

AI Lab-1

1. Read the information and write Prolog codes for the queries that follow:

- James and Mary have two children Robert and Linda.
- Robert was married to Susan and they have children David and Emily.
- Linda was married to Peter and they have children Sophia, George and Ethan.
- David is married to Nina and their children are Lily and Sam.
- Emily is married to Michael and they have children Ryan and Charlie.
- George married Julia and they have children Arya and Leo.

Answer:

```
female(emily) .
female(lily) .
female(sophia) .
female(julia) .
female(arya) .

father(X,Y):-parent(X,Y),male(X) .
mother(X,Y):-parent(X,Y),female(X) .
sibling(X,Y):-parent(Z,X),parent(Z,Y),X\=Y.
brother(X,Y):-sibling(X,Y),male(X) .
sister(X,Y):-sibling(X,Y),female(X) .
grandfather(X,Y):-parent(X,Z),parent(Z,Y),male(X) .
grandmother(X,Y):-parent(X,Z),parent(Z,Y),female(X) .

cousin(X,Y):-parent(P1,X),parent(P2,Y),sibling(P1,P2),X\=Y.

predecessor(X,Y):-parent(X,Y) .
predecessor(X,Y):-parent(X,Z),predecessor(Z,Y) .

successor(X,Y):-parent(Y,X) .
successor(X,Y):-parent(Z,X),successor(Z,Y) .
```

FACTS:

```
parent(james,robert).
parent(james,emily).
parent(james,robert).
parent(james,linda).
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parent(mary,robert).
parent(mary,linda).

parent(robert,david).
parent(robert,emily).
parent(susan,david).
parent(susan,david).

parent(linda,sophia).
parent(linda,george).
parent(linda,en).
parent(peter,sophia).
parent(peter,george).
parent(peter,en).

parent(david,lily).
parent(david,sam).
parent(nina,lily).
parent(nina,sam).

parent(Emily,ryan).
parent(Emily,charlie).
parent(Michael,ryan).
parent(Michael,charlie).

parent(geoge,arya).
parent(George,leo).
parent(Julia,arya).
parent(Julia,leo).
male(james).

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male(robert).

male(jack).

male(noah).

male(george).

male(ethan).

male(leo).

female(mary).

female(rose).

female(emily).

female(lily).

female(sophia).

female(julia).

female(arya).

father(X,Y):-parent(X,Y),male(X).

mother(X,Y):-parent(X,Y),female(X).

sibling(X,Y):-parent(Z,X),parent(Z,Y),X\=Y.

brother(X,Y):-sibling(X,Y),male(X).

sister(X,Y):-sibling(X,Y),female(X).

grandfather(X,Y):-parent(X,Z),parent(Z,Y),male(X).

grandmother(X,Y):-parent(X,Z),parent(Z,Y),female(X).

cousin(X,Y):-parent(P1,X),parent(P2,Y),sibling(P1,P2),X\=Y.

predecessor(X,Y):-parent(X,Y).

predecessor(X,Y):-parent(X,Z),predecessor(Z,Y).

successor(X,Y):-parent(Y,X).

successor(X,Y):-parent(Z,X),successor(Z,Y).

QUERIES:

?- parent(X,Y).

X = james,

Y = robert .

?- father(X,Y).

X = james,

Y = robert .

?- mother(X,lily).

X = rose.

?- sibling(ethan,X).

X = sophia

[1] ?- sibling(X,Y).

X = robert,

Y = emily .

[1] ?- brother(X,sophia).

X = george .

[1] ?- sister(X,george).

X = sophia .

[1] ?- grandfather(X,leo).

X = noah .

[1] ?- grandmother(X,arya).

X = emily .

[1] ?- cousin(X,lily).

X = sophia .

[1] ?- cousin(X,Y).

X = jack,

Y = sophia .

[1] ?- predecessor(X,arya).

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X = george .

[1] ?- successor(X,james).

X = Robert

2. Write a Prolog program using recursion, for finding the sum of first n natural numbers.

Answers:

FACTS:

sum(0,0).

sum(N,Total):-

 N>0,

 N1 is N-1,

 sum(N1,SubTotal),

 Total is SubTotal +N.

QUERY:

[1] ?-

| sum(8,Result).

Result = 36.

3. The greatest common divisor (GCD) is the largest positive integer that divides two or more integer without leaving a remainder. Write a Prolog program for finding the GCD of two positive integers.

ANSWERS:

FACTS:

gcd(A,0,A):-A>0.

gcd(A,B,GCD):-

B>0,

R is A mod B,

gcd(B,R,GCD).

QUERY:

[1] ?- gcd(48,18,Result).

Result = 6

[1] ?- gcd(100,26,G).

G = 2

4. Write programs in Prolog for demonstrating the following arithmetic operations:

ANSWERS:

FACTS:

add(X,Y,Result):-

Result is X+Y.

sub(X,Y,Result):-

Result is X-Y.

mul(X,Y,Result):-

Result is X*Y.

div(X,Y,Result):-

Y\=0,

Result is X/Y.

power(X,Y,Result):-

Result is X**Y.

sq_rt(X,Result):-

$x \geq 0$,

Result is $\text{sqrt}(X)$.

$\text{modulus}(X, Y, \text{Result})$:-

$Y \neq 0$,

Result is $X \bmod Y$.

$\text{minimum}(X, Y, \text{Min})$:-

Min is $\min(X, Y)$.

$\text{maximum}(X, Y, \text{Max})$:-

Max is $\max(X, Y)$.

QUERY:

[1] ?- $\text{add}(8, 26, R)$.

$R = 34$.

[1] ?- $\text{sub}(26, 8, R)$.

$R = 18$.

[1] ?- $\text{mul}(8, 26, R)$.

$R = 208$.

[1] ?- $\text{div}(26, 8, R)$.

$R = 3.25$.

[1] ?- $\text{power}(2, 4, R)$.

$R = 16$.

[1] ?- $\text{modulus}(17, 5, R)$.

$R = 2$.

[1] ?- $\text{maximum}(26, 8, R)$.

$R = 26$.

[1] ?- $\text{minimum}(8, 26, R)$.

$R = 8$.

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