



Lab 13

Artificial Intelligence

BY

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TO

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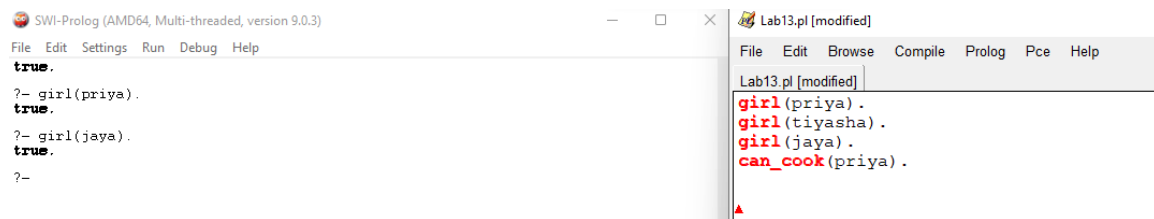
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Lab 13 Complex Knowledge-bases

Knowledge Base 1

```
girl(priya).  
girl(tiyasha).  
girl(jaya).  
can_cook(priya).
```



Knowledge Base 2

Let us see another knowledge base, where we have some rules. Rules contain some information that are conditionally true about the domain of interest. Suppose our knowledge base is as follows

```
SingASong(ananya).  
listens_to_music(rohit).  
listens_to_music(ananya) :-  
    sing_a_song(ananya).  
happy(ananya) :-  
    sing_a_song(ananya).  
happy(rohit) :-  
    listens_to_music(rohit).  
playes_guitar(rohit) :-  
    listens_to_music(rohit).
```

SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)

```
File Edit Settings Run Debug Help
% c:/Users/pak/Documents/Prolog/Lab13.pl compiled 0.00 sec, 0 clauses
?- plays_guitar(ananya).
false.
?- plays_guitar(rohit).
ROhit = rohit.
?- plays_guitar(rohit).
true.
?- happy(ananya).
true.
?-
```

Lab13.pl

```
File Edit Browse Compile Prolog Pce Help
Lab13.pl
SingASong(ananya).
listens_to_music(rohit).
listens_to_music(ananya) :-
    sing_a_song(ananya).
happy(ananya) :-
    sing_a_song(ananya).
happy(rohit) :-
    listens_to_music(rohit).
plays_guitar(rohit) :-
    listens_to_music(rohit).
```

Knowledge Base 3

The facts and rules of Knowledge Base 3 are as follows

SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)

```
File Edit Settings Run Debug Help
% c:/Users/pak/Documents/Prolog/Lab13.pl compiled 0.00 sec, -1 clauses
?- likes(priya,jaya).
true.
?- likes(priya,tiyasha).
true.
?- can_cook(X).
X = priya.
?- likes(priya,X).
X = jaya.
?- likes(priya,X).
X = jaya ;
X = tiyasha.
?-
```

Lab13.pl

```
File Edit Browse Compile Prolog Pce Help
Lab13.pl
can_cook(priya).
can_cook(jaya).
can_cook(tiyasha).
likes(priya,jaya) :-
    can_cook(jaya).
likes(priya,tiyasha) :-
    can_cook(tiyasha).
```

Activity 1:

Using variables and listing functors in prolog

Solution:

A functor is simply the function name and the number of arguments of that functor is called arity. For instance, woman(mia) is a complex term with functor woman and arity 1, while loves(vincent, mia) is a complex term with functor loves and arity 2.

SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)

```
File Edit Settings Run Debug Help
% c:/Users/pak/Documents/Prolog/Lab13.pl compiled 0.00 sec, 2 clauses
?- male(X).
X = sohaib ;
X = john ;
X = mohsin ;
X = qudrat.
?- female(X).
X = rehana.
?- female(X).
X = rehana ;
X = sadia ;
X = aneela.
?-
```

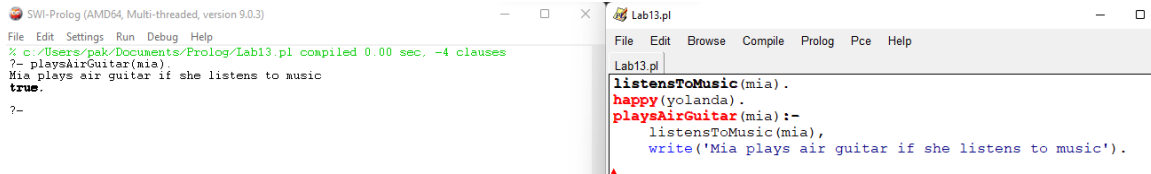
Lab13.pl

```
File Edit Browse Compile Prolog Pce Help
Lab13.pl
female(rehana).
female(sadia).
female(aneela).

male(sohaib).
male(john).
male(mohsin).
male(qudrat).
```

Activity 2:

How to print text in prolog?



