



# **University of Asia Pacific**

**Department of Computer Science & Engineering**

**Artificial Intelligence Lab**

**CSE 404**

## **Submitted to:**

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Section: B1

**Problem Title:**

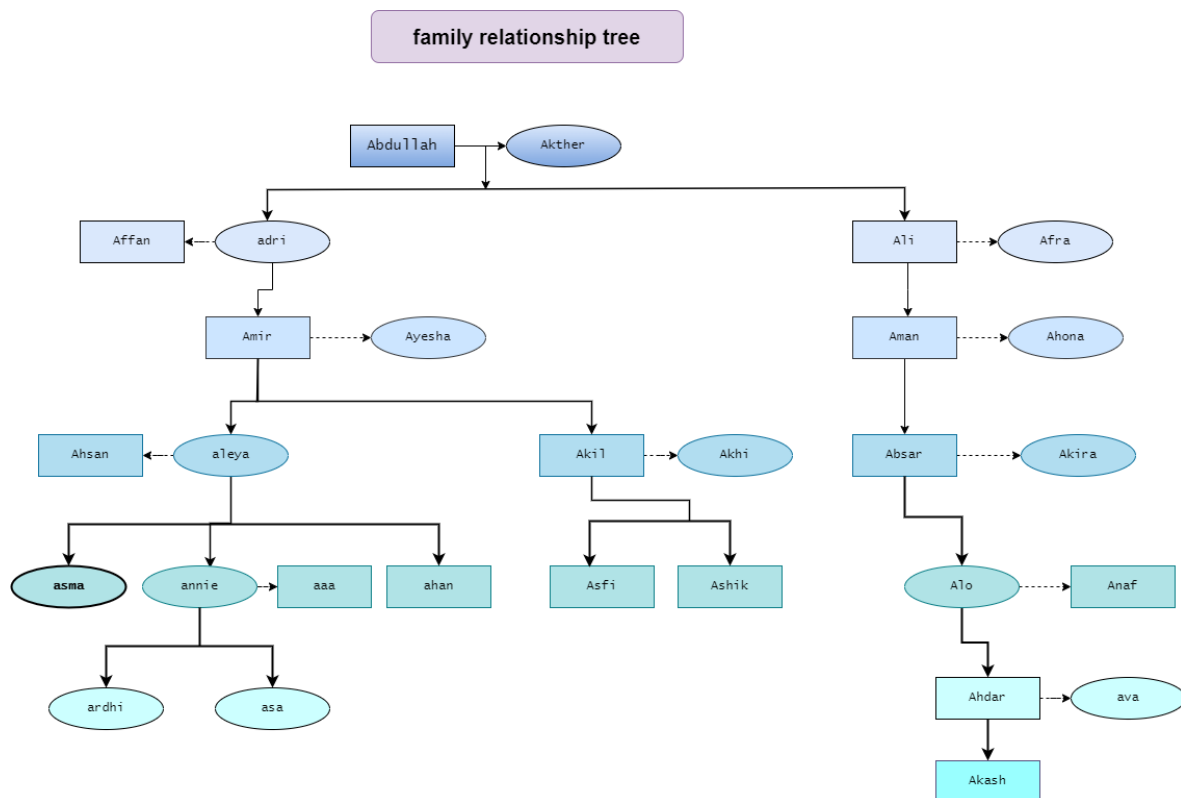
a family relationship tree structure using Prolog.

**Problem Description:**

Implement a basic family relationship tree structure of my own family using Prolog. Write rules to determine the degree and removal for up to the 3rd degree and twice removed situations for cousin relationships.

