

Principles of Programming Language (CS302)

Assignment - 7

U19CS012

1.) Write the predicates using the following relations:

1. parent/2 -

parent(X, Y) [parent predicate with 2 arguments]

Read as: - *X is the Parent of Y.*

2. male/1

male(X) [male predicate with 1 argument]

Read as: - *X is Male.*

3. female/1

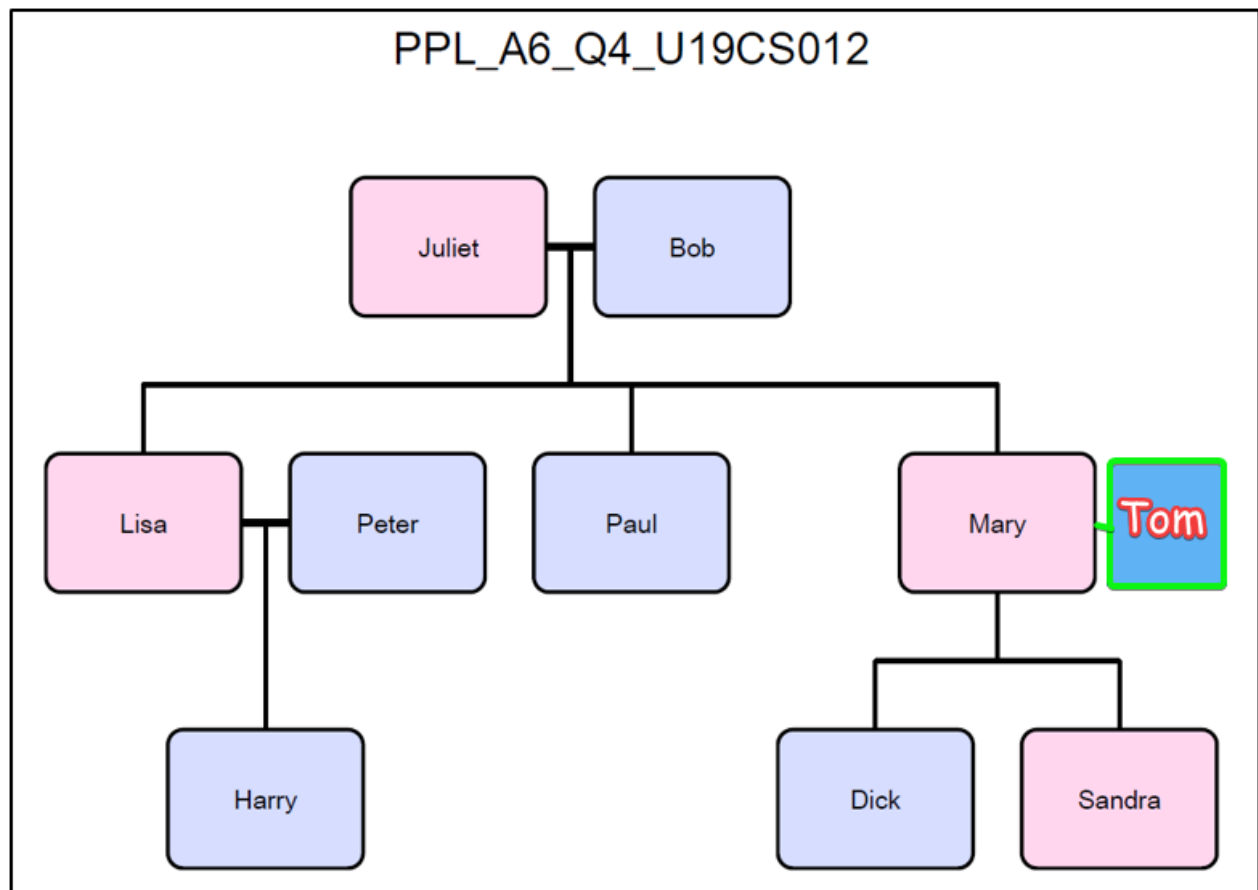
female(X) [female predicate with 1 argument]

Read as: - *X is Female.*

4. husband/2

husband(X, Y) [husband predicate with 2 arguments]

Read as: - *X is the Husband of Y.*



2.) Write the rules using above relations for the following:

