First Order Logic – Syntax (2A)

Young W. Lim
1/23/17

Please send corrections (or suggestions) to youngwlim@hotmail.com.

This document was produced by using LibreOffice

Based on

Contemporary Artificial Intelligence,
R.E. Neapolitan & X. Jiang

Logic and Its Applications,
Burkey & Foxley

Well-formed Strings

A **term**

- A constant symbol
- A variable symbol
- A function symbol with comma separated list

An **atomic formula**

- A predicate symbol
- A predicate symbol with comma separated list
- Two terms separated by the = symbol

An **formula**

- A **atomic formula**
- The operator ¬ followed by a formula
- Two formulas separated by ∧, ∨, ⇒, ⇔
- A quantifier following by a variable followed by a formula

A **sentence**

- A **formula** with no free variables

Term

A **term**

- A constant symbol

  Mary, Fred, Sam, ...

- A variable symbol : x, y

  A **free variable** : not quantified by ∀ or ∃ : ∀x love(x,y)

  Otherwise it is a **bound variable.** : ∀x tall(x)

- A function symbol with comma separated list : mother

  A **function** : a mapping

  from some subset of entities to an single entity

  mother(Laura) → Mary

Well-formed Strings

An **atomic formula**

- A **predicate** : a relationship among a set of entities or
  a property of a single entity

- A predicate symbol
  True
  False

- A predicate symbol followed by (term1, term2, …)
  married(Mary, Fred)
  young(Sam)

- Two terms separated by the = symbol
  to denote the two terms refer to the same entity
  Mary = mother(Laura)

Well-formed Strings

An **formula**

- A **atomic formula**
- The operator ¬ followed by a **formula**
- Two formulas separated by ∧, ∨, ⇒, ⇔
- A quantifier following by a variable followed by a formula

A **sentence**

- A **formula** with no free variables

∀x love(x,y)	: free variable y	: not a sentence
∀x tall(x)	: no free variable	: a sentence

Formal Language

A **free** variable

- Not quantified by the ∀ or the ∃ symbol

∀ ∃

An **bound** variable

- quantified by the ∀ or the ∃ symbol

A domain of discourse

- this domain is a set
- each element in the set : entity
- each constant symbol : one entity in the domain

Formal Language

A domain of discourse
A set and each element in the set is called entity   ∀ ∃

Each constant symbol identifies one entity in the domain

References

[1] en.wikipedia.org
[2] en.wiktionary.org
[3] U. Endriss, “Lecture Notes : Introduction to Prolog Programming”
[4] http://www.learnprolognow.org/ Learn Prolog Now!
[5] http://www.csupomona.edu/~jrfisher/www/prolog_tutorial
[6] www.cse.unsw.edu.au/~billw/cs9414/notes/prolog/intro.html
[7] www.cse.unsw.edu.au/~billw/dictionaries/prolog/negation.html
[8] http://ilppp.cs.lth.se/, P. Nugues,` An Intro to Lang Processing with Perl and Prolog