

# Declarative Programming Final Exam Questions

## Question1:

%family tree.

male(ahmet).

male(mustafa).

male(recep).

male(halil).

male(ersu).

male(bartu).

male(poyraz).

male(deniz).

male(atlas).

male(asil).

male(tuna).

female(afet).

female(pınar).

female(gamze).

female(nehir).

female(merve).

female(rümeysa).

parent(ahmet,recep). %ahmet recep's parent.

parent(ahmet,mustafa). %ahmet mustafa's parent.

parent(recep,pınar). %recep pınar's parent.

parent(recep,gamze). %recep gamze's parent.

parent(recep,halil). %recep halil's parent.

parent(afet,pınar). %afet pınar's parent.

parent(afet,gamze). %afet gamze's parent.

parent(afet,halil). %afet halil's parent.

parent(pınar,ersu). %pınar ersu's parent.

parent(pınar,bartu). %pınar bartu's parent.

```
parent(pınar,poyraz). %pınar poyraz's parent.  
parent(gamze,deniz). %gamze deniz's parent.  
parent(gamze,atlas). %gamze atlas's parent.  
parent(gamze,asil). %gamze asil's parent.  
parent(halil,nehir). %halil nehir's parent.  
parent(halil,tuna). %halil tuna's parent.  
parent(halil,merve). %halil merve's parent.  
parent(halil,rümeysa). %halil rümeysa's parent.
```

```
%rules.
```

```
father(X,Y) :- male(X),parent(X,Y). % We can find mother ,if X is a male.  
mother(X,Y) :- female(X),parent(X,Y). % We can find mother ,if X is a female.  
grandfather(X,Y) :- male(X),parent(X,Z),parent(Z,Y). % We can find grandfather, if X is a male.  
uncle(X,Y) :- male(X),brother(X,Z),parent(Z,Y). % We can find uncle, if X is a male.  
grand_uncle(X,Y) :- male(X),father(Z,Y),father(A,Z),brother(A,X). % We can find grand_uncle, if X is a male.  
grand_uncle(X,Y) :- male(X),mother(Z,Y),father(A,Z),brother(A,X). % We can find grand_uncle, if X is a male.  
brother(X,Y) :- male(Y),parent(Z,X),parent(Z,Y), X \= Y. % We can find brother, if X is a male.  
sister(X,Y) :- female(Y),parent(Z,X),parent(Z,Y), X \= Y. % We can find sister, if X is a female.
```

## **Question2:**

```
%family tree.
```

```
male(mustafa).  
male(recep).  
male(halil).  
male(ersu).  
male(bartu).  
male(poyraz).  
male(deniz).  
male(atlas).  
male(asil).  
male(tuna).  
female(afet).
```

female(pinar).

female(gamze).

female(nehir).

female(merve).

female(rümeysa).

%rules.

father(X,Y) :- male(X),parent(X,Y). % We can find mother ,if X is a male.

mother(X,Y) :- female(X),parent(X,Y). % We can find mother ,if X is a female.

grandfather(X,Y) :- male(X),parent(X,Z),parent(Z,Y). % We can find grandfather, if X is a male.

uncle(X,Y) :- male(X),brother(X,Z),parent(Z,Y). % We can find uncle, if X is a male.

grand\_uncle(X,Y) :- male(X),father(Z,Y),father(A,Z),brother(A,X). % We can find grand\_uncle, if X is a male.

grand\_uncle(X,Y) :- male(X),mother(Z,Y),father(A,Z),brother(A,X). % We can find grand\_uncle, if X is a male.

brother(X,Y) :- male(Y),parent(Z,X),parent(Z,Y), X \= Y. % We can find brother, if X is a male.

sister(X,Y) :- female(Y),parent(Z,X),parent(Z,Y), X \= Y. % We can find sister, if X is a female.

### Question3:

The screenshot shows a Prolog IDE with a family tree program. The program defines various family relationships and rules. The execution results show the output of the query `grand_uncle(mustafa,Y).` and `grand_uncle(mustafa,Y).`.

