

Logic Programming with Prolog

Section 3

Hello World Program

```
write('Hello World').
```

```
write('Hello World'),nl,write('Welcome to Prolog').
```

nl stands for 'start a new line'

```
writeln('Hello World').
```

Comments in prolog

Two forms of comment are allowed in Prolog:

- The character `%' followed by any sequence of characters up to end of line.
- The symbol `/*' followed by any sequence of characters (including new lines) up to `*/'.

Comparisons Operators

Operator	Meaning
$X > Y$	X is greater than Y
$X < Y$	X is less than Y
$X \geq Y$	X is greater than or equal to Y
$X \leq Y$	X is less than or equal to Y
$X == Y$	the X and Y values are equal
$X != Y$	the X and Y values are not equal

The following question is a naive attempt to request arithmetic computation:

```
?- X = 1 + 2.
```

Prolog will ‘quietly’ answer

```
X = 1 + 2
```

and not $X = 3$ as we might possibly expect. The reason is simple: the expression $1 + 2$ merely denotes a Prolog term where $+$ is the functor and 1 and 2 are its arguments. There is nothing in the above goal to force Prolog to actually activate the addition operation. A special predefined operator, **is**, is provided to circumvent this problem. The **is** operator will force evaluation. So the right way to invoke arithmetic is:

```
?- X is 1 + 2.
```

Now the answer will be:

```
X = 3
```

Arithmetic Operators

Operator	Meaning
+	Addition
-	Subtraction
*	Multiplication
/	Division
**	Power
//	Integer Division
mod	Modulus

?- 8 is 3 + 5.
true.

?- 10 is 20 - 10.
true.

?- 30 is 5 * 6.
true.

?- 2 is 4 / 2.
true.

?- 1 is 7 mod 3.
true.

?- X is 10+3.
X = 13.

?- Y is 5 - 2.
Y = 3.

?- Z is 3*4.
Z = 12.

?- W is 12/2.
W = 6.

?- S is 15 mod 3.
S = 0.

Arithmetic Functions

$\sin(X)$, $\cos(X)$, $\tan(X)$

$\text{abs}(X)$, $\text{sqrt}(X)$, $\log(X)$, $\text{round}(X)$

$\max(X,Y)$, $\min(X,Y)$

?- A is 30, B is 3, C is A + B + A * B + sin(A).
A = 30,
B = 3,
C = 122.01196837590714.

?- X is $\sin(90)$.
X = 0.8939966636005579.

?- X is $\cos(90)$.
X = -0.4480736161291701.

?- X is $\tan(90)$.
X = -1.995200412208242.

?- X is $\text{atan}(90)$.
X = 1.5596856728972892.

?- X is $\text{abs}(-5)$.
X = 5.

?- X is $\text{sqrt}(25)$.
X = 5.0.

?- X is $\text{round}(1.6)$.
X = 2.

?- X is $\log(1)$.
X = 0.0.

?- X is $\max(10,5)$.
X = 10.

?- X is $\min(10,5)$.
X = 5.

Logical Operators

And

,

Or

;

Not

\+

Conjunctions

Facts

likes(joe, fish).

likes(joe, mary).

likes(mary, book).

likes(john, book).

?- likes(mary,X), likes(john,X).

X = book.

?- likes(joe,X), likes(john,X).

false.

?- likes(joe,mary), likes(mary,joe).

false.

Equality

- It may be a match (without variables) or instantiated (with variables).
- If the structures are equal, then their arguments are matched.
- Ex:

```
?- rides(man,bicycle) = rides(man,X).  
X = bicycle.
```

```
?- parents(edward, X, Y) = parents(edward, victoria, albert).  
X = victoria,  
Y = albert.
```

?- hello = hello.
true.

?- hello = Y.
Y = hello.

?- policeman = policeman.
true.

?- paper = pencil.
false.

?- 1066 = 1066.
true.

