Pranav Nair
2019130042
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Experiment-6

Aim: To solve problems using Prolog Programming and solve the given 5 tasks.

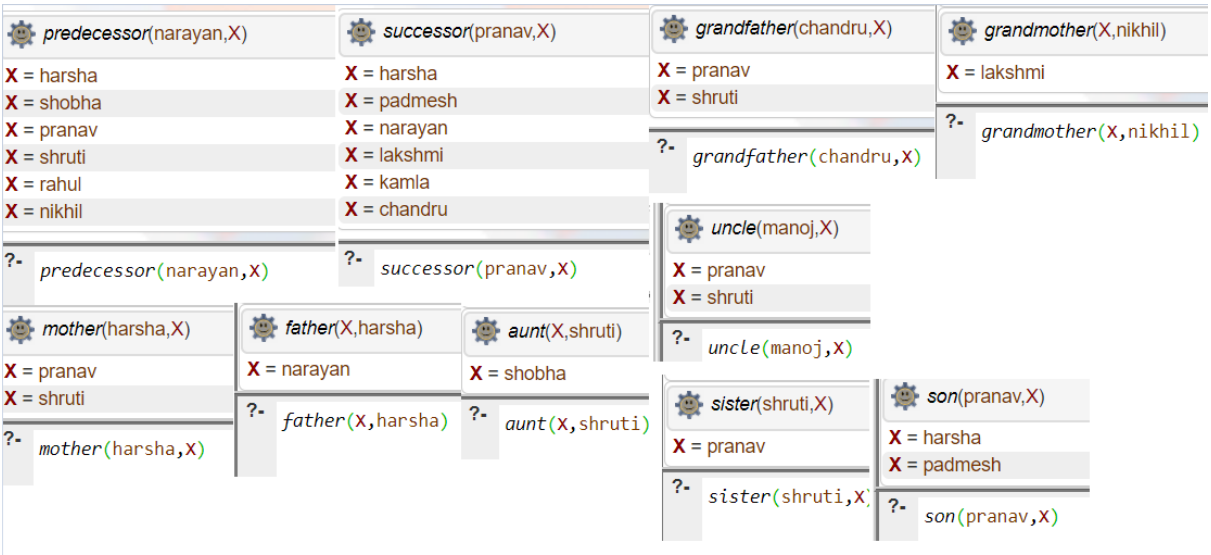
Problem statements:

1) Create a family tree using PROLOG. It should have rules for father, mother, brother, sister, grandparent, uncle, aunt, predecessors, successors.

   Code:

```
parent(kamla,padmesh).
parent(chandru,padmesh).
parent(chandru,manoj).
parent(kamla,manoj).
parent(harsha, pranav).
parent(padmesh, pranav).
parent(shobha, rahul).
parent(murli, rahul).
parent(narayan, harsha).
parent(lakshmi, harsha).
parent(lakshmi, shobha).
parent(narayan, shobha).
parent(shobha, nikhil).
parent(murli, nikhil).
parent(harsha, shruti).
parent(padmesh, shruti).
female(kamla).
female(harsha).
female(shruti).
female(shobha).
female(lakshmi).
male(murli).
male(manoj).
male(padmesh).
male(nikhil).
male(pranav).
male(rahul).
male(narayan).
male(chandru).

%rules
predecessor(X, Y) :- parent(X, Y).
predecessor(X, Y) :- parent(X, A),predecessor(A, Y).
successor(X, Y):- son(X,Y).
```

```
successor(X, Y):- daughter(X, Y).
successor(X, Y):- son(X, A), successor(A, Y).
successor(X, Y):- daughter(X, A), successor(A, Y).

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

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

aunt(X, Y):- sister(X, Z), parent(Z, Y).
uncle(X, Y):- brother(X, Z), parent(Z, Y).

sister(X, Y):- parent(A, X), parent(A, Y), female(X), X \= Y.
brother(X, Y):- parent(A, X), parent(A, Y), male(X), X \= Y.

son(X, Y):- parent(Y, X), male(X).
daughter(X, Y):- parent(Y, X), female(X).
```



2) Given a list [a,a,a,a,b,b,b,c,c] write a function that does the following
rle([a,a,a,a,b,b,c,c],X) X: [a,b,c]

Code:

```
%stopping condition
remove_duplicates([X],[X]).

%if next element is same
remove_duplicates([H, H|T],X) :-
    remove_duplicates([H|T],X).

%if next element not same
remove_duplicates([H, P|T],[H|Y]) :-
    H\=P,
    remove_duplicates([P|T],Y).
```

3) Given a list [a,b,c,d,e,f,g] write a function that does the following slice([a,b,c,d,e,f,g],2,5,X) X: [c,d,e,f]

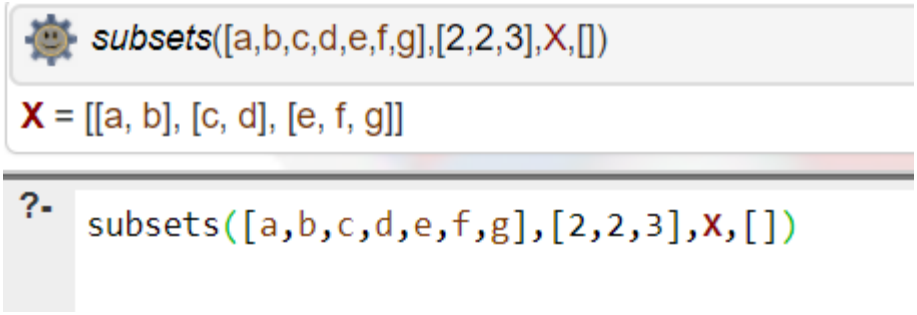
Code:

```
% puts last value of slice in output list
slice([X|_], 0, 0, [X]).

% called until last slice index is reached
slice([X|T], 0, L, [X|T_new]) :- L >0, L_new is L - 1, slice(T, 0, L_new, T_new).

% called until initial slice index is reached
slice([_|T], F, L, Output) :- F > 0, F_new is F - 1, L_new is L - 1, slice(T, F_new, L_new,
Output).
```

