**Artificial Intelligence**

**LAB # 01**

**INTRODUCTION TO PROLOG:**

**Prolog** is a general-purpose logic programming language associated with artificial intelligence and computational linguistics.

Prolog has its roots in first-order logic, a formal logic, and unlike many other programming languages, Prolog is declarative: the program logic is expressed in terms of relations, represented as facts and rules. A computation is initiated by running a *query* over these relations.

Prolog was one of the first logic programming languages, and remains the most popular among such languages today, with several free and commercial implementations available. The language has been used for **theorem proving**, **expert systems**, as well as its original intended field of use, **natural language processing** .Modern Prolog environments support creating graphical user interfaces, as well as administrative and networked applications.

### **Applications of Prolog:**

Some applications of Prolog are:

* intelligent data base retrieval
* natural language understanding
* expert systems
* specification language
* machine learning
* robot planning
* automated reasoning
* problem solving

### **Programming in Prolog:**

Programming in prolog involves three basic terms these are define as:

* Facts
* Rules
* Queries

**Fact:**

What is known is called **fact** for example Johnny is fat, the dog is brown, Suzie likes pizza.

**Predicate:** Fat Brown Likes

**In Prolog:**

Fat (Johnny)

Brown (dog)

Likes (Suzie)

**Examples:**

% parent child Relationship

Parent(tom,liz).

Parent(bob,ann).

Parent(bob,pat).

Parent(pat,jim).

% lectures(X, Y): person X lectures in course Y

lectures([turing](http://en.wikipedia.org/wiki/Alan_Turing), 9020).

lectures([codd](http://en.wikipedia.org/wiki/Edgar_F._Codd), 9311).

lectures([backus](http://en.wikipedia.org/wiki/John_Backus), 9021).

lectures([ritchie](http://en.wikipedia.org/wiki/Dennis_Ritchie), 9201).

lectures([minsky](http://en.wikipedia.org/wiki/Marvin_Minsky), 9414).

lectures(codd, 9314).

% studies(X, Y): person X studies in course Y

studies(fred, 9020).

studies(jack, 9311).

studies(jill, 9314).

studies(jill, 9414).

studies(henry, 9414).

studies(henry, 9314).

**Rules:**

Rules defining implicit relationships between objects (e.g. the sister rule above) and/or rules defining implicit object properties (e.g. X is a parent if there is a Y such that Y is a child of X).

**Example:**

teaches(Teacher, Student) :-

lectures(Teacher, Course),

studies(Student, Course).

**Questions/Query:**

Asking questions above relationships between objects, and/or about object properties (e.g. does Suzie likes pizza? is Jonny is fat?)

**Variables:**

The variable stands for an object that does not know about yet.

To answer the question, Prolog has to find out the value of X, if it exists.

The name of a variable must begin with a capital letter or an underscore character, "\_".

Variables are used to return some value from database, they don’t reserved memory in computer.

**Example:**

weather (phoenix,summer,hot).

weather (la,summer,warm).

weather (phoenix,winter,warm).

**Query:**

weather (City,summer,hot).

Answer: City=phoenix

weather (City,\_,warm).

Answer:

City=la,

City=phoenix

**Compound Query:**

weather (City,summer,hot),weather(City,warm,winter).

Answer: City=phoenix

**LAB TASKS + Assignment:**

1. Represent the following in Prolog:

* John is a killer.
* Mia and Marsellus are married.
* Zed is dead.
* Marsellus kill Bia.
* Jules eats mango.

1. **What will be the prolog answers to following questions (referring to examples of fact)?**

?- lectures([turing](http://en.wikipedia.org/wiki/Alan_Turing), X)

?-lectures(X, 9311).

?-lectures(X, Y).

?- lectures(codd, X),lectures(X,9311).

?-lectures([ritchie](http://en.wikipedia.org/wiki/Dennis_Ritchie), X).

?-lectures([Y](http://en.wikipedia.org/wiki/Marvin_Minsky), 9414).

1. **What will be the prolog answers to following questions?**

weather(phoenix,hot,summer).

weather(la,warm,summer).

warmer\_Than(C1,C2):-

weather(C1,hot,summer),

weather(C2,warm,summer),

write(C1),write(‘is warmer than’),write(C2),nl.

**Query:**

?- warmer\_Than(la,phoenix).

1. Suppose we are working with the following knowledge base:

wizard(ron).

hasWand(harry).

quidditchPlayer(harry).

hasBroom(harry).

wizard(X):- hasBroom(X), hasWand(X).

hasBroom(X):- quidditchPlayer(X).

How does Prolog respond to the following queries?

1. wizard(ron).
2. witch(ron).
3. wizard(hermione).
4. witch(hermione).
5. wizard(harry).
6. wizard(Y).
7. witch(Y).
8. hasBroom(ron).
9. How many facts, rules, clauses, and predicates are there in the following knowledge base? What are the heads of the rules, and what are the goals they contain?

woman(vincent).

woman(mia).

man(jules).

person(X):- man(X); woman(X).

loves(X,Y):- father(X,Y).

father(Y,Z):- man(Y), son(Z,Y).

father(Y,Z):- man(Y), daughter(Z,Y).