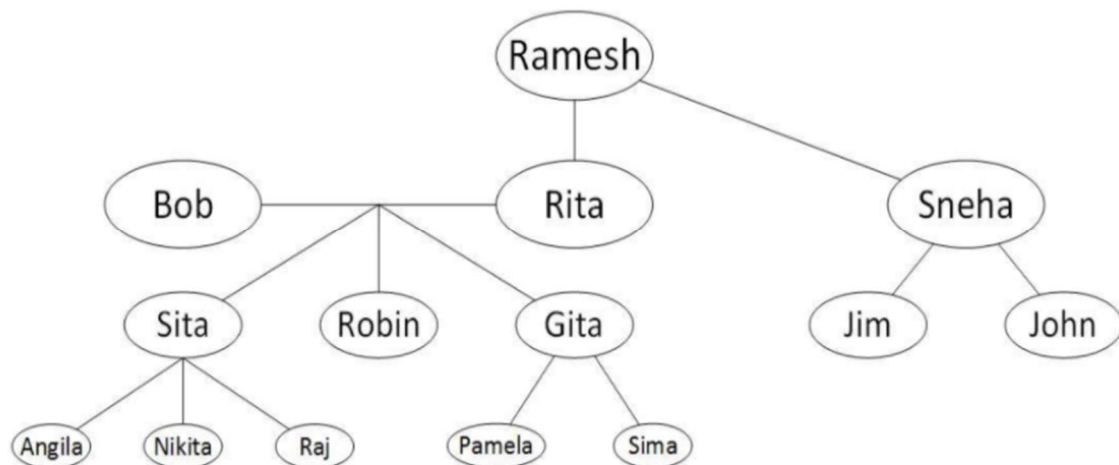1. Implement the following family tree using Prolog

Design the knowledge base and solve the queries.
father_daughter(ramesh,sneha).
husband_wife(bob,rita).
father_daughter(ramesh,rita).
father_daughter(bob,sita).
father_son(bob,robin).
father_daughter(bob,gita).
mother_daughter(sita, angila).
mother_daughter(sita, nikita).
mother_son(sita, raj).
mother_daughter(gita, pamela).
mother_daughter(gita, sima).
mother_son(sneha, jim).
mother_son(sneha, john).
mother_daughter(rita,sita).
mother_son(rita,robin).
mother_daughter(rita,gita).

bro_sis(X,Y):-
 father_son(Z,X),
 father_daughter(Z,Y).

bro_sis(X,Y):-
 mother_son(Z,X),
 mother_daughter(Z,Y).

sis_sis(X,Y):-
 father_daughter(Z,X),
 father_daughter(Z,Y).

```
sis_sis(X,Y):-
    mother_daughter(Z,X),
    mother_daughter(Z,Y).


bro_bro(X,Y):-
    father_son(Z,X),
    father_son(Z,Y).


bro_bro(X,Y):-
    mother_son(Z,X),
    mother_son(Z,Y).
```

Q1. Who is the grandparent of Robin?

Ans: Ramesh

```
Warning:    Clauses of mother_daughter/2 are not together in the source-file
Warning:    Earlier definition at c:/users/user/onedrive/documents/prolog/first.pl:7
Warning:    Current predicate: mother_son/2
Warning:    Use :- discontiguous mother_daughter/2. to suppress this message
?- father_son(X,bob).
false.

?- father_son(X,robin).
X = bob.

?- father_son(X,bob).
false.

?- mother_son(X,robin).
X = rita.

?- father_daughter(X,rita).
X = ramesh.

?- ■
```

Q2. Who is the sister of Sita?

Ans:

```
File   Edit   Settings   Run   Debug   Help

es
?- sis_sis(sita,X).
X = sita ;
X = gita ;
X = sita ;
X = gita ;
false.

?- ■
```

Q3. Who is the aunt of Jim?

Ans: Rita

```
SWI-Prolog (AMD64, Multi-threaded, version 8.4.2)

File  Edit  Settings  Run  Debug  Help

?- father_son(X,jim).
false.

?- mother_son(X,jim).
X = sneha.

?- sis_sis(sneha,X).
X = sneha ,
X = rita ,
false.

?- █
```

Q4. Who is the father-in-law of Bob?