**Tools and Languages:**

- draw.io for tree diagram
- SWI-Prolog for code
- docs for report
- snipping Tool for input/output screenshot

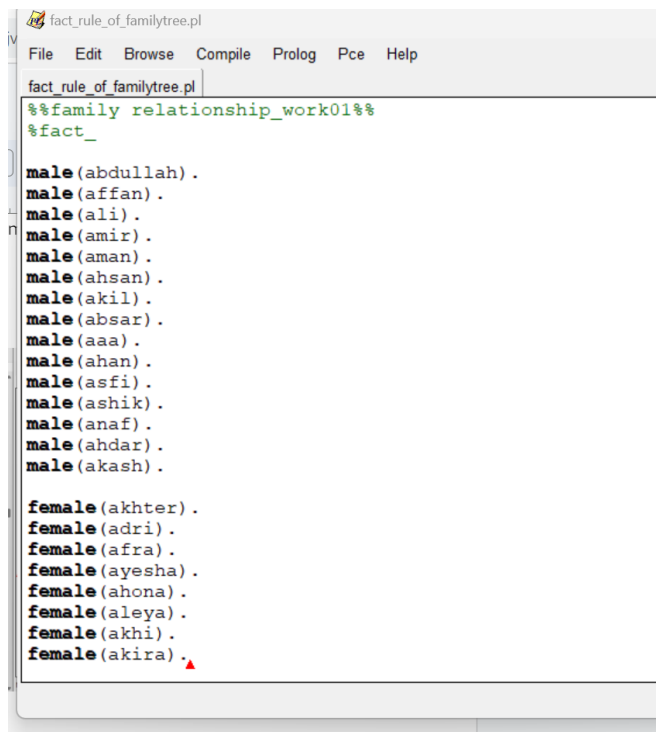
**Diagram:**

The above diagram is my family relationship tree structure. Now with help of SWI-

Prolog, I remove the first, second, third cousin twice. In the tree, all rectangular boxes represent male entities, and the circle box represents female entities. And the dotted line is parent relationship.

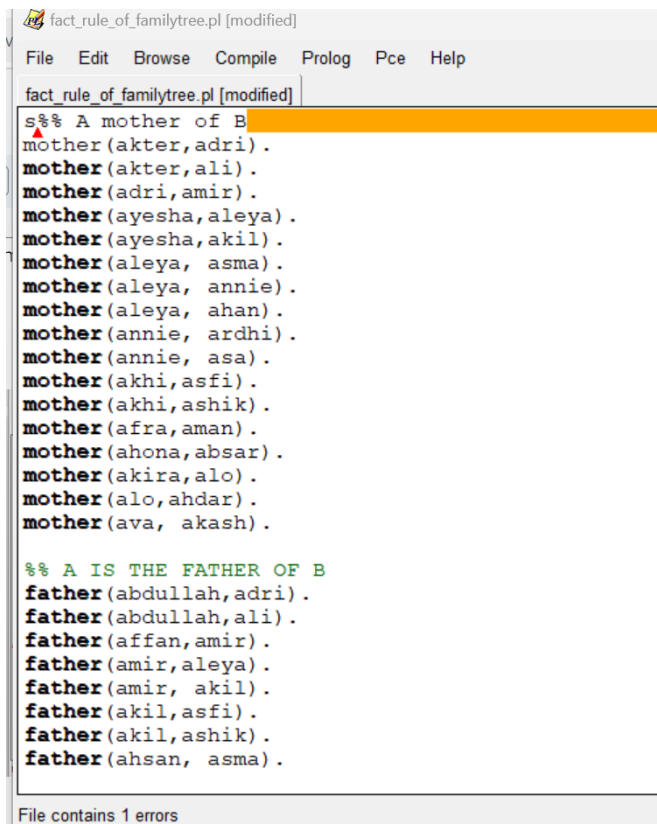
### Sample Input / Output:

