

Name - Yash Lakhtariya

Enrollment number - 21162101012

Branch - CBA Batch - 61

AI Practical 5

Exercise 1 : Below the food table shows the facts, rules, goals and their English meanings.

Facts :

1. burger is a food
2. sandwich is a food
3. pizza is a food
4. sandwich is a lunch
5. pizza is a dinner

Rules

meal(X) :- food(X). // Every food is a meal OR Anything is a meal if it is a food

Queries / Goals

- ?- Is pizza a food?
- ?- Which food is a meal and lunch?
- ?- Is a sandwich a dinner?

Logic :

```
food(burger).  
food(sandwich).  
food(pizza).  
lunch(sandwich).  
dinner(pizza).  
meal(X) :- food(X).
```

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Output (with series wise answers) :

The screenshot shows a code editor interface with a terminal window below it. The code editor has an Explorer sidebar on the left showing files like demo.pl, extra_questions, p3.1, p3.1.pl, p3.2.pl, p3.3.pl, p3.4.pl, and p3.5.pl. The main editor area displays the contents of p3.1.pl:

```
1 food(burger).  
2 food(sandwich).  
3 food(pizza).  
4 lunch(sandwich).  
5 dinner(pizza).  
6 meal(X):-food(X).
```

The terminal window below shows the execution of the file:

```
yash ~/Practical_5 $ main ?> 10:02 runpl.sh p3.1.pl  
% Disabled autoloading (loaded 35 files)  
% Disabled autoload (loaded 0 files)  
Welcome to SWI-Prolog (threaded, 64 bits, version 9.0.4)  
SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software.  
Please run ?- license. for legal details.  
  
For online help and background, visit https://www.swi-prolog.org  
For built-in help, use ?- help(Topic). or ?- apropos(Word).  
  
?- food(pizza).  
true.  
  
?- meal(X),lunch(X).  
X = sandwich ;  
false.  
  
?- dinner(sandwich).  
false.  
  
?-
```

The status bar at the bottom of the terminal indicates: Ln 6, Col 18, Spaces: 4, UTF-8, LF, Perl, and Prettier.

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Exercise 2 : Below student-professor relation table shows the facts, rules, goals and their english meanings.

Facts :

- charlie studies csc135
- olivia studies csc135
- jack studies csc131
- arthur studies csc134
- kirke teaches csc135
- collins teaches csc131
- collins teaches csc171
- juniper teaches csc134

Rules :

- X is a professor of Y if X teaches C and Y studies C.

Queries / Goals :