PROLOG Code

```
/* Facts */

female(mary).
female(sandra).
female(juliet).
female(lisa).

male(peter).
male(paul).
male(dick).
male(bob).
male(harry).
% Added "tom", Husband of Mary
male(tom).

parent(bob, lisa).
parent(bob, paul).
parent(bob, mary).
parent(juliet, lisa).
parent(juliet, paul).
parent(juliet, mary).
parent(peter, harry).
parent(lisa, harry).
parent(mary, dick).
parent(mary, sandra).

husband(bob,juliet).
husband(peter,lisa).
husband(tom,mary).

/* Rules */

% Child
child(X, Y):-
    parent(Y, X).

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

% Father
father(X, Y):-
    male(X),
    parent(X, Y).
```

```

% Wife
wife(X, Y):-
    husband(Y, X).

% Son
son(X, Y):-
    male(X),
    parent(Y, X).

% Daughter
daughter(X, Y):-
    female(X),
    parent(Y, X).

% Brother
brother(X,Y) :-
    male(X),
    parent(P,X),
    parent(P,Y),
    X \= Y.
print_brothers :- brother(X, Y), format('~a is_brother_of ~a', [X, Y]).

% Sister
sister(X,Y) :-
    female(X),
    parent(P,X),
    parent(P,Y),
    X \= Y.
print_sisters :- sister(X, Y), format('~a is_sister_of ~a', [X, Y]).

% Uncle - X is an uncle of Y if X is the brother of some person, Z, and Z is a parent of Y
uncle(X, Y) :-
    brother(X, Z),
    parent(Z, Y).
print_uncles :- uncle(X, Y), format('~a is_uncle_of ~a', [X, Y]).

% Aunt - X is an aunt of Y if X is the sister of some person, P, and P is a parent of Y
aunt(X, Y) :-
    sister(X, P),
    parent(P, Y).
aunt(X, Y) :-
    parent(P, Y),
    brother(Uncle, P),
    wife(X, Uncle).
print_aunts :- aunt(X, Y), format('~a is_aunt_of ~a', [X, Y]).

% Nephew
nephew(X, Y) :- uncle(Y, X), male(X).
nephew(X, Y) :- aunt(Y, X), male(X).
print_nephews :- nephew(X, Y), format('~a is_nephew_of ~a', [X, Y]).

```

```
% Niece
niece(X, Y) :- uncle(Y, X), female(X).
niece(X, Y) :- aunt(Y, X), female(X).
print_nieces :- niece(X, Y), format('~a is_niece_of ~a', [X, Y]).
```

a.) Child

```
% Child
child(X, Y):-
    parent(Y, X).
```

```
?- child(paul,juliet).
true.
```

```
?- child(harry,peter).
true .
```

```
?- child(sandra,mary).
true.
```

b.) Mother

```
% Mother
mother(X, Y):-
    female(X),
    parent(X, Y).
```

```
?- mother(juliet,mary).
true.
```

```
?- mother(Who,harry).
Who = lisa.
```

c.) Father

```
% Father
father(X, Y):-
    male(X),
    parent(X, Y).
```

```
?- father(bob,lisa).
true .
```

```
?- father(bob,paul).
true .
```

```
?- father(bob,mary).
true .
```

```
?- father(peter,harry).
true .
```

d.) Wife

```
% Wife
wife(X, Y):-
    husband(Y, X).
```

```
?- wife(juliet,bob).
true.
```

```
?- wife(mary,tom).
true.
```

```
?- wife(Who,peter).
Who = lisa.
```

e.) Son

```
% Son
son(X, Y):-
    male(X),
    parent(Y, X).
```

```
?- son(harry,lisa).
true.
```

```
?- son(paul,bob).
true .
```

```
?- son(dick,mary).
true.
```

f.) Daughter

```
% Daughter
daughter(X, Y):-
    female(X),
    parent(Y, X).
```

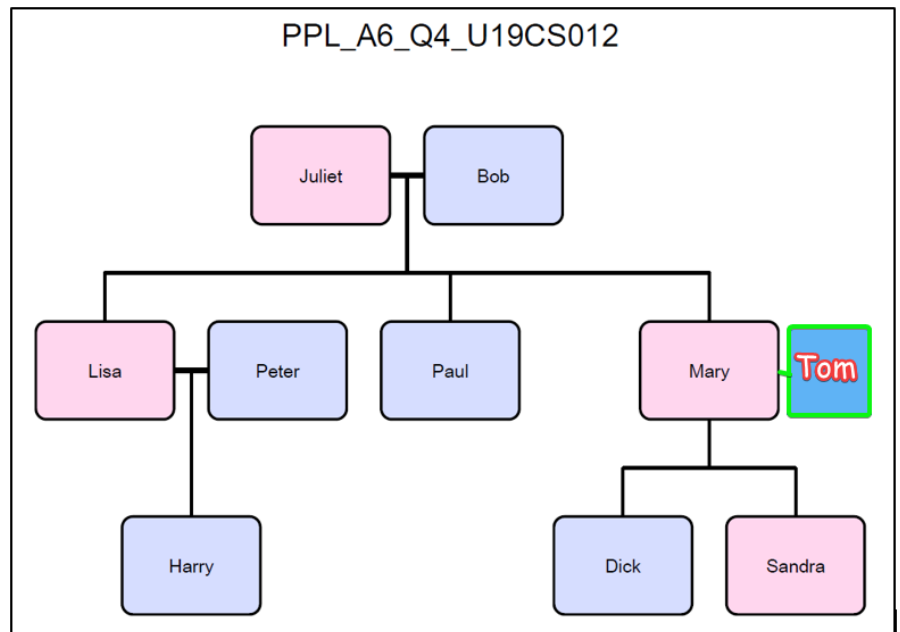
```
?- daughter(sandra,mary).
true.
```

```
?- daughter(Who,bob).
Who = mary ;
Who = lisa ;
false.
```

