AI Lab Sheet
III Year / II Part
Faculty: Computer

Labsheet#6: Logic Programming using Prolog

Objective
   1. Familiarity with the Prolog programming environment.
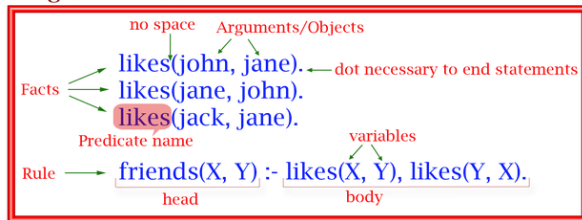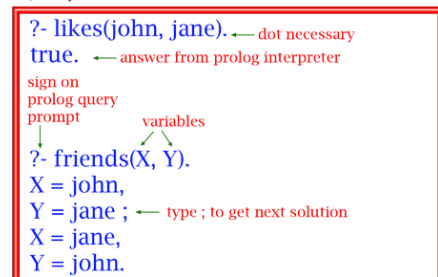
Prolog

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:


```
/* Facts */
likes(ram,sita).
likes(sita,ram).

/* Rules */
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	English meanings
food(burger).	// burger is a food
food(sandwich).	// sandwich is a food
food(pizza).	// pizza is a food
lunch(sandwich).	// sandwich is a lunch
dinner(pizza).	// 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).	// Is pizza a food?
?- meal(X), lunch(X).	// Which food is meal and lunch?
?- dinner(sandwich).	// Is sandwich a dinner?

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

Facts	English meanings
studies(charlie, csc135).	// charlie studies csc135
studies(olivia, csc135).	// olivia studies csc135
studies(jack, csc131).	// jack studies csc131
studies(arthur, csc134).	// arthur studies csc134
teaches(kirke, csc135).	// kirke teaches csc135
teaches(collins, csc131).	// collins teaches csc131
teaches(collins, csc171).	// collins teaches csc171
teaches(juniper, csc134).	// 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).	// charlie studies what? OR What does charlie study?
?- professor(kirke, Students).	// Who are the students of professor kirke.

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:
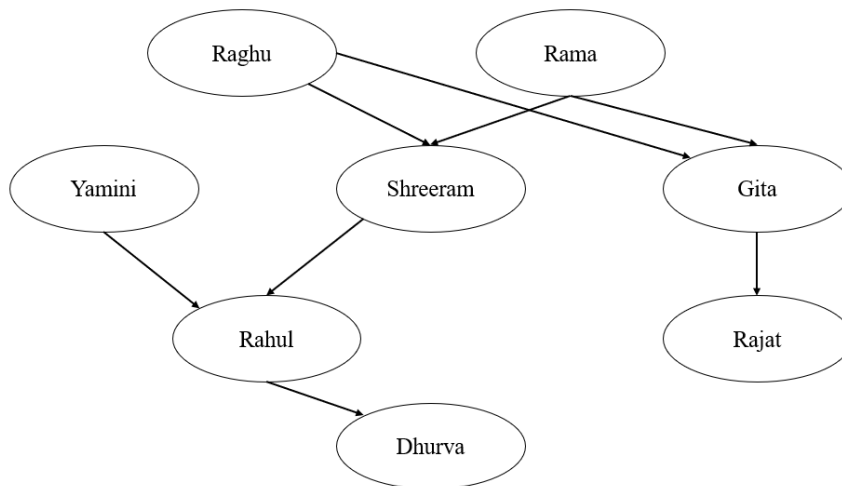
a) Enlist the various facts in terms of clauses.
b) Is Sriram parent of Rahul?
c) Is Lakshman parent of Gita?
d) Is Rahul parent of Yamini?
e) Find all children of Raghu.
f) Enlist all parent-child relations.
g) Who is grand-parent of Rahul?
h) Who are grand-children of Rama?
i) Are Shreeram and Gita siblings?
j) 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.