4) Group list into sublists according to the distribution given For example subsets([a,b,c,d,e,f,g],[2,2,3],X,[]) should return X = [[a,b][c,d][e,f,g]] The order of the list does not matter

Code:

```
el(X,[X|L],L).
el(X,[_|L],R) :-
   el(X,L,R).
selectN(0,_,[]) :- !.
selectN(N,L,[X|S]) :-
   N > 0,
   el(X,L,R),
   N1 is N-1,
   selectN(N1,R,S).
subsets([],[],[],[]).
subsets(G,[N1|Ns],[G1|Gs],[]) :-
   selectN(N1,G,G1),
   subtract(G,G1,R),
    subsets(R,Ns,Gs,[]).
```

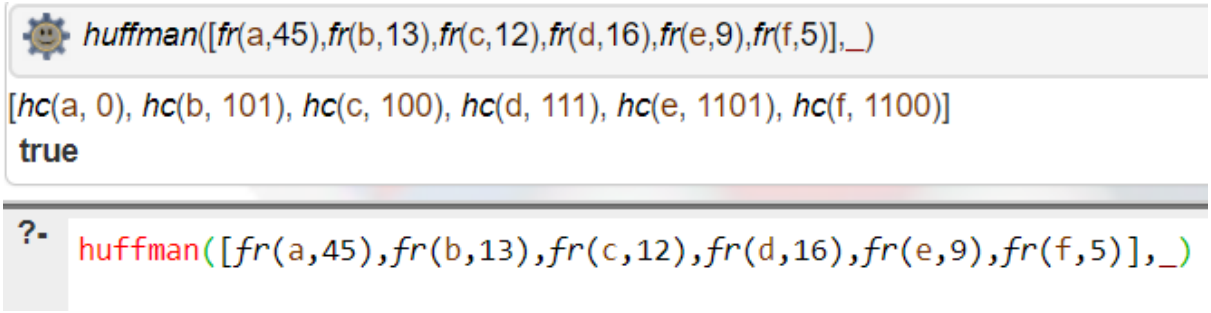


5) Huffman Code We suppose a set of symbols with their frequencies, given as a list of fr(S,F) terms. Example: [fr(a,45),fr(b,13),fr(c,12),fr(d,16),fr(e,9),fr(f,5)].
Our objective is to construct a list hc(S,C) terms, where C is the Huffman code word for the symbol S. In our example, the result could be Hs =[hc(a,'0'), hc(b,'101'), hc(c,'100'), hc(d,'111'), hc(e,'1101'), hc(f,'1100')].
The task shall be performed by the predicate huffman/2 defined as follows: % huffman(Fs,Hs) :- Hs is the Huffman code table for the frequency table Fs

Code:

```
huffman(Fs,Cs) :-
   initialize(Fs,Ns),
   make_tree(Ns,T),
   traverse_tree(T,Cs).

initialize(Fs,Ns) :- init(Fs,NsU), sort(NsU,Ns).

init([],[]).
init([fr(S,F)|Fs],[n(F,S)|Ns]) :- init(Fs,Ns).

make_tree([T],T).
make_tree([n(F1,X1),n(F2,X2)|Ns],T) :-
   F is F1+F2,
   insert(n(F,s(n(F1,X1),n(F2,X2))),Ns,NsR),
   make_tree(NsR,T).

insert(N,[],[N]) :- !.
insert(n(F,X),[n(F0,Y)|Ns],[n(F,X),n(F0,Y)|Ns]) :- F < F0, !.
insert(n(F,X),[n(F0,Y)|Ns],[n(F0,Y)|Ns1]) :- F >= F0, insert(n(F,X),Ns,Ns1).

traverse_tree(T,Cs) :-
    traverse_tree(T,'',Cs1-[]), sort(Cs1,Cs),
    write(Cs).

traverse_tree(n(_,A),Code,[hc(A,Code)|Cs]-Cs) :-
    atom(A).

traverse_tree(n(_,s(Left,Right)),Code,Cs1-Cs3) :-
   atom_concat(Code,'0',CodeLeft),
   atom_concat(Code,'1',CodeRight),
```

traverse_tree(Left,CodeLeft,Cs1-Cs2),
traverse_tree(Right,CodeRight,Cs2-Cs3).



Conclusion:
In this experiment, the aim was to learn prolog programming, prolog has been used for logic programming.Here I performed list operations using prolog such as removing duplicates from list, slicing a list, creating subsets of list of given size and also to generate huffman code for the given symbols. Basically the three basic contructs of Prolog are rules,facts and queries. The Prolog programs are basically knowledge bases, consisting of rules, facts and queries are asked to which the answer is seeked from this knowledge base and a boolean value is sent.

GitHub: https://github.com/pranav567/AI-ML-Lab/tree/master/experiment-6