g.) Brother

```
% Brother
brother(X,Y) :-
    male(X),
    parent(P,X),
    parent(P,Y),
    X \= Y.
print_brothers :- brother(X, Y), format('~a is_brother_of ~a', [X, Y]).
```

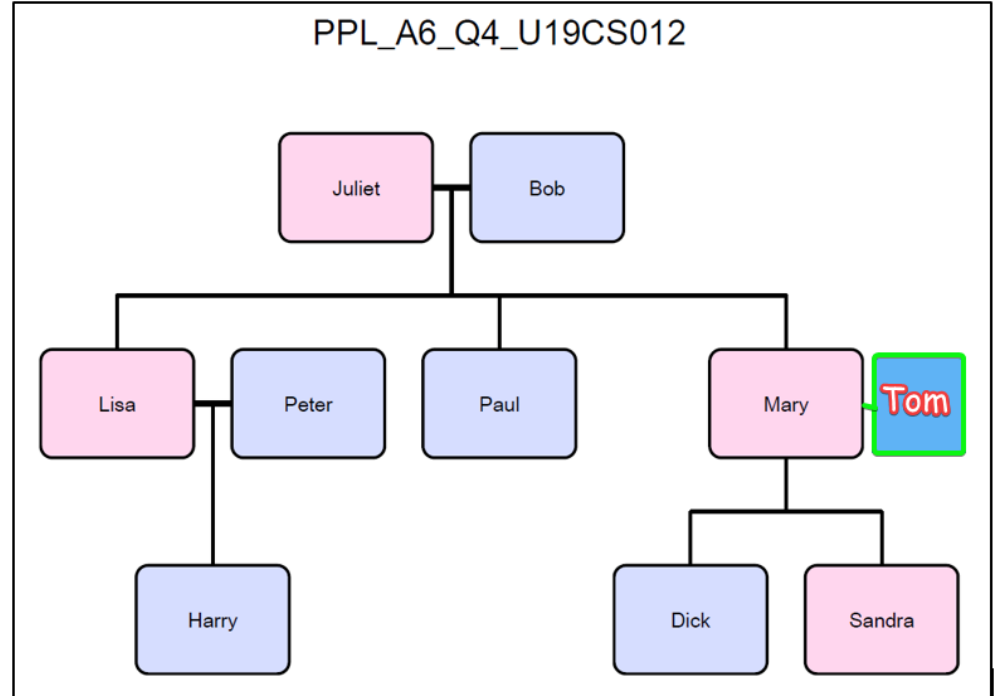
```
?- print_brothers.
paul is_brother_of lisa
true ;
paul is_brother_of mary
true ;
paul is_brother_of lisa
true ;
paul is_brother_of mary
true ;
dick is_brother_of sandra
true ;
false.
```



h.) Sister

```
% Sister
sister(X,Y) :-
    female(X),
    parent(P,X),
    parent(P,Y),
    X \= Y.
print_sisters :- sister(X, Y), format('~a is_sister_of ~a', [X, Y]).
```

