Atomic Sentences

- Atomic sentences are formed by putting a predicate of arity *n* in front of *n* names (enclosed in parentheses and separated by commas).
- Atomic sentences are built from the identity predicate, =, using infix notation.
- The order of names is crucial in forming atomic sentences.

General First-Order Languages

- In this course, you will be asked to use a predefined language, that of the blocks world.
- More often than not, you need to design your own language
- Consider: “Claire gave Scruffy to Max.”

Example Language

English	FOL	Comment
Names:		
Max	max	
Claire	claire	
Folly	folly	The name of a certain dog.
Carl	carl	The name of another dog.
Scruffy	scruffy	The name of a certain cat.
Pris	pris	The name of another cat.
2 pm, Jan 2, 2001	2:00	The name of a time.
2:01 pm, Jan 2, 2001	2:01	One minute later.
⋮	⋮	Similarly for other times.

Example Language

Predicates:		
x is a pet	Pet(x)	
x is a person	Person(x)	
x is a student	Student(x)	
t is earlier than t′	$t < t'$	Earlier-than for times.
x was hungry at time t	Hungry(x, t)	
x was angry at time t	Angry(x, t)	
x owned y at time t	Owned(x, y, t)	
x gave y to z at t	Gave(x, y, z, t)	
x fed y at time t	Fed(x, y, t)	

Function Symbols

In a language with function symbols,

- Complex terms are typically formed by putting a function symbol of arity *n* in front of *n* terms (simple or complex).
- Complex terms are used just like names (simple terms) in forming atomic sentences
- In FOL, complex terms are assumed to refer to one and only one object.

The first-order language of set theory

- Two predicates: = (identity symbol), $\in$ (membership)
- Infix notation
- Individual constants

The first-order language of arithmetic

- Two names: 0, 1
- Two binary predicate symbols: =, <
- Two binary function symbols: +, *
- Terms are formed in the following way:
  1. The names 0, 1 are terms
  2. If t_1 and t_2 are terms, then the expressions $(t_1 + t_2)$ and $(t_1 * t_2)$ are also terms.
  3. Nothing is a term unless it can be obtained by repeated application of (1) and (2).