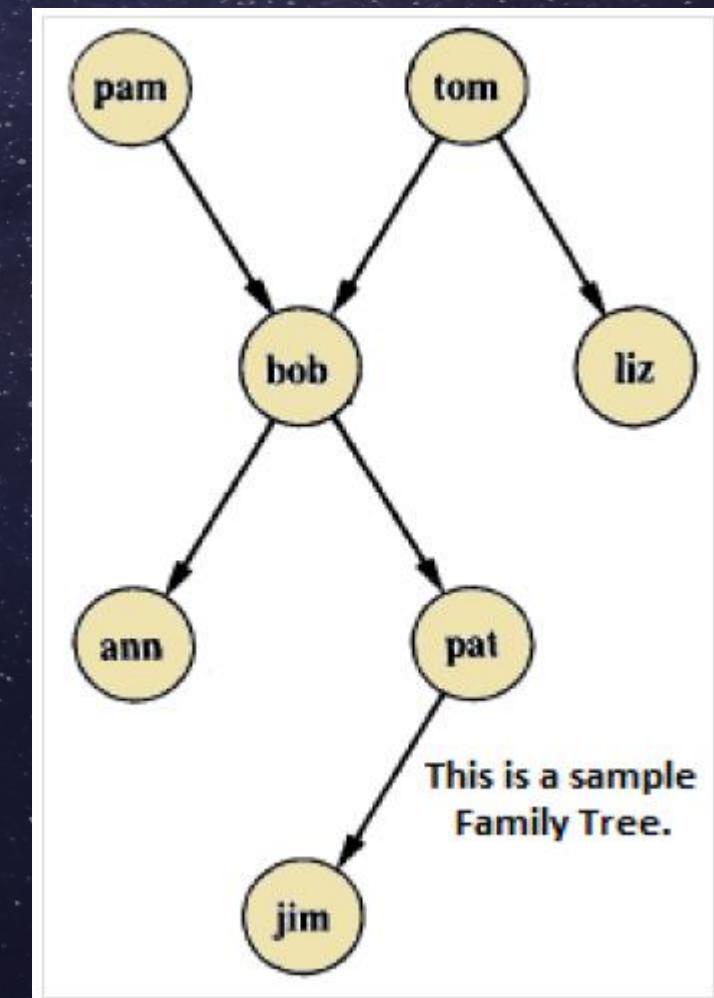
?- 1250 = 1358.
false.

Family Relationship in Prolog

Here from this tree, we can understand that there are few relationships. Here bob is a child of pam and tom, and bob also has two children — ann and pat. Bob has one brother liz, whose parent is also tom. So, we want to make predicates as follows:

Predicates

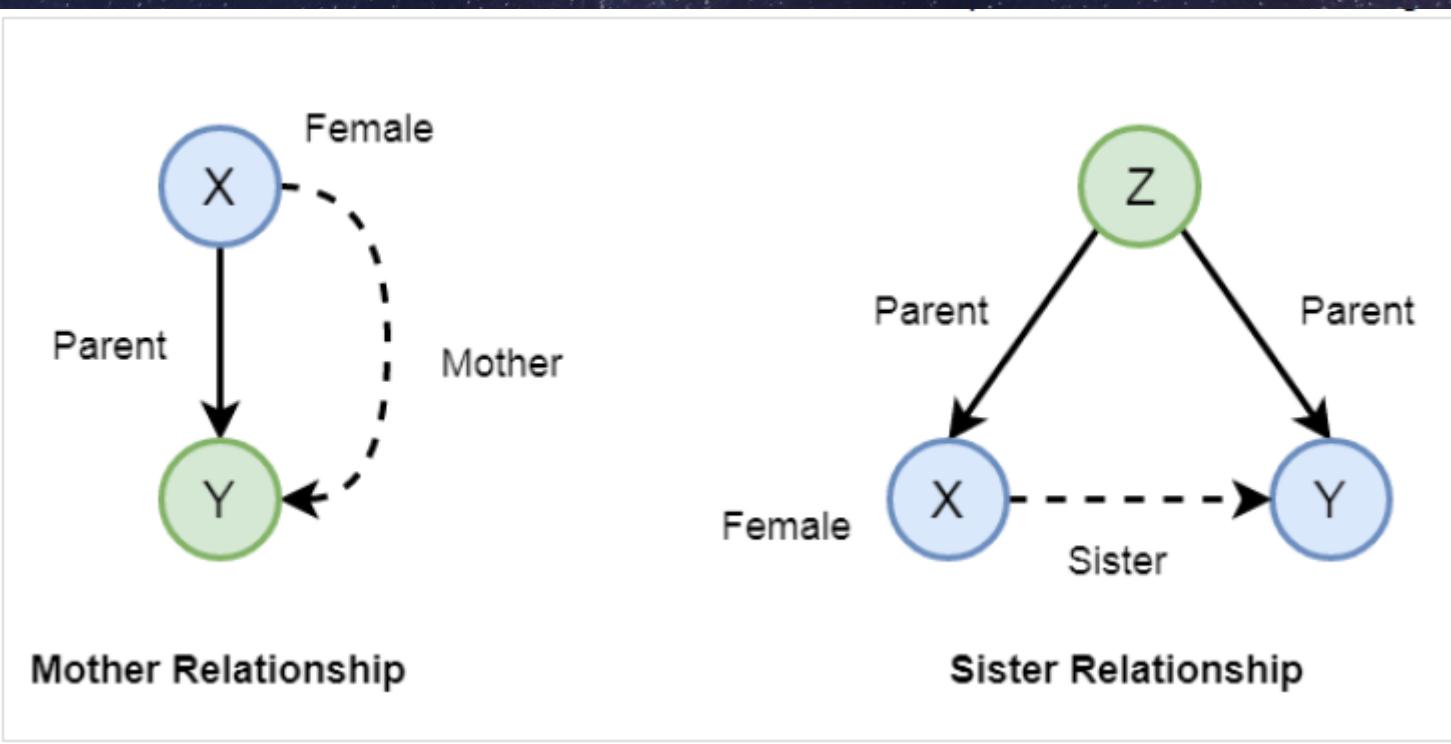
- `parent(pam, bob).`
- `parent(tom, bob).`
- `parent(tom, liz).`
- `parent(bob, ann).`
- `parent(bob, pat).`
- `parent(pat, jim).`



