

AI Lab Sheet

III Year / II Part

Faculty: Computer

Labsheet#6: Logic Programming using Prolog

Objective

1. Familiarity with the Prolog programming environment.

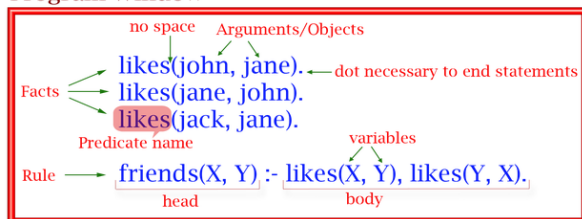
Prolog

How to use SWI-Prolog?

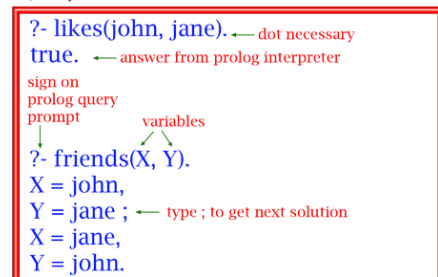
Read: <http://athena.ecs.csus.edu/~mei/logicp/prolog/swi-prolog.html>

Online Prolog Compiler: <https://swish.swi-prolog.org/>

Program Window



Query Window



Q.1 Write the following facts & rules:

```

p01.pl  X
C: > Users > ErSKS > Documents > Prolog > p01.pl
1  /* Facts */
2  likes(ram,sita).
3  likes(sita,ram).
4
5  /* Rules */
6  friends(ram,sita):- likes(ram,sita), likes(sita,ram).|

```

Write the following queries on prolog prompt after loading the file into prolog memory, and check whether prolog will return true or false or related answers to your goals:

- likes(ram,Sita).
- friends(X,Y).
- likes(who,ram).

Explain the warning/error, and how you resolve these issues?

Example 1: Below food table shows the facts, rules, goals and their English meanings:

Facts

food(burger).
 food(sandwich).
 food(pizza).
 lunch(sandwich).
 dinner(pizza).

English meanings

// burger is a food
 // sandwich is a food
 // pizza is a food
 // sandwich is a lunch
 // pizza is a dinner

Rules

meal(X):- food(X).

// Every food is a meal OR
 Anything is a meal if it is a food

Queries / Goals

?- food(pizza).
 ?- meal(X), lunch(X).
 ?- dinner(sandwich).

// Is pizza a food?
 // Which food is meal and lunch?
 // Is sandwich a dinner?

Try below queries by yourself and find out why did you get those answers:

- (1) ?- meal(X), dinner(X).
- (2) ?- meal(What).
- (3) ?- meal(X), dinner(Y).

Example 2: Below student-professor relation table shows the facts, rules, goals and their English meanings:

Facts

studies(charlie, csc135).
 studies(olivia, csc135).
 studies(jack, csc131).
 studies(arthur, csc134).
 teaches(kirke, csc135).
 teaches(collins, csc131).
 teaches(collins, csc171).
 teaches(juniper, csc134).

English meanings

// charlie studies csc135
 // olivia studies csc135
 // jack studies csc131
 // arthur studies csc134
 // kirke teaches csc135
 // collins teaches csc131
 // collins teaches csc171
 // juniper teaches csc134

Rules

professor(X, Y) :-
 teaches(X, C), studies(Y, C).

// X is a professor of Y if X teaches C and Y
 studies C.

Queries / Goals

?- studies(charlie, What).
 ?- professor(kirke, Students).

// charlie studies what? OR
 What does charlie study?
 // Who are the students of professor kirke.

Try below queries by yourself and find out why did you get those answers:

- ?- studies(Who, csc135). (hint : after getting first solution type ' ; ' to find all the possible solutions)
- Just copy paste below query and see the result:
 - ?- studies(charlie, Which), teaches(Who,Which), write('charlie studies '), write(Which), write(' and professor '), write(Who), write(' teaches '), write(Which).

Q.2 For given English statements, write a prolog program.