Ans: Ramesh

```
Warning:     Earlier definition at C:/users/user/onedrive/documents/prolog/first.pl:7
Warning:     Current predicate: mother_son/2
Warning:     Use :- discontiguous mother_daughter/2. to suppress this message
?- husband_wife(bob,X).
X = rita.

?- father_daughter(X,rita).
X = ramesh.

?-
```

Q5. Who is the husband of Rita?

Ans: Bob

```
?- husband_wife(X,rita).
X = bob.

?- █
```

Q6. Who are the cousin sisters of Raj?

Ans: Pamela and Sima

```
?- mother_son(X,raj).
X = sita.

?- bro_sis(X,sita).
X = robin ,
X = robin.

?- sis_sis(X,sita).
X = sita ,
X = gita ,
X = sita ,
X = gita ,
false.

?- father_son(robin,X).
false.

?- father_daughter(robin, X).
false.

?- mother_son(gita,X).
false.

?- mother_daughter(gita,X).
X = pamela ,
X = sima.

?-
```

Q7. Who is not the sister of Pamela?

Ans: Anyone other than Sima.

```
?- sis_sis(pamela,X).
X = pamela ,
X = sima ,
false.

?-
```
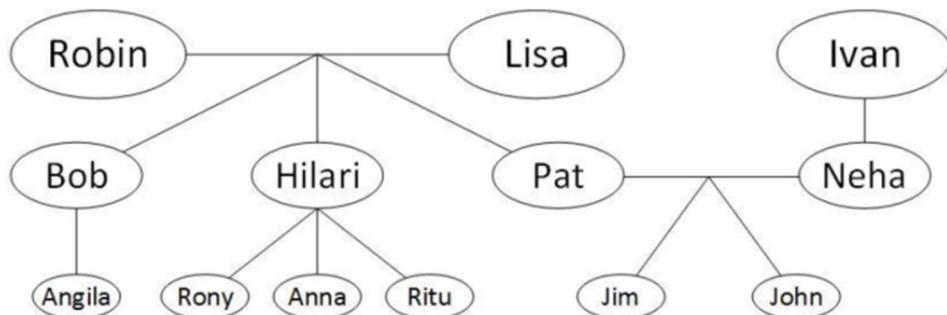
Q8. Who are the grandparents of Sima?

Ans: Bob and Rita

```
?- father_daughter(X,sima).
false.

?- mother_daughter(X,sima).
X = gita.

?- father_daughter(X,gita).
X = bob.

?- husband_wife(bob,X).
X = rita.

?-
```

Q9. Who is the brother of John?

Ans: Jim

```
?- bro_bro(john,X).
X = jim ;
X = john.

?-
```


2.

Knowledge Base:

husband_wife(robin,lisa).

father_son(robin,bob).

father_son(robin,hilari).

father_son(robin,pat).

mother_son(lisa,bob).

mother_son(lisa,hilari).

```prolog
mother_son(lisa,pat).

father_daughter(bob,angila).


father_daughter(hilari,rony).

father_daughter(hilari,anna).

father_daughter(hilari,ritu).


husband_wife(pat, neha).

father_son(pat, jim).

father_son(pat, john).

mother_son(neha, jim).

mother_son(neha, john).


father_daughter(ivan, neha).


bro_sis(X,Y):-

    father_son(Z,X),

    father_daughter(Z,Y).


sis_sis(X,Y):-

    father_daughter(Z,X),

    father_daughter(Z,Y).


bro_bro(X,Y):-

    father_son(Z,X),

    father_son(Z,Y).
```

```
bro_bro(X,Y):-

    mother_son(Z,X),

    mother_son(Z,Y).
```

Q1. Who is the grandmother of Angila?

Ans: Lisa

```
Warning:     Current predicate: mother_son/2
Warning:     Use :- discontiguous father_daughter/2. to suppress this message
?- father_daughter(X,angila).
X = bob.

?- mother_son(X,bob).
X = lisa.

?-
```

Q2. Who is the grandfather of Angila?

Ans: Robin

```
Warning:     Current predicate: mother_son/2
Warning:     Use :- discontiguous father_daughter/2. to suppress this message
?- father_daughter(X,angila).
X = bob.

?- mother_son(X,bob).
X = lisa.

?- father_son(X,bob).
X = robin.

?- █
```

Q3. Who is the aunt of Jim?