Family Relationship in Prolog

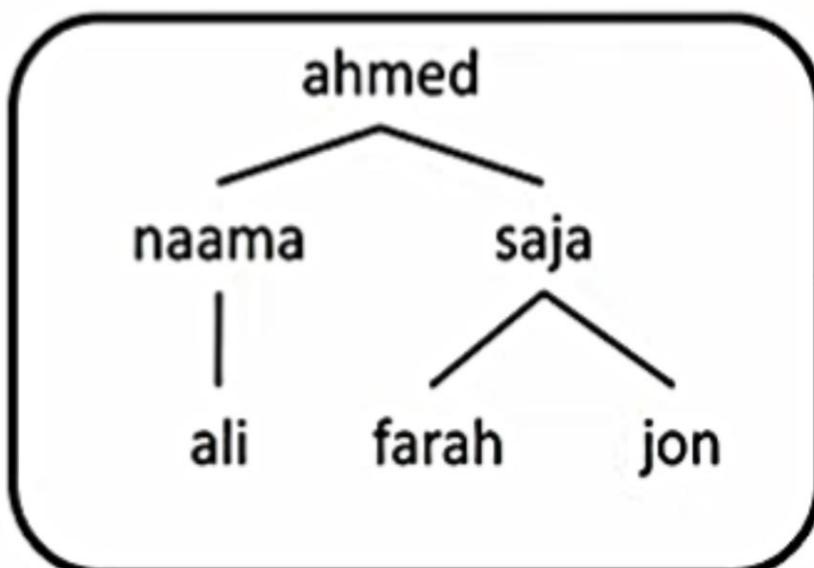
In Prolog syntax, we can write:

- `mother(X,Y) :- parent(X,Y), female(X).`
- `sister(X,Y) :- parent(Z,X), parent(Z,Y), female(X), X \== Y.`



Example

Family Tree



Example

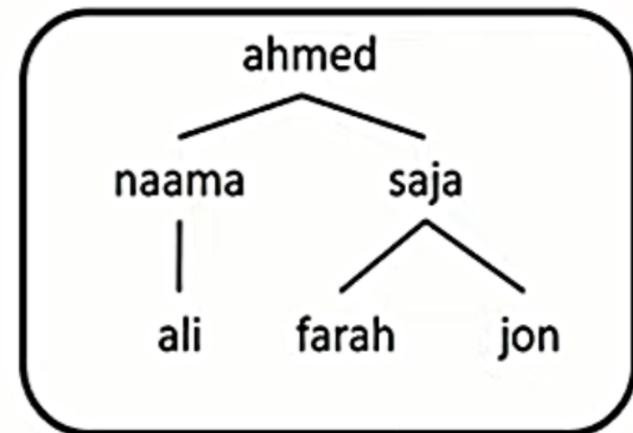
Facts

```
male(ahmed).  
male(naama).  
male(ali).  
male(jon).  
female(saja).  
female(farah).  
parent(ahmed,naama).  
parent(ahmed,saja).  
parent(naama,ali).  
parent(saja,farah).  
parent(saja,jon).
```

Query

```
?-parent(naama,ali).  
true.  
?-parent(naama,X).  
X=ali.  
?-parent(saja,Y).  
Y=farah;  
Y=jon.  
?-parent(X,naama),male(X).  
X=ahmed.
```