- Facts & Rules

- (1) jia is a woman.
- (2) john is a man.
- (3) john is healthy.
- (4) jia is healthy.
- (5) john is wealthy.
- (6) anyone is a traveler if he is healthy and wealthy.
- (7) anyone can travel if he is a traveler.

- Goals.

- (1) Who can travel?
- (2) Who is healthy and wealthy?

Q.3 What answers do you get for below queries for given program.

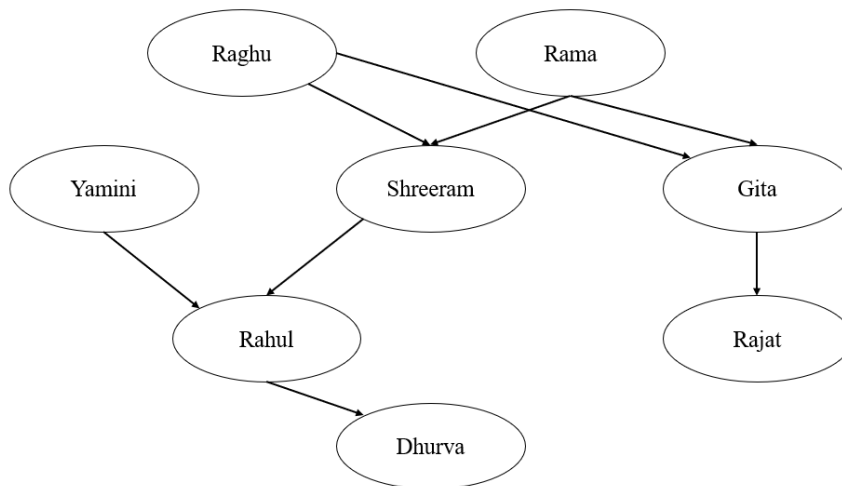
Program:

```
vegetarian(jose).  
vegetarian(james).  
vegetable(carrot).  
vegetable(egg_plant).  
likes(jose, X) :- vegetable(X).  
loves(Who, egg_plant) :- vegetarian(Who).
```

Queries:

```
?- vegetable(X).  
?- vegetable(potato).  
?- vegetarian(_).  
?- likes(jose, What).  
?- likes(Who, egg_plant).  
?- loves(Who, egg_plant).
```

Q.4 Given below is a family relation. Assuming that an arrow ($X \rightarrow Y$) in figure below depicts a parent relation from X to Y, in other words, X is parent of Y. Answer the following questions using Prolog programming:



Enlist the various facts in terms of clauses. And answer the following questions:

- a) Is Shreeram parent of Rahul?
- b) Is Lakshman parent of Gita?
- c) Is Rahul parent of Yamini?
- d) Find all children of Raghu.
- e) Enlist all parent-child relations.
- f) Who is grand-parent of Rahul?
- g) Who are grand-children of Rama?
- h) Are Shreeram and Gita siblings?
- i) *Is Shreeram father of Rahul?*
- j) *Is Rama mother of Rajat?*
- k) What are the results of the following prolog statements?
 - i. `?- parent(X,Shreeram).`
 - ii. `?- parent(Gita,X).`
 - iii. `?- parent(X,Y), parent(Yamini,X), parent(Y,Dhruva).`

Notes:

1. Prolog programs consist of clauses, each terminated with a full-stop (.).
2. A relation can be defined in form of n-tuple.
3. Arguments to the relation can be of two types – atoms and variables.
4. Clauses are of three types – facts, rules and questions. Facts declare statements that are unconditionally true, rules are statements that are true based on certain conditions and through questions, user can ask what is true and what is false.
5. Questions are given as goals to be satisfied whose answers are “yes” or “no”.
6. Prolog clauses consist of head and body, body consist of list of goals separated by comma (,) where a comma is a conjunction.
7. Facts are prolog clauses with empty body.
8. Predecessor relation (formed using recursive rule) is composed of two rules. First rule determines direct relation while second rule determines indirect relation.

9. Prolog programs explains declarative and procedural meanings, declarative decides the output of the program while procedural decides how the output is obtained.
10. Emphasis upon the declarative style of programming.