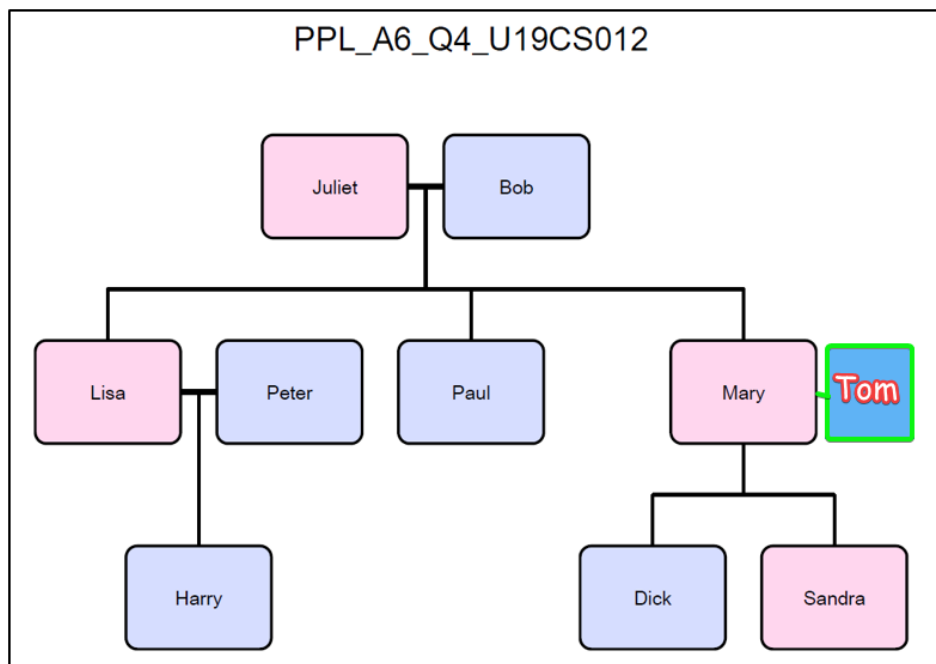
```
?- print_sisters.
mary is_sister_of lisa
true ;
mary is_sister_of paul
true ;
mary is_sister_of lisa
true ;
mary is_sister_of paul
true ;
sandra is_sister_of dick
true ;
lisa is_sister_of paul
true ;
lisa is_sister_of mary
true ;
lisa is_sister_of paul
true ;
lisa is_sister_of mary
true.
```



i.) Uncle

```
% Uncle - X is an uncle of Y if X is the brother of some person, Z, and Z is a parent of Y
uncle(X, Y) :-
    brother(X, Z),
    parent(Z, Y).
print_uncles :- uncle(X, Y), format('~a is_uncle_of ~a', [X, Y]).
```

```
?- print_uncles.
paul is_uncle_of harry
true ;
paul is_uncle_of dick
true ;
paul is_uncle_of sandra
true ;
paul is_uncle_of harry
true ;
paul is_uncle_of dick
true ;
paul is_uncle_of sandra
true ;
false.
```



j.) Aunt

```
% Aunt - X is an aunt of Y if X is the sister of some person, P, and P is a parent of Y
aunt(X, Y) :-
    sister(X, P),
    parent(P, Y).
aunt(X, Y) :-
    parent(P, Y),
    brother(Uncle, P),
    wife(X, Uncle).
print_aunts :- aunt(X, Y), format('~a is_aunt_of ~a', [X, Y]).
```

?- **print_aunts.**

mary is_aunt_of harry
true ;

mary is_aunt_of harry
true ;

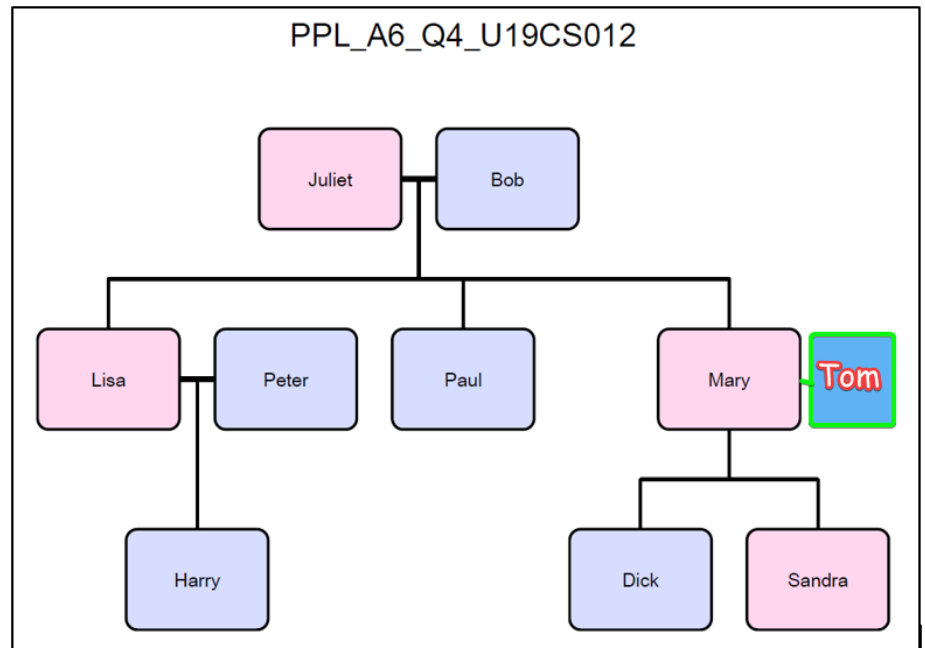
lisa is_aunt_of dick
true ;

lisa is_aunt_of sandra
true ;

lisa is_aunt_of dick
true ;

lisa is_aunt_of sandra
true ;

false.