here is the sample input



```
fact_rule_of_familytree.pl
File Edit Browse Compile Prolog Pce Help
fact_rule_of_familytree.pl
%%family relationship_work01%%
%fact_
male(abdullah).
male(affan).
male(ali).
male(amir).
male(aman).
male(ahsan).
male(akil).
male(absar).
male(aaa).
male(aahan).
male(asfi).
male(ashik).
male(anaf).
male(ahdar).
male(akash).

female(akhter).
female(adri).
female(afra).
female(ayesha).
female(ahona).
female(aleya).
female(akhi).
female(akira).
```



```
fact_rule_of_familytree.pl [modified]
File Edit Browse Compile Prolog Pce Help
fact_rule_of_familytree.pl [modified]
s%% A mother of B
mother(akter, adri).
mother(akter, ali).
mother(adri, amir).
mother(ayesha, aleya).
mother(ayesha, akil).
mother(aleya, asma).
mother(aleya, annie).
mother(aleya, ahan).
mother(annie, ardhi).
mother(annie, asa).
mother(akhi, asfi).
mother(akhi, ashik).
mother(afra, aman).
mother(ahona, absar).
mother(akira, alo).
mother(alo, ahdar).
mother(ava, akash).

%% A IS THE FATHER OF B
father(abdullah, adri).
father(abdullah, ali).
father(affan, amir).
father(amir, aleya).
father(amir, akil).
father(akil, asfi).
father(akil, ashik).
father(ahsan, asma).

File contains 1 errors
```

here is the sample output for father, mother, parent,  
sibling, uncle, aunt,  
grandparent, great-grandparent,  
great-great-grandparent,  
for an individual person.

SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)

```
File Edit Settings Run Debug Help
ilytree.pl:192:3: Syntax error: Illegal start of term
% c:\Users\HP\Documents\Prolog\fact_rule_of_familytree.pl compile
d 0.00 sec, 79 clauses
?- father(X,asma).
X = ahsan.

?- mother(X,asma).
X = aleya.

?- parent(X,asma).
X = aleya ;
X = ahsan.

?- siblings(X,asma).
X = annie ;
X = ahan ;
false.

?- aunt(X,asma).
false.

?- uncle(X,asma).
X = skil ;
false.

?-

```

fact\_rule\_of\_familytree.pl

```
File Edit Browse Compile Prolog Pce Help

fact_rule_of_familytree.pl

father(ahsan, ahan).
father(aaa, ardhi).
father(ali, aman).
father(aman, absar).
father(absar, alo).
father(anaf, ahdar).
father(ahdar, akash).

%%%rules
%
parent(X,Y):-
    mother(X,Y);
    father(X,Y).

siblings(X,Y):-
    father(Z,X),
    father(Z,Y),
    X\= Y.

aunt(X,Y):-
    parent(Z,Y),
    siblings(X,Z),
    female(X).

uncle(X,Y):-
    parent(Z,Y),
    siblings(X,Z),
    male(X).

No changes need saving
Line: 83

```

SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)

```
File Edit Settings Run Debug Help

?- grandmother(X,asma).
X = ayesha ;
false.

?- grandfather(X,asma).
X = amir ;
false.

?- grandparent(X,asma).
X = ayesha ;
X = amir.

?- great_grandparent(X,asma).
X = adri ;
X = affan ;
false.

?- great_greatgrandparent(X,asma).
X = akter ;
X = abdullah.

?-

```

fact\_rule\_of\_familytree.pl [modified]

```
File Edit Browse Compile Prolog Pce Help

fact_rule_of_familytree.pl [modified]

parent(Z,Y),
siblings(X,Z),
male(X).

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

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

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

great_grandparent(X,Y):-
    grandparent(X,Z),
    parent(Z,Y).

great_greatgrandparent(X,Y):-
    great_grandparent(X,Z),
    parent(Z,Y).

%%-cousin_rule
first_cousin(X,Y):-

```

user.first\_cousin/2: (loaded) 1 clause

Is X the father of Y?  
Is X the mother of Y?

