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TE COMPS

Batch C

Experiment 6

Aim: To solve problems using Prolog Programming.

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

Code:

```
parent(pandu, arjun).

parent(pandu, bheem).

parent(pandu, nakul).

parent(arjun, abhimanyu).

parent(arjun, pragati).

parent(abhimanyu, parikshit).


parent(uttara, parikshit).

parent(subhadra, abhimanyu).

parent(subhadra, pragati).

parent(kunti, arjun).

parent(kunti, bheem).

parent(madri, nakul).


female(kunti).

female(madri).

female(pragati).

female(uttara).
```

```
female(subhadra).

male(pandu).
male(arjun).
male(nakul).
male(abhimanyu).
male(parikshit).

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

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

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

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.

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

predecessor(X, Y) :- parent(X, Y), X\=Y.
predecessor(X, Y) :- parent(X, A),predecessor(A, Y).
```

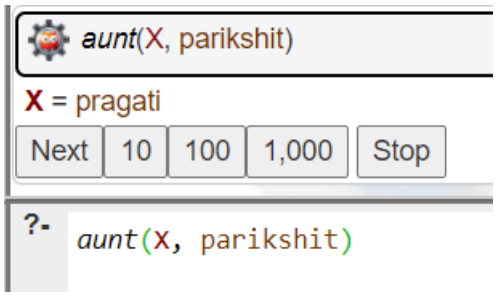
successor(X, Y):- son(Y, X), X\=Y.

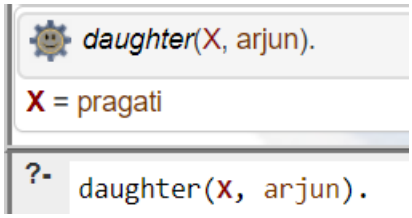
successor(X, Y):- daughter(Y, X).

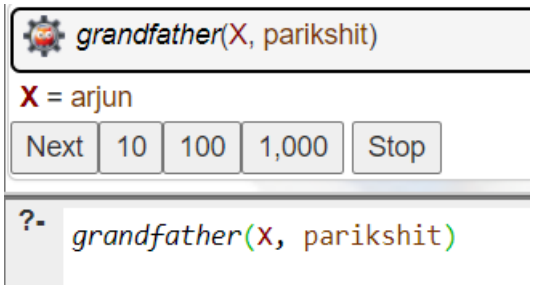
successor(X, Y):- son(A, X), successor(A, Y).

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

Output:







grandmother(X, parikshit)

X = subhadra

Next | 10 | 100 | 1,000 | Stop

```
?- grandmother(X, parikshit)
```

mother(X, abhimanyu).

X = subhadra

```
?- mother(X, abhimanyu).
```

sister(X, abhimanyu)

X = pragati

Next | 10 | 100 | 1,000 | Stop

```
?- sister(X, abhimanyu)
```

son(X, arjun)

X = abhimanyu

Next | 10 | 100 | 1,000 | Stop

```
?- son(X, arjun)
```

successor(X, abhimanyu).

X = parikshit

Next | 10 | 100 | 1,000 | Stop

```
?- successor(X, abhimanyu).
```

uncle(X, abhimanyu)

X = bheem

X = nakul

Next | 10 | 100 | 1,000 | Stop

```
?- uncle(X, abhimanyu)
```

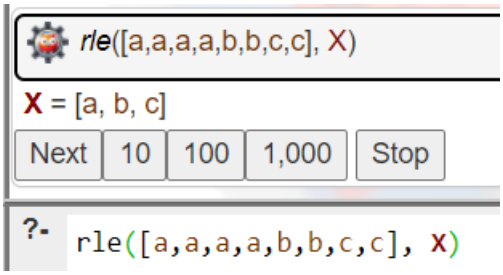
Q.2) Given a list [a,a,a,a,b,b,b,c,c] write a function that does the following

rle([a,a,a,a,b,b,c,c],X), X: [a,b,c]

Code:

```
rle([],[]).

rle([X],[X]).

rle([X, X|REMAINING],OUTPUT) :- rle([X|REMAINING],OUTPUT).

rle([X, Y|REMAINING], [X|OUTPUT_TAIL]) :- X \= Y, rle([Y|REMAINING],

OUTPUT_TAIL).
```

Output:

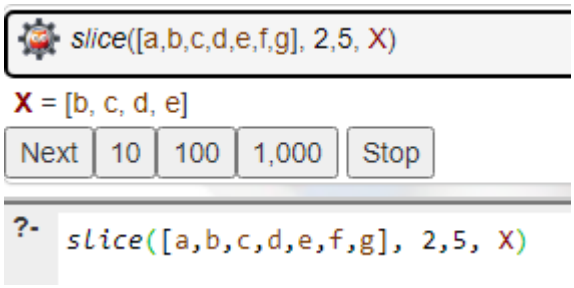


Q.3) Given a list [a,b,c,d,e,f,g] write a function that does the following slice([a,b,c,d,e,f,g],[2,5],X), X: [c,d,e,f]

Code:

```
slice([X|_], 1, 1, [X]).

slice([X|TAIL], 1, CURRENT_INDEX, [X|REM_TAIL]) :- CURRENT_INDEX >

1,

NEXT_INDEX is CURRENT_INDEX - 1, slice(TAIL, 1, NEXT_INDEX,

REM_TAIL).

slice([_|TAIL], I, CURRENT_INDEX, OUTPUT) :- I > 1,

I1 is I - 1, NEXT_INDEX is CURRENT_INDEX - 1, slice(TAIL, I1,

NEXT_INDEX, OUTPUT).
```

Output:



Q.4) Group list into sublists according to the distribution given

For example,

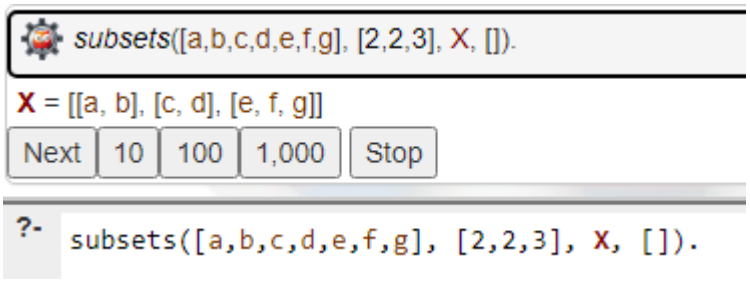
subsets([a,b,c,d,e,f,g],[2,2,3],X,[]) should return X = [[a,b][c,d][e,f,g]]

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,[]).
```

Output:



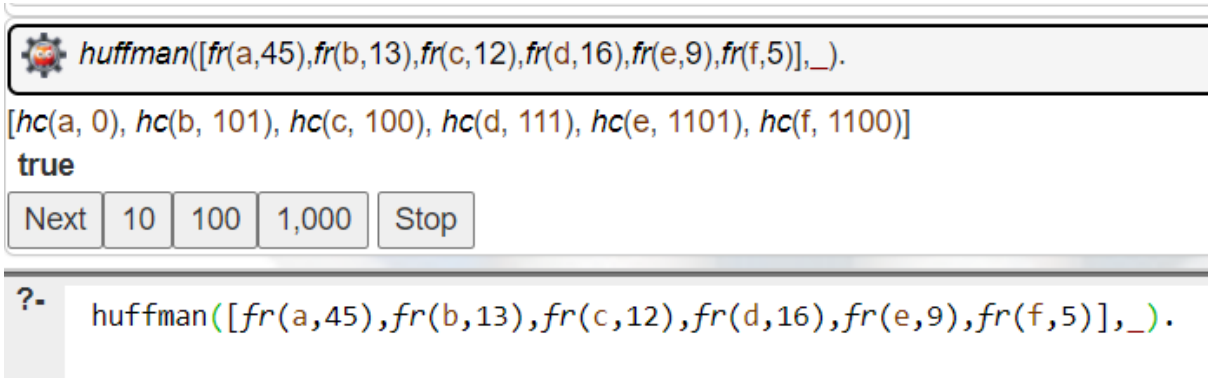
Q5) Huffman Code We suppose a set of symbols with their frequencies, given as a list of fr(S,F) terms. Example: [fr(a,45),fr(b,13),fr(c,12),fr(d,16),fr(e,9),fr(f,5)]. Our objective is to construct a list hc(S,C) terms, where C is the Huffman code word for the symbol S. In our example, the result could be Hs =[hc(a,'0'), hc(b,'101'), hc(c,'100'), hc(d,'111'), hc(e,'1101'), hc(f,'1100')] [hc(a,'01'),...etc.]. 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).
```

Output:



Conclusion:

From this experiment, I have observed that, prolog is a purely logic programming language. Logic here is expressed as relations. It's very easy to build databases in prolog. Prolog searches using recursion method.

Github: https://github.com/PatilOjas/AIML-Lab/tree/main/Exp%206