the indicated property

Note: There are no restrictions on what things can be!

## An example of a singular sentence

The sentence

”Mars is round”

Is build from the constant

”Mars” and the predicate

”\_ is round”

## Symbolization of singular sentences

a, b, c, ... stands for constants

P, Q, R, ... stands for predicates

***Singular sentences are symbilized***

P(a), Q(b), R(c), ...

***which respectively stand for***

”a has the property P”,

”b has the property Q”, ”c has the property R”, etc.

## Example of symbolization

If a is the constant ”Mars” and

P is the predicate ”\_ is round” then

P(a)symbolizes ”Mars is round”

## General sentences

A general sentence is built from a quantifier and a predicate such a sentence either says that all things have the indicated property (universal quantification) or says that there exists a thing that has the indicated property (existential quantification)

## An example of a general sentence

The sentence

”every thing is round” is built from the quantifier

”every thing”

And the predicate

”\_ is round”

## Symbolization of general sentences

x, y, z, ... stands for variables

∀x and ∃y stand for respectively

”for all x it is the case that” and ”there exists a y such that”

***General sentences are symbolized***

∀xP(x), ∃yQ(y), ...

***Which respectively stand for***

”for all x it is the case that x has the property P”,

”there exists a y such that y has the property Q”, etc.

## Example of symbolization

If P is the predicate

”\_ is round” then ∀xP(x)symbolizes the sentence

”for all x it is the case that x is round” that is

”everything is round”

There are many more sorts of sentences that singular and general sentences!

A predicate can have an arbitrary number of places, this number is called the arity of the predicate

## Examples

The sentence ”John is taller than Poul” is built from

the constants => ”John” and ”Poul”

and the predicate => ”\_ is taller than \_” which has the 2 arity

## Examples

P(a), P(x), Q(b,z), Q(y,z) where P has 1 arity and Q has 2arity Compound formulas are built using the connectives ¬, ∧, ∨, ⇒ and the quantifiers ∀x, ∃y together with parentheses

## Examples of compound formulas

P(x)∧Q(b,z), ∀xP(x), ∃zQ(b,z)