The screenshot shows two windows of the SWI-Prolog IDE. The left window is the Prolog REPL, and the right window is the editor for 'fact\_rule\_of\_familytree.pl'.

```

SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)
File Edit Settings Run Debug Help
ed end of file
?- mother(annie,asa).
true.
?- father(ahdar,akash).
true.
?-

```

```

fact_rule_of_familytree.pl [modified]
File Edit Browse Compile Prolog Pce Help
fact_rule_of_familytree.pl [modified]
mother(ahona,absar).
mother(akira,alo).
mother(alo,ahdar).
mother(ava, akash).

%% A IS THE FATHER OF B
father(abdullah,adri).
father(abdullah,ali).
father(affan,amir).
father(amir,aleya).
father(amir, akil).

```

Resized to 100 percent Line: 59

Is X the aunt of Y?

Is X the uncle of Y?

The screenshot shows the SWI-Prolog IDE with the Prolog REPL and the 'fact\_rule\_of\_familytree.pl' file. The file now includes rules for 'aunt' and 'uncle'.

```

SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)
File Edit Settings Run Debug Help
ed end of file
?- mother(annie,asa).
true.
?- father(ahdar,akash).
true.
?- aunt(asma,asa).
true.
?- uncle(ahan,asa).
true.
?- aunt(asma,X).
X = ardhi ;
X = asa ;
false.
?-

```

```

fact_rule_of_familytree.pl [modified]
File Edit Browse Compile Prolog Pce Help
fact_rule_of_familytree.pl [modified]
aunt(X,Y):-
    parent(Z,Y),
    siblings(X,Z),
    female(X).

uncle(X,Y):-
    parent(Z,Y),
    siblings(X,Z),
    male(X).

```

Line: 83

here is the sample input output for first cousin, second cousin, and third cousin for an individual person.

The screenshot shows the SWI-Prolog IDE with the Prolog REPL and the 'fact\_rule\_of\_familytree.pl' file. The file now includes rules for 'first\_cousin', 'second\_cousin', and 'third\_cousin'.

```

SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)
File Edit Settings Run Debug Help
?- first_cousin(asma,X).
X = asfi ;
X = ashik .
?- second_cousin(asma,X).
false.
?- third_cousin(asma,X).
X = alo .
?- first_cousin(X,asma).
X = asfi ;
X = ashik .
?- third_cousin(X,asma).
X = alo .
?-

```

```

fact_rule_of_familytree.pl [modified]
File Edit Browse Compile Prolog Pce Help
fact_rule_of_familytree.pl [modified]
first_cousin(X,Y):-
    grandparent(Z,X),
    grandparent(Z,Y),
    not(siblings(X,Y)),
    X\=Y.
second_cousin(X,Y):-
    great_grandparent(Z,X),
    great_grandparent(Z,Y),
    not(siblings(X,Y)),
    not(first_cousin(X,Y)),
    X\=Y.
third_cousin(X,Y):-
    great_greatgrandparent(Z,X),
    great_greatgrandparent(Z,Y),
    not(first_cousin(X,Y)),
    not(second_cousin(X,Y)),
    not(siblings(X,Y)),
    X\=Y.

```

Line: 120

here is the sample input output for first cousin once removed, and first cousin twice removed for an individual person.

The image shows two Prolog IDE windows. The left window, titled 'SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)', displays the execution of a query. The right window, titled 'fact\_rule\_of\_familytree.pl', displays the source code for the family tree rules.

**Left Window (Execution Output):**

```
?- third_cousin_once_removed(X,Y).
X = alo,
Y = ardhi ;
X = alo,
Y = ardhi ;
X = alo,
Y = asa ;
X = alo,
Y = asa ;
X = asma,
Y = ahder ;
X = annie,
Y = ahder ;
X = ahan,
Y = ahder ;
X = ahder,
Y = asfi ;
X = ahder,
Y = ahder .

?- third_cousin_twice_removed(X,Y).
X = asma,
Y = akash ;
X = annie,
Y = akash ;
X = ahan,
Y = akash ;
X = asfi,
Y = akash ;
X = ashik,
Y = akash ;
X = asma,
Y = akash ;
X = annie,
Y = akash ;
X = ahan,
Y = akash ;
X = asfi,
Y = akash .
```