Ans: No one

```
File  Edit  Settings  Run  Debug  Help

?- father_son(X,jim).
X = pat.

?- bro_sis(pat,X).
false.

?- mother_son(X,jim).
X = neha.

?- sis_sis(neha,X).
X = neha.

?- █
```

Q4. Who is the aunt of Ritu?

Ans: No one

```
?- father_daughter(X,ritu).
X = hilari.

?- bro_sis(hilari,X).
false.

?- mother_daughter(X,ritu).
ERROR: Unknown procedure: mother_daughter/2 (DWIM could not correct goal)
?-
```

Q5. Who is the sister of Anna?

Ans: Rony and Ritu

```
es
?- sis_sis(anna,X).
X = rony ,
X = anna ,
X = ritu.

?-
```

Q6. Who is the wife of Robin?

Ans: Lisa

```
?- husband_wife(robin,X).
X = lisa.

?-
```

Q7. Who is the brother of John?

Ans: Jim

```
File Edit Settings Run Debug Help
?- husband_wife(robin,X).
X = lisa.

?- bro_bro(john,X).
X = jim ,
X = john ,
X = jim ,
X = john.

?-
```

Q8. Who are the cousin sisters of Anglia?

Ans: Rony, Anna, Ritu

```
?- father_daughter(X,angila).
X = bob.

?- bro_sis(bob,X).
false.

?- bro_bro(bob,X).
X = bob ,
X = hilari ,
X = pat ,
X = bob ,
X = hilari ,
X = pat.

?- father_daughter(hilari,X).
X = rony ,
X = anna ,
X = ritu.

?- father_daughter(pat, X).
false.

?-
```

Q9. Who are the cousin brothers of Anglia?

Ans: Jim and John

```
?- father_daughter(X,angila).
X = bob.

?- bro_sis(bob,X).
false.

?- bro_bro(bob,X).
X = bob ,
X = hilari ,
X = pat ,
X = bob ,
X = hilari ,
X = pat.

?- father_daughter(hilari,X).
X = rony ,
X = anna ,
X = ritu.

?- father_daughter(pat, X).
false.

?- father_son(pat,X).
X = jim ,
X = john.

?- █
```

Q10. Who are the grandparents of Ritu?

Ans: Robin and Lisa.

```
File  Edit  Settings  Run  Debug  Help

?- father_daughter(X,ritu).
X = hilari.

?- father_son(X,hilari).
X = robin.

?- mother_son(X,hilari).
X = lisa.

?-
```

Q11. Who is the grandchild of Lisa?

.Ans: Anjila, Rony, Anna, Ritu, Jim, John.

```
?- mother_son(lisa,X).
X = bob ,
X = hilari ,
X = pat.

?- father_son(bob,X).
false.

?- father_daughter(bob,X).
X = angila.

?- father_son(hilari,X).
false.

?- father_daughter(hilari,X).
X = rony ,
X = anna ,
X = ritu.

?- father_son(pat,X).
X = jim ,
X = john.

?- father_daughter(pat,X).
false.

?-
```

Q12. Who is not the sister of Anna?

Ans: Jim

Q13. Who is the grandchild of Robin?

Ans: Anjila, Rony, Anna, Ritu, Jim, John.

(Same as Lisa)

Q14. Who is the mother-in-law of Ivan?

Ans: No one

```
File  Edit  Settings  Run  Debug  Help

?- husband_wife(ivan, X).
false.

?-
```

Q15. Who is the son-in-law of Neha?

Ans: No one.

Q16. Who is the grandparent of John?

Ans: Robin

```
?- father_son(X,john).
X = pat.

?- father_son(X,pat).
X = robin.

?-
```

Q17. Who is the brother-in-law of Neha?

Ans: Bob and Hilari

```
?- father_son(X,john).
X = pat.

?- father_son(X,pat).
X = robin.

?- husband_wife(X,neha).
X = pat.

?- bro_bro(pat,X).
X = bob ,
X = hilari ,
X = pat ,
X = bob ,
X = hilari ,
X = pat.

?-
```

Q18. Who is the sister-in-law of Neha?

Ans: No one.

```
?- father_son(X,john).
X = pat.

?- father_son(X,pat).
X = robin.

?- husband_wife(X,neha).
X = pat.

?- bro_bro(pat,X).
X = bob ,
X = hilari ,
X = pat ,
X = bob ,
X = hilari ,
X = pat.

?- bro_sis(pat,X).
false.

?-
```