Family Tree



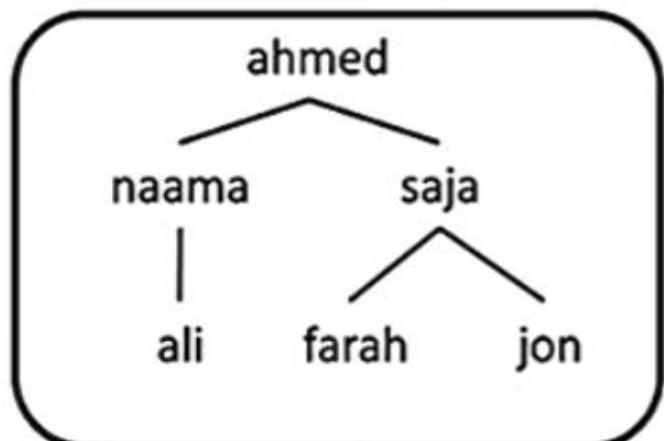
Facts

male(ahmed).
male(naama).
male(ali).
male(jon).
female(saja).
female(farah).
parent(ahmed,naama).
parent(ahmed,saja).
parent(naama,ali).
parent(saja,farah).
parent(saja,jon).

Rules

father(X,Y):-parent(X,Y),male(X).
mother(X,Y):-parent(X,Y),female(X).
siblings(X,Y):-parent(Z,X),parent(Z,Y),X\==Y.
uncle(X,Y):-
parent(Z,Y),parent(G,Z),parent(G,X),X\==Z.
grandfather(X,Y):-parent(X,Z),parent(Z,Y),male(X).
son(X,Y):-parent(Y,X),male(X).
sister(X,Y):-
parent(Z,X),parent(Z,Y),female(X),X\==Y.

Family Tree



Query

?-mother(X,jon).

Query

?-son(jon,saja).

Query

?-uncle(X,farah).

Query

?-grandfather(X,ali).

Query

?-siblings(X,Y).

X=saja

true.

X=naama

X=ahmed

X=naama,

Y=saja;

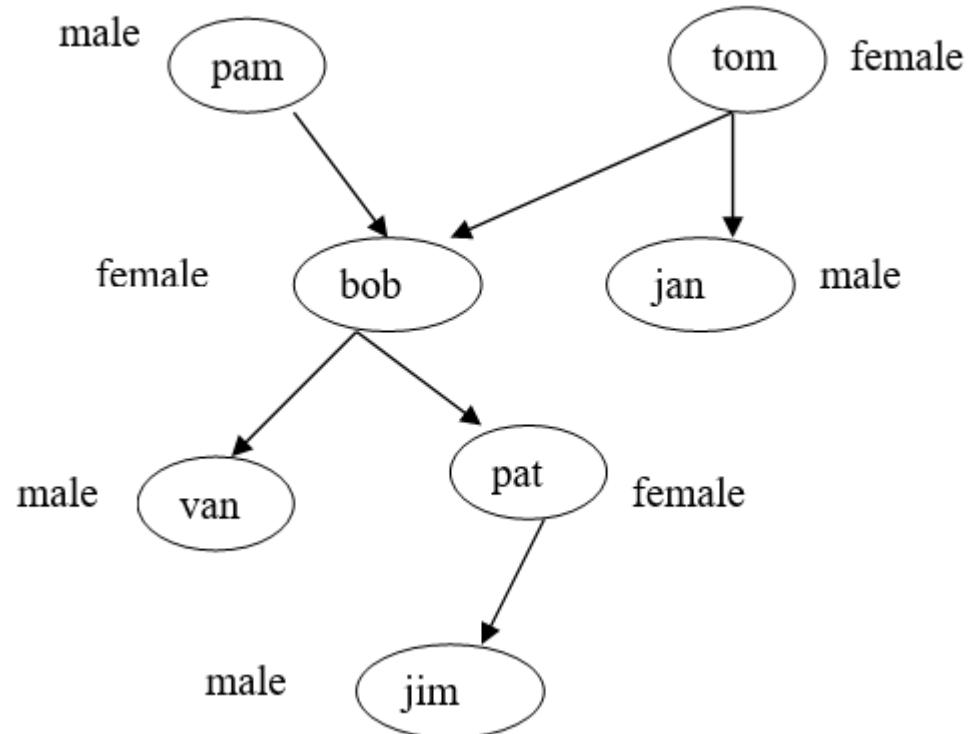
X=farah,

Y=jon;

false

Task

1. parent(X,jim).
2. uncle(X,jim)
3. sister(X,jan)
4. father(X,bob), mother(Y,bob)



Thank
you