The screenshot shows the SWI-Prolog IDE with two windows. The left window, titled 'SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)', displays the following text:

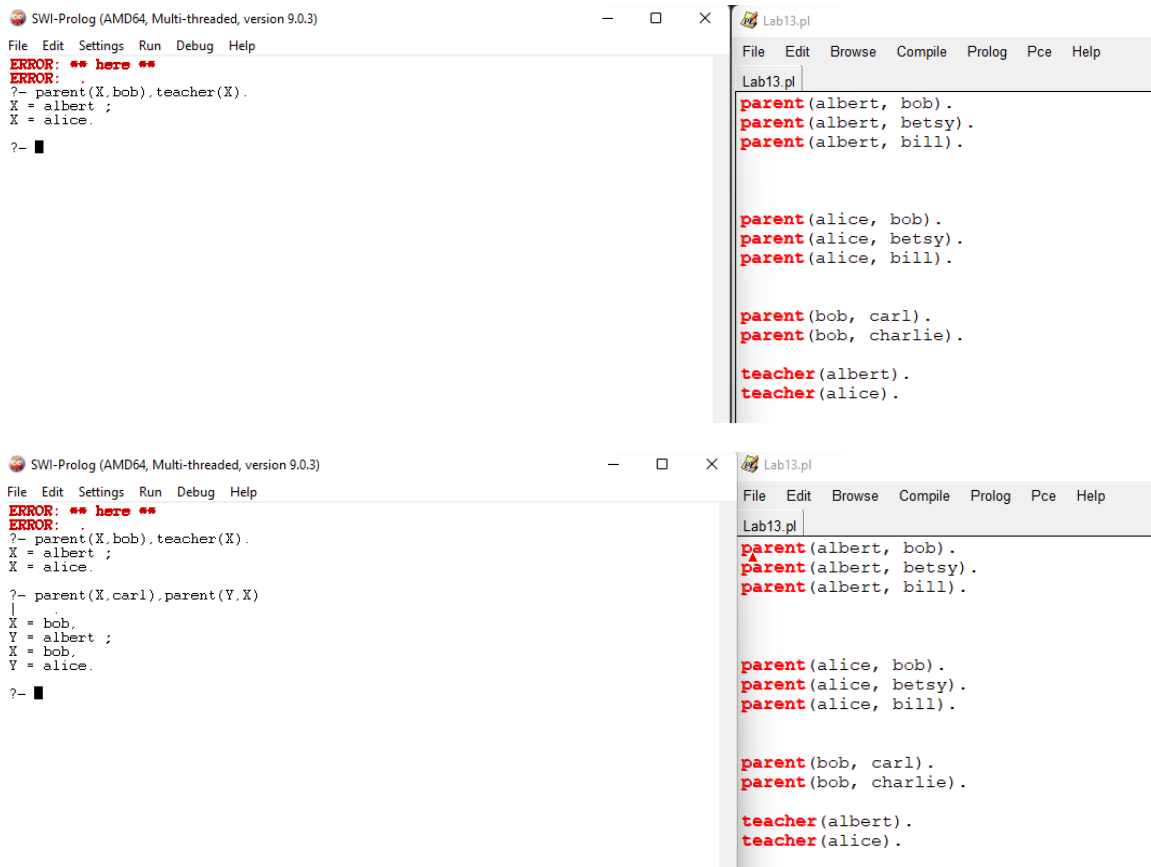
```
File Edit Settings Run Debug Help
?- playsAirGuitar(mia).
Mia plays air guitar if she listens to music
true.
?-
```

The right window, titled 'Lab13.pl', contains the following Prolog code:

```
File Edit Browse Compile Prolog Pce Help
Lab13.pl
listensToMusic(mia).
happy(yolanda).
playsAirGuitar(mia):-
    listensToMusic(mia),
    write('Mia plays air guitar if she listens to music').
```

Activity 3:

How to ask complex queries?



The first screenshot shows the SWI-Prolog IDE with two windows. The left window, titled 'SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)', displays the following text:

```
File Edit Settings Run Debug Help
ERROR: ** here **
ERROR:
?- parent(X,bob),teacher(X).
X = albert ;
X = alice.
?-
```

The right window, titled 'Lab13.pl', contains the following Prolog code:

```
File Edit Browse Compile Prolog Pce Help
Lab13.pl
parent(albert, bob).
parent(albert, betsy).
parent(albert, bill).

parent(alice, bob).
parent(alice, betsy).
parent(alice, bill).

parent(bob, carl).
parent(bob, charlie).

teacher(albert).
teacher(alice).
```