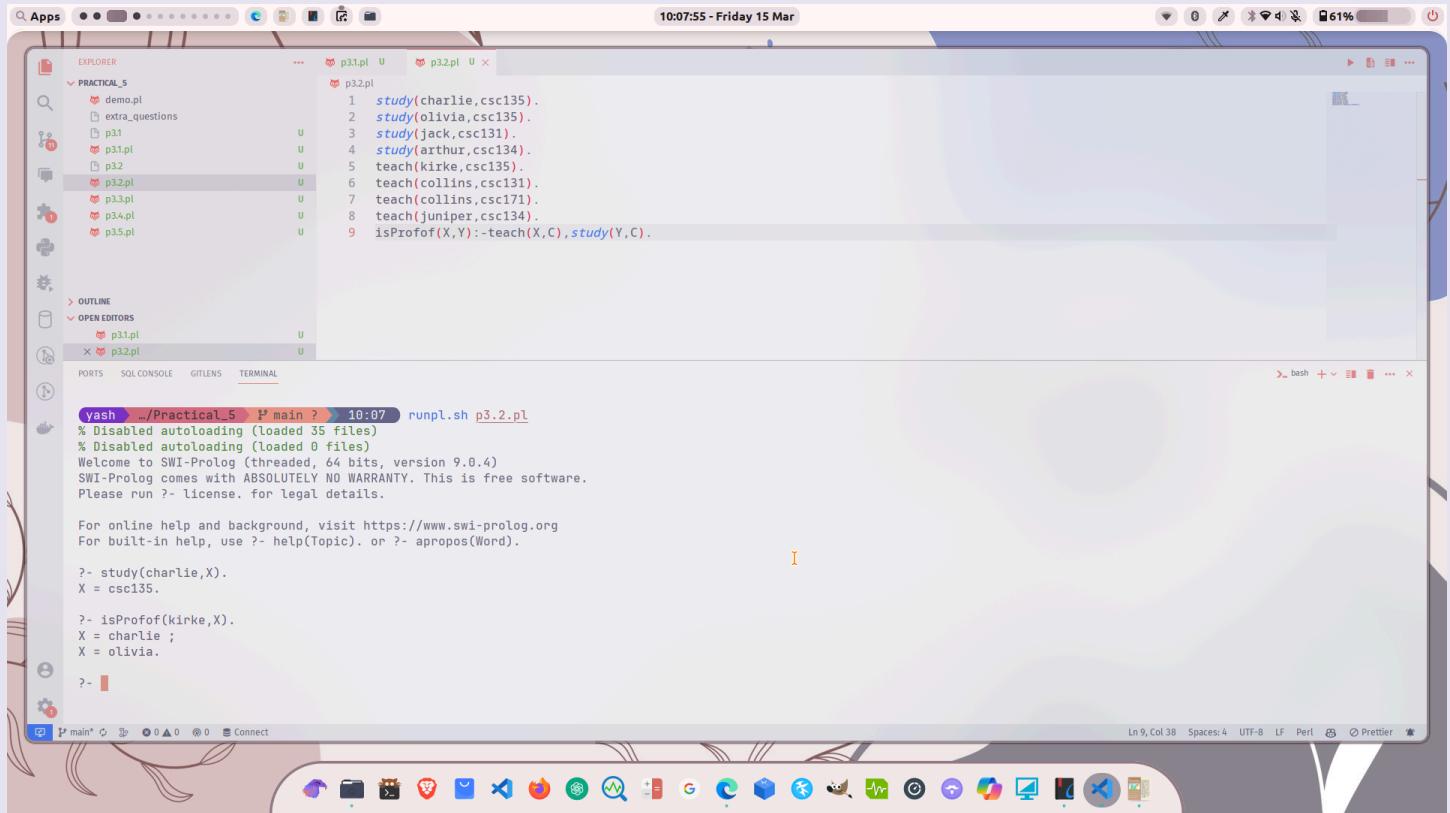
- Charlie studies what? OR What does Charlie study?
- Who are the students of professor kirke.

Logic :

```
study(charlie,csc135).  
study(olivia,csc135).  
study(jack,csc131).  
study(arthur,csc134).  
teach(kirke,csc135).  
teach(collins,csc131).  
teach(collins,csc171).  
teach(juniper,csc134).  
isProfof(X,Y) :- teach(X,C), study(Y,C).
```

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Output (with series wise answers) :



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "yash _/Practical_5 > main ? 10:07". The terminal content is as follows:

```
% Disabled autoloading (loaded 35 files)
% Disabled autoloading (loaded 0 files)
Welcome to SWI-Prolog (threaded, 64 bits, version 9.0.4)
SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software.
Please run ?- license. for legal details.

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For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- study(charlie,X).
X = csc135.

?- isProfof(kirke,X).
X = charlie ;
X = olivia.

?- 
```

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Exercise - 3 : We want to reason about the information available in this text :
Books have a unique ID, their ISBN code: e.g. the book 'The art of Prolog' (written by Statler, 400 pages) has ISBN code 1 and the book 'The mystery of strawberries' (by Waldorf, 42 pages) has ISBN 23. Furthermore, suppose Waldorf owns a copy of 'The mystery of strawberries' (but Statler doesn't). Neither Statler nor Waldorf own a copy of 'The art of Prolog', Statler even hates this book.

book table		
isbn	title	pages
1	the art of prolog	400
23	the mystery of strawberries	42

person table	
name	
statler	
waldorf	

owns table	
person	isbn
waldorf	23

author table	
person	isbn
statler	1
waldorf	23

hate table	
person	isbn
statler	1

For Rule you can take reference as :

book_hates(X):- hates(Y,ISBN),wrote(Y,ISBN),book(ISBN,X).

books(X):- book(_,X).

Queries -

1. Write a query to retrieve ISBN number with title = "the mystery of strawberries".
2. Write a query to retrieve the title of all books.
3. Write a query to retrieve the pages of book "the mystery of strawberries".