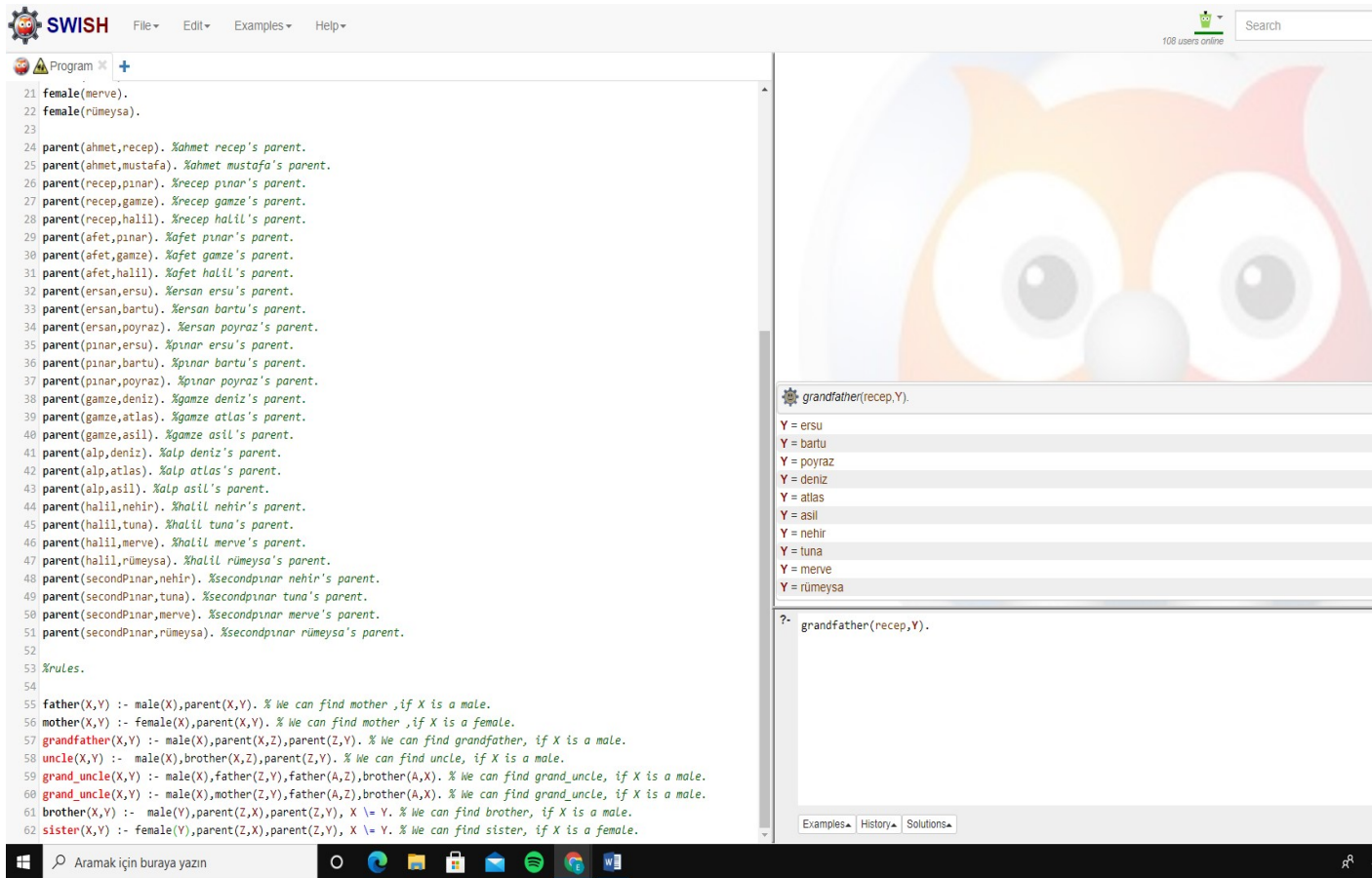
```
22 female(rümeysa).
23
24 parent(ahmet,recep). %ahmet recep's parent.
25 parent(ahmet,mustafa). %ahmet mustafa's parent.
26 parent(recep,pinar). %recep pinar's parent.
27 parent(recep,gamze). %recep gamze's parent.
28 parent(recep,halil). %recep halil's parent.
29 parent(afet,pinar). %afet pinar's parent.
30 parent(afet,gamze). %afet gamze's parent.
31 parent(afet,halil). %afet halil's parent.
32 parent(ersan,ersu). %ersan ersu's parent.
33 parent(ersan,bartu). %ersan bartu's parent.
34 parent(ersan,poyraz). %ersan poyraz's parent.
35 parent(pinar,ersu). %pinar ersu's parent.
36 parent(pinar,bartu). %pinar bartu's parent.
37 parent(pinar,poyraz). %pinar poyraz's parent.
38 parent(gamze,deniz). %gamze deniz's parent.
39 parent(gamze,atlas). %gamze atlas's parent.
40 parent(gamze,asil). %gamze asil's parent.
41 parent(alp,deniz). %alp deniz's parent.
42 parent(alp,atlas). %alp atlas's parent.
43 parent(alp,asil). %alp asil's parent.
44 parent(halil,nehir). %halil nehir's parent.
45 parent(halil,tuna). %halil tuna's parent.
46 parent(halil,merve). %halil merve's parent.
47 parent(halil,rümeysa). %halil rümeysa's parent.
48 parent(secondPinar,nehir). %secondPinar nehir's parent.
49 parent(secondPinar,tuna). %secondPinar tuna's parent.
50 parent(secondPinar,merve). %secondPinar merve's parent.
51 parent(secondPinar,rümeysa). %secondPinar rümeysa's parent.
52
53 %rules.
54
55 father(X,Y) :- male(X),parent(X,Y). % We can find mother ,if X is a male.
56 mother(X,Y) :- female(X),parent(X,Y). % We can find mother ,if X is a female.
57 grandfather(X,Y) :- male(X),parent(X,Z),parent(Z,Y). % We can find grandfather, if X is a male.
58 uncle(X,Y) :- male(X),brother(X,Z),parent(Z,Y). % We can find uncle, if X is a male.
59 grand_uncle(X,Y) :- male(X),father(Z,Y),father(A,Z),brother(A,X). % We can find grand_uncle, if X is a male.
60 grand_uncle(X,Y) :- male(X),mother(Z,Y),father(A,Z),brother(A,X). % We can find grand_uncle, if X is a male.
61 brother(X,Y) :- male(Y),parent(Z,X),parent(Z,Y), X \= Y. % We can find brother, if X is a male.
62 sister(X,Y) :- female(Y),parent(Z,X),parent(Z,Y), X \= Y. % We can find sister, if X is a female.
63
```