The second screenshot shows the SWI-Prolog IDE with two windows. The left window, titled 'SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)', displays the following text:

```
File Edit Settings Run Debug Help
ERROR: ** here **
ERROR:
?- parent(X,bob),teacher(X).
X = albert ;
X = alice.

?- parent(X,carl),parent(Y,X)
|
X = bob,
Y = albert ;
X = bob,
Y = alice.
?-
```

The right window, titled 'Lab13.pl', contains the following Prolog code:

```
File Edit Browse Compile Prolog Pce Help
Lab13.pl
parent(albert, bob).
parent(albert, betsy).
parent(albert, bill).

parent(alice, bob).
parent(alice, betsy).
parent(alice, bill).

parent(bob, carl).
parent(bob, charlie).

teacher(albert).
teacher(alice).
```

```
parent(albert, bob).
parent(albert, betsy).
parent(albert, bill).
```

```

parent(alice, bob).
parent(alice, betsy).
parent(alice, bill).

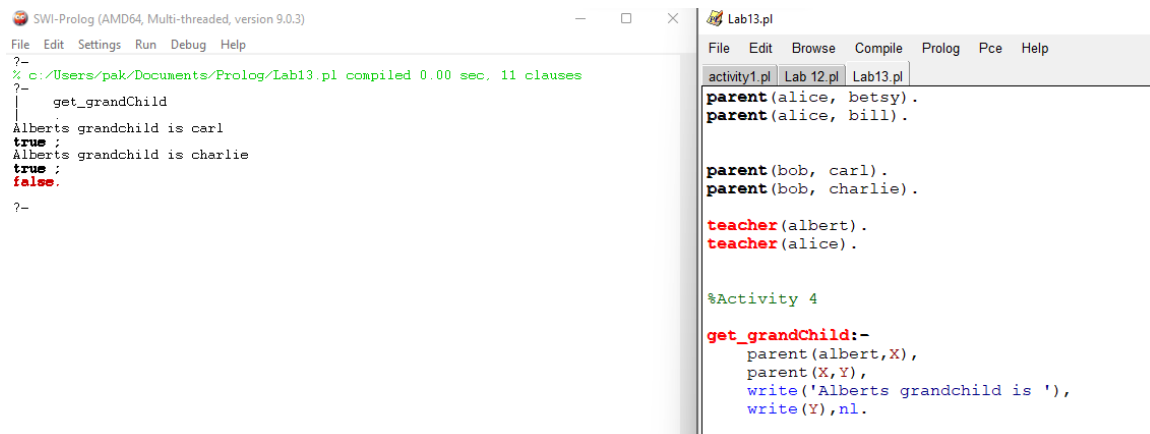
parent(bob, carl).
parent(bob, charlie).

teacher(albert).
teacher(alice).

```

Activity 4:

Write a query in a similar fashion to determine grandchildren of Albert in above knowledgebase.



The screenshot shows the SWI-Prolog IDE with two windows. The left window, titled 'Lab13.pl', shows the execution of a query. The right window, titled 'Lab13.pl', shows the Prolog code used for the query.

Left Window (Lab13.pl):

```

?-
% c:\Users\pak\Documents\Prolog\Lab13.pl compiled 0.00 sec, 11 clauses
?-
|   get_grandChild
|   Albert's grandchild is carl
|   true ;
|   Albert's grandchild is charlie
|   true ;
|   false.
?-

```

Right Window (Lab13.pl):

```

File Edit Browse Compile Prolog Pce Help
activity1.pl Lab 12.pl Lab13.pl
parent(alice, betsy).
parent(alice, bill).

parent(bob, carl).
parent(bob, charlie).

teacher(albert).
teacher(alice).

%Activity 4
get_grandChild:-
    parent(albert,X),
    parent(X,Y),
    write('Alberts grandchild is '),
    write(Y),nl.

```

Activity 5:

We can also define variables within a consequent of a predicate which helps us to find grandparent of any X.

```

SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)
File Edit Settings Run Debug Help
?-
% c:/Users/pak/Documents/Prolog/Lab13.pl compiled 0.00 sec, 12 clauses
?-
| get_grandParent(carl,V).
false.
?- get_grandParent(carl,alice).
false.
?-

```

```

Lab13.pl
File Edit Browse Compile Prolog Pce Help
Lab13.pl
%Activity 5
get_grandParent(X,Y):-
    parent(Z,X),
    parent(Y,Z).

```

```

get_grandParent(X,Y):-
    parent(Z,X),
    parent(Y,Z).

```

Activity 6:

How to use format command to print inside a Knowledge Base?

```

SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)
File Edit Settings Run Debug Help
?-
% c:/Users/pak/Documents/Prolog/Lab13.pl compiled 0.00 sec, 0 clauses
?-
| get_grandParent.
bob is the grandparent
true.
?-

```

```

Lab13.pl
File Edit Browse Compile Prolog Pce Help
Lab13.pl
%Activity 6
get_grandParent:-
    parent(X,carl),
    parent(X,charlie),
    format('~w ~s grandparent ~n',[X,'is the']).