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Logic :

```
book(1,'the art of prolog',400).  
book(23,'the mystery of strawberries',42).  
person(statler).  
person(waldorf).  
author(statler,1).  
author(waldorf,23).  
owns(waldorf,23).  
hate(statler,1).
```

Output (series wise answers) :

```
10:20:51 - Friday 15 Mar
```

```
p33.pl  U x  
p33.pl  
1 book(1,'the art of prolog',400).  
2 book(23,'the mystery of strawberries',42).  
3 person(statler).  
4 person(waldorf).  
5 author(statler,1).  
6 author(waldorf,23).  
7 owns(waldorf,23).  
8 hate(statler,1).
```

```
Please run ?- license. for legal details.  
For online help and background, visit https://www.swi-prolog.org  
For built-in help, use ?- help(Topic), or ?- apropos(Word).  
?- hate(statler,X).  
X = 1.  
?- owns(X,23).  
X = waldorf.  
?- author(X,23).  
X = waldorf.  
?- book(23,'the mystery of strawberries',X).  
X = 42.  
?- author(statler,_), hate(statler,_).  
true.  
?- owns(waldorf,1).  
false.  
?- book(X,'the mystery of strawberries',_).  
X = 23.  
?- book(_,X,_).  
X = 'the art of prolog' ;  
X = 'the mystery of strawberries'.  
?- book(_, 'the mystery of strawberries',X).  
X = 42.  
?- ^C  
Action (h for help) ? exit (status 4)
```

```
yash .../Practical_5 $ main ? 10:20
```

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Exercise - 4

Facts

- jack owns bmw car
- john owns chevy car
- olivia owns civic car
- jane owns chevy car
- bmw car is sedan
- civic car is sedan
- chevy car is truck

Rule:

- Jane owns Sedan car if jane owns bmw and bmw is sedan car.
owns(jane,sedan)
:- owns(jane,bmw),car(bmw,sedan).
- If jane owns chevy and chevy is a truck then jane owns truck.

Queries / Goals & answers

- What does John own?
- Does John own something?
- Who owns a car chevy?
- Does Jane own a sedan?
- Does Jane own a truck?

Logic :

```
owns(jack,bmw).  
owns(john,chevy).  
owns(olivia,civic).  
owns(jane,chevy).  
car(bmw,sedan).  
car(civic,sedan).  
car(chevy,truck).  
owner(jane,sedan) :- owns(jane,bmw), car(bmw,sedan).  
owner(jane,truck) :- owns(jane,chevy), car(chevy,truck).
```

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Output (series wise answers) :

The screenshot displays a macOS desktop environment with two terminal windows open.

Left Terminal Window:

```
p34.pl
1 owns(jack,bmw).
2 owns(john,chevy).
3 owns(olivia,civic).
4 owns(jane,chevy).
5 car(bmw,sedan).
6 car(civic,sedan).
7 car(chevy,truck).
8 owner(jane,sedan):-owns(jane,bmw),car(bmw,sedan).
9 owner(jane,truck):-owns(jane,chevy),car(chevy,truck).
```

Right Terminal Window:

```
yash > .../Practical_5 > main ? 10:24 runpl.sh p34.pl
% Disabled autoloading (loaded 35 files)
% Disabled autoloading (loaded 0 files)
Welcome to SWI-Prolog (threaded, 64 bits, version 9.0.4)
SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software.
Please run ?- license. for legal details.

For online help and background, visit https://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- owns(john,X).
X = chevy.

?- owns(john,_).
true.

?- owns(X,chevy).
X = john ;
X = jane.

?- owner(jane,sedan).
false.

?- owner(jane,truck).
true.

?- ^C
Action (h for help) ? exit (status 4)
```

The terminal session starts with the command `runpl.sh p34.pl`, followed by several queries to the SWI-Prolog database. The output shows facts about ownership and car types, and then asks for the owner of a sedan, which is correctly answered as false since there is no fact for a sedan owned by Jane.

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Exercise - 5

1. Download the family.pl file.
2. Add a male() rule that includes all fathers as males.
3. Add a female() rule that includes all mothers as females.
4. Add the following rules to the family database:
 - I. daughter_of(X,Y)
 - II. brother_of(X,Y)
 - III. sister_of(X,Y)
5. Given the addition of the sibling_of rule, and assuming the above order for the facts and rules, show the PROLOG trace for the query sibling_of(paul,mary).
6. Write Queries.
 - A. Who are the siblings of jane.
 - B. Who is the father of paul. C. Is ralph male?
 - D. Who is daughter of mary.

