LAB 2 | Artificial Intelligence

Aim: Study of RULES & UNIFICATION.

1. Write a prolog program for the given facts and rules and answer the given question.

Code:

```
domains
        patient, indication, disease=symbol
predicates
        symptom(patient, indication).
        hypothesis(patient, disease).
clauses
        symptom("Parva",fever).
        symptom("Parva",rash).
        symptom("Parva",headache).
        symptom("Parva",runny_nose).
        symptom("Vidhi",chills).
        symptom("Vidhi",fever).
        symptom("Vidhi",headache).
        symptom("Vivan",runny_nose).
        symptom("Vivan",rash).
        symptom("Vivan",flu).

        hypothesis(Patient,measles):-symptom(Patient,fever),
                                     symptom(Patient,cough),
                                     symptom(Patient,conjunctivitis),
                                     symptom(Patient,rash).

        hypothesis(Patient,german_measles):-symptom(Patient,fever),
                                            symptom(Patient,headache),
                                            symptom(Patient,runny_nose),
                                            symptom(Patient,rash).

        hypothesis(Patient,flu):-symptom(Patient,fever),
                                 symptom(Patient, headache),
                                 symptom(Patient,body_ache),
                                 symptom(Patient,chills).

        hypothesis(Patient,common_cold):-symptom(Patient,headache),
                                         symptom(Patient,sneezing),
                                         symptom(Patient,sore_throat),
                                         symptom(Patient,chills),
```

```
                                        symptom(Patient,runny_nose).

hypothesis(Patient,mumps):-symptom(Patient,fever),
                           symptom(Patient,swollen_glands).

hypothesis(Patient,chicken_pox):-symptom(Patient,fever),
                                 symptom(Patient,rash),
                                 symptom(Patient,body_ache),
                                 symptom(Patient,chills).
```

Question : Identify patients with any particular disease based on rules and facts given above.

```
Goal: hypothesis(X,measles)
No Solution
Goal: symptom(X,fever),symptom(X,rash),symptom(X,headache),symptom(X,runny_nose)
X=Parva
1 Solution
Goal: hypothesis(X,chicken_pox)
No Solution
Goal: hypothesis("Vivan",flu)
No
Goal: symptom(X,headache)
X=Parva
X=Vidhi
2 Solutions
```

2. Write a program for a family tree given question which contains three predicates: male, female, parent.

Make rules for family relations : father , mother, grandfather, grandmother, brother, sister, uncle, aunt, nephew and niece.

Code:

```
predicates
        male(symbol).
        female(symbol).
        parent(symbol,symbol).
        father(symbol,symbol).
        mother(symbol,symbol).
        wife(symbol,symbol).
        grandfather(symbol,symbol).
        grandmother(symbol,symbol).
        brother(symbol,symbol).
        sister(symbol,symbol).
        uncle(symbol,symbol).
        aunt(symbol,symbol).
        nephew(symbol,symbol).
        niece(symbol,symbol).

clauses
        male("Pandu").
        male("Nakula").
        male("Sahadeva").
        male("Arjuna").
        male("Bhima").
        male("Yudhishthira").
        male("Satanika").
        male("Shrutasena").
        male("Shrutakarma").
        male("Abhimanyu").
        male("Iravan").
        male("Babruvahana").
        male("Sutasoma").
        male("Prativindhya").

        female("Madri").
        female("Kunti").
        female("Draupadi").
        female("Subhadra").
        female("Ulupi").
        female("Chitrangada").

        parent("Pandu","Nakula").
```

```
parent("Pandu","Sahadeva").
parent("Pandu","Arjuna").
parent("Pandu","Bhima").
parent("Pandu","Yudhishthira").
parent("Madri","Nakula").
parent("Madri","Sahadeva").
parent("Kunti","Arjuna").
parent("Kunti","Bhima").
parent("Kunti","Yudhishthira").
parent("Nakula","Satanika").
parent("Draupadi","Satanika").
parent("Sahadeva","Shrutasena").
parent("Draupadi","Shrutasena").
parent("Arjuna","Shrutakarma").
parent("Arjuna","Abhimanyu").
parent("Arjuna","Iravan").
parent("Arjuna","Babruvahana").
parent("Draupadi","Shrutakarma").
parent("Subhadra","Abhimanyu").
parent("Ulupi","Iravan").
parent("Chitrangada","Babruvahana").
parent("Bhima","Sutasoma").
parent("Draupadi","Sutasoma").
parent("Yudhishthira","Prativindhya").
parent("Draupadi","Prativindhya").

father(X,Y):-parent(X,Y),male(X).
mother(X,Y):-parent(X,Y),female(X).
wife(X,Y):-parent(X,Z),parent(Y,Z),
           male(X),female(Y).
grandfather(X,Y):-father(X,Z),father(Z,Y).
grandmother(X,Y):-mother(X,Z),father(Z,Y).
brother(X,Y):-father(A,X),father(A,Y),
              mother(B,X),mother(B,Y),
              male(X),not(X=Y).
sister(X,Y):-father(A,X),father(A,Y),
             mother(B,X),mother(B,Y),
             female(X),not(X=Y).
uncle(X,Y):-father(Z,Y),brother(X,Z).
aunt(X,Y):-father(Z,Y),brother(B,Z),wife(B,X).
nephew(X,Y):-father(Z,Y),brother(X,Z),
             male(X),male(Y).
niece(X,Y):-father(Z,Y),brother(X,Z),
            male(X),female(Y).
```

Output :

```
Goal: father("Pandu",Y)
Y=Nakula
Y=Sahadeva
Y=Arjuna
Y=Bhima
Y=Yudhishthira
5 Solutions
Goal: mother("Kunti",X)
X=Arjuna
X=Bhima
X=Yudhishthira
3 Solutions
Goal: grandfather(X,"Prativindhya")
X=Pandu
1 Solution
Goal: brother(X,"Arjuna")
X=Bhima
X=Yudhishthira
2 Solutions
Goal: uncle("Arjuna",Y)
Y=Sutasoma
Y=Prativindhya
2 Solutions
Goal: nephew("Bhima",Y)
Y=Shrutakarma
Y=Abhimanyu
Y=Iravan
Y=Babruvahana
Y=Prativindhya
5 Solutions
```

3. Write a prolog program for the given facts and rules, trace the given goals.

Code:

```
domains
        course, level, material, component, person = symbol
predicates
        is(course,level).
        available(course,material).
        has(course,component).
        takes(person,course).
        hypothesis(person,course).
clauses
        is("hardware","easy").
        is("logic","not easy").
        is("graphics","easy").

        has("graphics","8 credits").
        has("graphics","lab component").

        available("hardware","Books").
        available("database","Books").

        takes("Mary","compilers").

        hypothesis(X,Y):-takes(X,Y),is(Y,"easy"),available(Y,"Books").
        hypothesis(X,Y):-takes(X,Y),has(Y,"8 credits"),has(Y,"lab component").
```

Goals:

1. Does Mary take a graphics course?
   I/p & O/p:
   ```
   Goal: takes("Mary","graphics")
   No
   ```

2. Which course Mary takes?
   I/p & O/p:
   ```
   Goal: takes("Mary",X)
   X=compilers
   1 Solution
   ```

3. Who takes graphics course?
   I/p & O/p:
   ```
   Goal: takes(X,"graphics")
   No Solution
   ```