```

```

getGrandParent:-
    parent(X,carl),
    parent(X,charlie),
    format('~w ~s grandparent ~n',[X,'is the']).

```

Activity 7:

Deriving facts using variables?

```

SWI-Prolog (AMD64, Multi-threaded, version 9.0.3)
File Edit Settings Run Debug Help
?-
% c:/Users/pak/Documents/Prolog/Lab13.pl compiled 0.00 sec, 2 clauses
?-
| hates(aliRelative,X).
X = mohsin.
?-

```

```

Lab13.pl
File Edit Browse Compile Prolog Pce Help
Lab13.pl
%Activity 7
stabs(mohsin,ali).
hates(aliRelative,X):-
    stabs(X,ali).

```

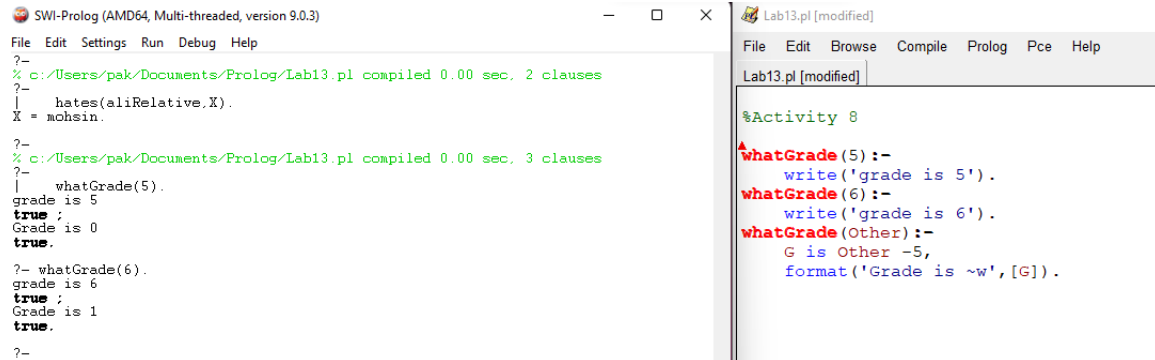
```

stabs(mohsin,ali).
hates(aliRelative,X):-
    stabs(X,ali).

```

Activity 8:

Using a single predicate with constants and variables as arguments?



The screenshot shows the SWI-Prolog IDE. The left pane displays a Prolog session with the following text:

```
?-
% c:/Users/pak/Documents/Prolog/Lab13.pl compiled 0.00 sec, 2 clauses
?-
|   hates(aliRelative,X).
X = mohsin.

?-
% c:/Users/pak/Documents/Prolog/Lab13.pl compiled 0.00 sec, 3 clauses
?-
|   whatGrade(5).
grade is 5
true ;
Grade is 0
true.

?- whatGrade(6).
grade is 6
true ;
Grade is 1
true.

?-
```

The right pane shows the file `Lab13.pl` with the following code:

```
%Activity 8
whatGrade(5):-
    write('grade is 5').
whatGrade(6):-
    write('grade is 6').
whatGrade(Other):-
    G is Other -5,
    format('Grade is ~w',[G]).
```

```
whatGrade(5):-
    write('grade is 5').
whatGrade(6):-
    write('grade is 6').
whatGrade(Other):-
    G is Other -5,
    format('Grade is ~w',[G]).
```

Lab Task 1:

Consider the knowledgebase in activity 3. Define a brotherhood relationship and write a query that gives every uncle of a person X in the knowledgebase. An uncle is defined as brother of one's parent.

```
% Lab Task 1
parent(albert, bob).
parent(albert, betsy).
parent(albert, bill).

parent(alice, bob).
parent(alice, betsy).
parent(alice, bill).

parent(bob, carl).
parent(bob, charlie).

brother(X,Y):-
```

```

male(X),
male(Y),
parent(Z,X),
parent(Z,Y).

uncle_of(X,Y):-
    male(X),
    parent(P,Y),
    sibling(X,P).

```

Lab Task 2

Consider the knowledge base of activity 4. Write a query to find all pairs that share grand-parenthood relationship.

```

% Lab Task 2
parent(firdus,basit).
parent(saeed,sami).
sibling(firdus,saeed).
share_grandParent(X,Y):-
    parent(A,X),
    parent(B,Y),
    sibling(A,B).

```

```

% Lab Task 2
parent(firdus,basit).
parent(saeed,sami).
sibling(firdus,saeed).
share_grandParent(X,Y):-
    parent(A,X),
    parent(B,Y),
    sibling(A,B).

```