Execution results:

```
?- grand_uncle(mustafa,Y).
Y = nehir
Y = tuna
Y = merve
Y = rümeysa
Y = ersu
Y = bartu
Y = poyraz
Y = deniz
Y = atlas
Y = asil

?- grand_uncle(mustafa,Y).
```

## Question4:



The image shows the SWISH Prolog IDE interface. The main window displays a Prolog program with the following code:

```
21 female(merve).
22 female(rümeysa).
23
24 parent(ahmet,recep). %ahmet recep's parent.
25 parent(ahmet,mustafa). %ahmet mustafa's parent.
26 parent(recep,pınar). %recep pınar's parent.
27 parent(recep,gamze). %recep gamze's parent.
28 parent(recep,halil). %recep halil's parent.
29 parent(afet,pınar). %afet pınar's parent.
30 parent(afet,gamze). %afet gamze's parent.
31 parent(afet,halil). %afet halil's parent.
32 parent(ersan,ersu). %ersan ersu's parent.
33 parent(ersan,bartu). %ersan bartu's parent.
34 parent(ersan,poyraz). %ersan poyraz's parent.
35 parent(pınar,ersu). %pınar ersu's parent.
36 parent(pınar,bartu). %pınar bartu's parent.
37 parent(pınar,poyraz). %pınar poyraz's parent.
38 parent(gamze,deniz). %gamze deniz's parent.
39 parent(gamze,atlas). %gamze atlas's parent.
40 parent(gamze,asil). %gamze asil's parent.
41 parent(alp,deniz). %alp deniz's parent.
42 parent(alp,atlas). %alp atlas's parent.
43 parent(alp,asil). %alp asil's parent.
44 parent(halil,nehir). %halil nehir's parent.
45 parent(halil,tuna). %halil tuna's parent.
46 parent(halil,merve). %halil merve's parent.
47 parent(halil,rümeysa). %halil rümeysa's parent.
48 parent(secondPınar,nehir). %secondpınar nehir's parent.
49 parent(secondPınar,tuna). %secondpınar tuna's parent.
50 parent(secondPınar,merve). %secondpınar merve's parent.
51 parent(secondPınar,rümeysa). %secondpınar rümeysa's parent.
52
53 %rules.
54
55 father(X,Y) :- male(X),parent(X,Y). % We can find mother ,if X is a male.
56 mother(X,Y) :- female(X),parent(X,Y). % We can find mother ,if X is a female.
57 grandfather(X,Y) :- male(X),parent(X,Z),parent(Z,Y). % We can find grandfather, if X is a male.
58 uncle(X,Y) :- male(X),brother(X,Z),parent(Z,Y). % We can find uncle, if X is a male.
59 grand_uncle(X,Y) :- male(X),father(Z,Y),father(A,Z),brother(A,X). % We can find grand_uncle, if X is a male.
60 grand_uncle(X,Y) :- male(X),mother(Z,Y),father(A,Z),brother(A,X). % We can find grand_uncle, if X is a male.
61 brother(X,Y) :- male(Y),parent(Z,X),parent(Z,Y), X \= Y. % We can find brother, if X is a male.
62 sister(X,Y) :- female(Y),parent(Z,X),parent(Z,Y), X \= Y. % We can find sister, if X is a female.
```

The right-hand side of the interface shows the execution results for the query `grandfather(recep,Y).`

**Y = ersu**  
**Y = bartu**  
**Y = poyraz**  
**Y = deniz**  
**Y = atlas**  
**Y = asil**  
**Y = nehir**  
**Y = tuna**  
**Y = merve**  
**Y = rümeysa**

Below the results, there is a section for the query `?- grandfather(recep,Y).` with buttons for Examples, History, and Solutions.

## Question5:

Sir,My comments lines are in the code.