k.) Nephew

```
% Nephew
nephew(X, Y) :- uncle(Y, X), male(X).
nephew(X, Y) :- aunt(Y, X), male(X).
print_nephews :- nephew(X, Y), format('~a is_nephew_of ~a', [X, Y]).
```

?- print_nephews.

harry is_nephew_of paul

true ;

dick is_nephew_of paul

true ;

harry is_nephew_of mary

true ;

dick is_nephew_of mary

true ;

harry is_nephew_of lisa

true ;

dick is_nephew_of lisa

true ;

dick is_nephew_of lisa

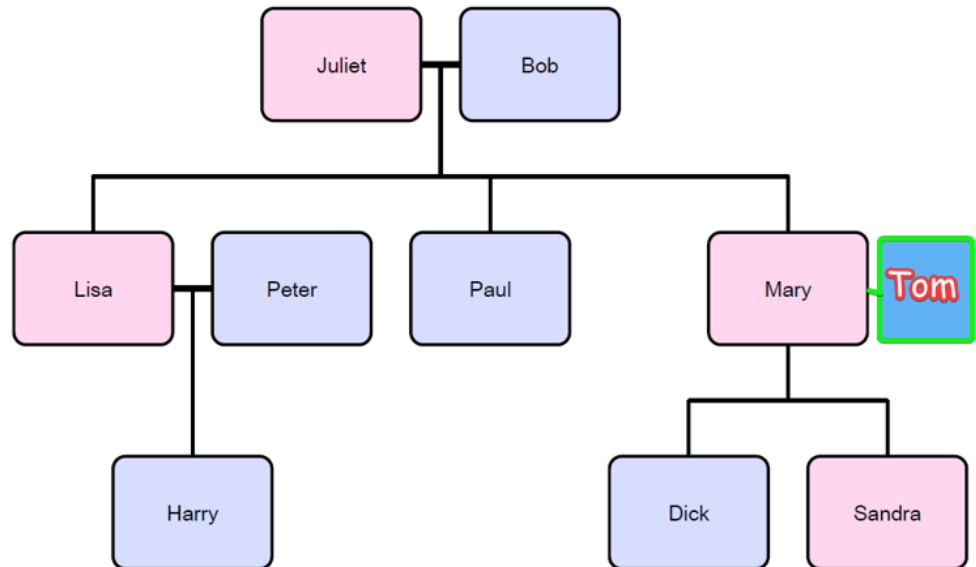
true ;

dick is_nephew_of lisa

true ;

false.

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I.) Niece

% Niece

niece(X, Y) :- uncle(Y, X), female(X).

niece(X, Y) :- aunt(Y, X), female(X).

print_nieces :- niece(X, Y), format('~a is_niece_of ~a', [X, Y]).

?- print_nieces.

sandra is_niece_of paul

true ;

sandra is_niece_of paul

true ;

sandra is_niece_of lisa

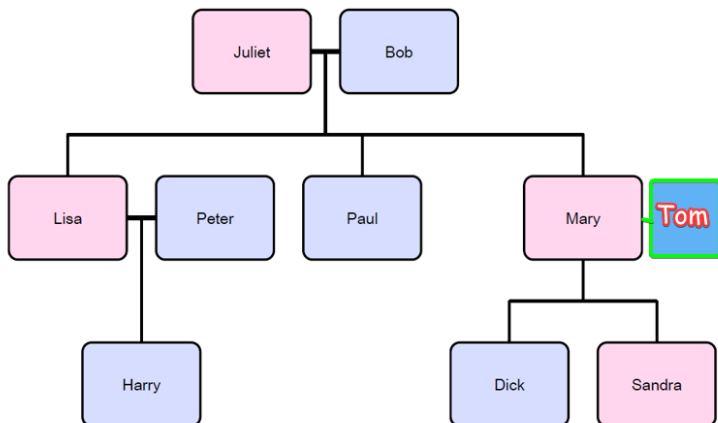
true ;

sandra is_niece_of lisa

true ;

false.

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