**Right Window (Source Code):**

```
fact_rule_of_familytree.pl

second_cousin_twice_removed(X,Y):-
(
grandparent(Z,Y),
second_cousin(X,Z)
);
(
grandparent(Z,X),
second_cousin(Y,Z)
).

third_cousin_once_removed(X,Y):-
(
parent(Z,Y),
third_cousin(X,Z)
);
(
parent(Z,X),
third_cousin(Z,Y)
).

third_cousin_twice_removed(X,Y):-
(
grandparent(Z,Y),
third_cousin(X,Z)
);
(
grandparent(Z,X),
third_cousin(Z,Y)
).
```

Buffer saved in file 'fact\_rule\_of\_familytree.pl' Line: 19

Who's relation-

The image shows two Prolog IDE windows. The left window, titled 'SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)', displays the execution of a query. The right window, titled 'fact\_rule\_of\_familytree.pl', displays the source code for the family tree rules.

**Left Window (Execution Output):**

```
?- parent(X,Y).
X = akter,
Y = adri ;
X = akter,
Y = ali ;
X = adri,
Y = amir ;
X = ayesha,
Y = aleya ;
X = ayesha,
Y = akil ;
X = aleya,
Y = asma ;
X = aleya,
Y = annie ;
X = aleya,
Y = ahan ;
X = annie,
Y = ardhi ;
X = annie,
Y = annie .

?- grandparent(X,Y).
Correct to: "grandparent(X,Y)"?
Please answer 'y' or 'n'? yes
X = akter,
Y = amir ;
X = akter,
Y = aman ;
X = adri,
Y = aleya ;
X = adri,
Y = akil ;
X = ayesha,
Y = asma ;
X = ayesha,
Y = ayesha ;
X = annie,
Y = ayesha .
```

**Right Window (Source Code):**

```
fact_rule_of_familytree.pl

siblings(X,Y):-
father(Z,X),
father(Z,Y),
X\= Y.

aunt(X,Y):-
parent(Z,Y),
siblings(X,Z),
female(X).

uncle(X,Y):-
parent(Z,Y),
siblings(X,Z),
male(X).

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

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

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

Line: 105

```
SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)
File Edit Settings Run Debug Help
?- great_grandparent(X,Y).
X = akter,
Y = aleya ;
X = akter,
Y = akil ;
X = akter,
Y = absar ;
X = adri,
Y = asma ;
X = adri,
Y = annie ;
?- great_greatgrandparent(X,Y).
X = akter,
Y = asma ;
X = akter,
Y = annie ;
X = akter,
Y = ahan ;
X = akter,
Y = asfi ;
X = akter,
Y = ashik ;
X = akter,
Y = alo ;
X = adri,
Y = ardhi ;
X = adri,
Y = asa ;
X = afra,
Y = ahdar ;
X = ahona,
Y = akash ;
X = abdullah,
Y = asma ;
X = abdullah,
Y = annie ;
X = abdullah,
Y = ahan ;
?-

fact_rule_of_familytree.pl
File Edit Browse Compile Prolog Pce Help
fact_rule_of_familytree.pl
parent(X,Z),
parent(Z,Y).

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

great_grandparent(X,Y):-
parent(X,Z),
grandparent(Z,Y).

great_greatgrandparent(X,Y):-
parent(X,Z),
great_grandparent(Z,Y).

%%-cousin_rule
first_cousin(X,Y):-
grandparent(Z,X),
grandparent(Z,Y),
```

## Conclusion and Challenges:

I've faced some minor difficulties during completing this assignment. SWI-Prolog was showing some errors. But after some troubleshooting I was able to fix all the errors of SWI-Prolog.