Introduction to Prolog

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Overview

• Introduction & Preliminaries

• Syntax
  – Characters
  – Constants
  – Variables
  – Operators

• Arithmetic

[ref.: Chapter 2- Clocksin]
A sample program

student(john, 3401):-.
student(mary, 3401):-.
study_hard(john):-.

pass_3401(X):- student(X, 3401), study_hard(X).

:-pass_3401(john).
In Prolog

consult(user).
    student(john, 3401).
    student(mary, 3401).
    study_hard(john).

    pass_3401(X):- student(X, 3401), study_hard(X).

Ctrl+D

:-pass_3401(john).
true.
:- pass_3401(mary).
false.
Introductory notes

• Predicates shown by a name starting with lower case letters.
• Arguments are written in parentheses, separated by commas.
• A dot (period) comes at the end.
• The predicate name and the number of arguments is decided by the user.
• Queries are answered by matching with the knowledge given (facts and rules).
• A **false** means ‘not enough knowledge to prove it’ (does not mean it is actually false, maybe not enough knowledge given to Prolog).
In Prolog

consult(user).
student(john, 3401).
student(mary, 3401).
study_hard(john).

pass_3401(X):- student(X, 3401), study_hard(X).

Ctrl+D

:-pass_3401(john).
true.
:- pass_3401(mary).
false.
Syntax

• Characters
  – Upper case A, B, ..., Z
  – Lower case a, b, ..., z
  – Digits 0, 1, ..., 9
  – Sign characters +, -, ..., $, &

• Constants
  – Two kinds: Atoms and Numbers
  – Numbers, such as 25, 9.99, -30, 7.08e-15
  – Some symbols used for atoms are made up of letters and digits, must normally begin with a lower case, e.g. mary, john, likes, ...
  – If enclosed in single quotes, may have any character, e.g. ‘George-Smith’, ‘23g’, ...
  – Underline symbol ‘_’ may be in the middle
  – Some are made from signs only
Syntax (cont.)

- Variables
  - Their names begin with a capital letter or ‘_’
  - The **anonymous** variable: _ (with a peculiar characteristic!)

- Structures or compound terms
  - A single **object** consisting of a collection of other objects, called **components**
  - Defined as a **functor** and its components
  - e.g. `book(programming_in_prolog, clocksin, 2003)`
  - Can use anonymous variable when not enough info e.g. `book(book123, _, _)`
• **Operators**
  – To make some functors easier to use, e.g. instead of \(+(3,4)\) we can write 3+4 (Important: it is not the same as 7)

  – **Position**
    • prefix, infix, or postfix, e.g. \(+(3,4), 2*5, 7!\)

  – **Precedence**
    • An integer associated with each operator, the closer to 1, the higher the precedence
    • e.g. multiplication has a higher precedence than addition, \(a-b/c\) is \(-(a,/(b,c))\)

  – **Associativity**
    • Left or right
    • All arithmetic operators left associative
    • e.g. 8/4/4 is \((8/4)/4\)
Arithmetic

- $X + Y$, $X - Y$, $X \times Y$, $X / Y$
- $X // Y$, $X \text{ mod } Y$ (integer quotient and remainder)
- $X =:= Y$, $X =\neq Y$ (same numbers, different numbers)
- $X < Y$, $X > Y$, $X =< Y$, $X >= Y$ (comparisons)

is: an infix operator, evaluating the right-hand argument, matched with left-hand argument
The population density of a country X is Y, if:
- The population of X is P, and
- The area of X is A, and
- Y is calculated by dividing P by A.

\[-\text{density}(X,Y) : -\text{pop}(X,P),\]
\[-\text{area}(X,A),\]
\[-Y \text{ is } P/A.\]

\[-\text{density}(\text{china}, X).\]
\[-X=200.\]