Logic :

```
father_of(joe,paul).  
father_of(joe,mary).  
father_of(joe,hope).  
mother_of(jane,paul).  
mother_of(jane,mary).  
mother_of(jane,hope).  
male(paul).  
male(joe).  
male(ralph).  
female(mary).  
female(jane).  
female(hope).  
son_of(X,Y) :- father_of(Y,X),male(X).
```

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```
son_of(X,Y) :- mother_of(Y,X), male(X).  
sibling_of(X,Y) :- !, father_of(Z,X), father_of(Z,Y), X\=Y.  
sibling_of(X,Y) :- !, mother_of(Z,X), mother_of(Z,Y), X\=Y.  
male(X) :- father_of(X,_).  
female(X) :- mother_of(X,_).  
daughter_of(X,Y) :- female(X), mother_of(Y,X) ; father_of(Y,X).  
brother_of(X,Y) :- male(X), sibling_of(Y,X).  
sister_of(X,Y) :- female(X), sibling_of(Y,X).
```

Output (series wise answers) :

The screenshot displays a Mac OS X desktop environment with two terminal windows open. The left terminal window contains the source code for two Prolog files, p34.pl and p35.pl. The right terminal window shows the SWI-Prolog interpreter running, displaying various predicates and their definitions along with some warning messages. The desktop background features a floral pattern.

Left Terminal (Code):

```
p34.pl  
1 father_of(joe,paul).  
2 father_of(joe,mary).  
3 father_of(joe,hope).  
4 mother_of(jane,hope).  
5 mother_of(jane,mary).  
6 mother_of(jane,paul).  
7 male(paul).  
8 male(joe).  
9 male(ralph).  
10 female(mary).  
11 female(jane).  
12 female(hope).  
13 son_of(X,Y) :- father_of(Y,X), male(X).  
14 son_of(X,Y) :- mother_of(Y,X), male(X).  
15 sibling_of(X,Y) :- !, father_of(Z,X), father_of(Z,Y), X\=Y.  
16 sibling_of(X,Y) :- !, mother_of(Z,X), mother_of(Z,Y), X\=Y.  
17 male(X) :- father_of(X,_).  
18 female(X) :- mother_of(X,_).  
19 daughter_of(X,Y) :- female(X), mother_of(Y,X) ; father_of(Y,X).  
20 brother_of(X,Y) :- male(X), sibling_of(Y,X).  
21 sister_of(X,Y) :- female(X), sibling_of(Y,X).
```

Right Terminal (SWI-Prolog):

```
Warning: /home/yash/Documents/sem6practicals/AI/Practical_5/p3.5.pl:17:  
Warning: Clauses of male/1 are not together in the source-file  
Warning: Earlier definition at /home/yash/Documents/sem6practicals/AI/Practical_5/  
p3.5.pl:7  
Warning: Current predicate: sibling_of/  
Warning: Use :- discontiguous male/1. to suppress this message  
Warning: /home/yash/Documents/sem6practicals/AI/Practical_5/p3.5.pl:18:  
Warning: Clauses of female/1 are not together in the source-file  
Warning: Earlier definition at /home/yash/Documents/sem6practicals/AI/Practical_5/  
p3.5.pl:10  
Warning: Current predicate: male/  
Warning: Use :- discontiguous female/1. to suppress this message  
% Disabled autoloading (Loaded 35 files)  
% Disabled autoloading (Loaded 0 files)  
Welcome to SWI-Prolog (threaded, 64 bits, version 9.0.4)  
SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software.  
Please run ?- license. for legal details.  
  
For online help and background, visit https://www.swi-prolog.org  
For built-in help, use ?- help(Topic). or ?- apropos(Word).  
  
?- sibling_of(paul,mary).  
true.  
  
?- sibling_of(jane,X).  
false.  
  
?- father_of(X,paul).  
X = joe.  
  
?- male(ralph).  
true .  
  
?- daughter_of(X,mary).  
false.  
  
?- 
```