Started on	Wednesday, 16 August 2023, 1:59 PM
State	Finished
Completed on	Thursday, 17 August 2023, 3:30 PM
Time taken	1 day 1 hour
Marks	8.00/8.00
Grade	**1.00** out of 1.00 (**100**%)

Information

Getting started with Prolog

Start a terminal and type `swipl`. You should see something like this:

```
Welcome to SWI-Prolog

...

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

?-
```

Open an editor. It is better to use an editor that supports syntax highlighting for Prolog programs (e.g. emacs, vim, atom). Paste the following in the editor and save it as `kb1.pl`.

```
wizard(harry).
wizard(ron).
wizard(hermione).
muggle(uncle_vernon).
muggle(aunt_petunia).
chases(crookshanks,scabbers).
```

Go back to Prolog interpreter prompt at the terminal and type `consult('kb1.pl').` or equivalently type `consult(kb1)`. Now ask the following **queries** one by one.

```
wizard(ron).
muggle(ron).
muggle(X).
chases(crookshanks,X).
chases(X,Y)
```

Don't forget to put a full stop at the end of each query before pressing return. If you forget to put a full stop, Prolog will react by just doing nothing. This is what you will see on the screen:

```
?- wizard(harry)
|
```

To fix it just type a full stop and press `return` again:

```
?- wizard(harry)
|    .

true.
```

If something else goes wrong and Prolog starts writing crazy things on the screen without getting back to showing you the `?-` prompt, type `Ctrl-C` . This should show you the following line:

```
Action (h for help) ?
```

Type `a` (for abort) and press return. This should get you back to the `?-` prompt.

Change the file or paste the content of some of the examples in the lecture notes. You need to make Prolog to read the file again by using `consult`.

In order to leave Prolog type `halt.`

How to test your code locally

If you want to test your code locally before submitting it (which is a good idea), you can paste the content of a test case in a file after your solution; save it; consult it; and then ask the query `test_answer.` at the prompt.

Note that if you put multiple test cases in one file and then ask the query test_answer, multiple test_answer rules may be tried until one succeeds. This is not perhaps what you want. If you want to have multiple test cases in one file, rename the test rules so that they are different from each other (e.g. test1, test2, etc).

Installing Prolog on your home computer

The official download page is available here with instructions and links for various operating systems: https://www.swi-prolog.org/download/stable.

On most Linux distributions you can install it via a package manager. For example, on distributions based on Debian and APT (e.g. Debian, Ubuntu, Mint, ...) you can simply install the package by entering `sudo apt install swi-prolog` in a terminal shell.

On Windows, the download link given above should work.

On MacOS you can either directly download it from the above link (and also install Xcode and XQuartz) or install a package manager such as brew and then install it via the package manager (for example by entering `brew install swi-prolog` at the command prompt.)

Question 1

Correct

Mark 1.00 out of 1.00

Define a set of relations in the form of Prolog rules about people according to the following statements.

1. *A person eats something if the person likes that thing.* Use the predicate `eats/2` where the first argument is a person and the second argument is a thing, and the predicate `likes/2` where the first argument is a person and the second is a thing. For example if the fact `likes(bob, chocolate)` is in the knowledge base then the query `eats(bob, chocolate)` must always succeed (be true), even if the fact is not explicitly in the knowledge base.
2. *A person eats something if the person is hungry and the thing is edible.* Use predicates `hungry/1` and `edible/1`.

Please note that you do not need to provide any facts. Only write two rules (two lines).

For example:

Test	Result

`likes(bob, chocolate).`
`hungry(alice).`
 	
`test_answer :- eats(bob, chocolate),`
`writeln('Bob eats chocolate.').`
	`Bob eats chocolate.`

`edible(crisps).`
`hungry(bob).`
`likes(bob, sushi).`
 	
`test_answer :- eats(bob, crisps),`
`writeln('Bob eats crisps.').`
	`Bob eats crisps.`

`/* This example shows how our incomplete definition of rules can lead to unexpected (nonsense) answers. */`
 	
`likes(alice, rock).`
`likes(alice, jazz).`
`edible(pizza).`
`hungry(bob).`
 	
`test_answer :- eats(alice, rock),`
`writeln('Alice eats rock!').`
	`Alice eats rock!`

Answer: (penalty regime: 0, 15, ... %)

```
1 eats(X, Y) :- likes(X, Y).
2 eats(X, Y) :- hungry(X), edible(Y).
```

	Test	Expected	Got	

✔	`likes(bob, chocolate).`
	`hungry(alice).`
	
	`test_answer :- eats(bob, chocolate),`
	`writeln('Bob eats chocolate.').`
		`Bob eats chocolate.`	`Bob eats chocolate.`	✔

✔	`edible(crisps).`
	`hungry(bob).`
	`likes(bob, sushi).`
	
	`test_answer :- eats(bob, crisps),`
	`writeln('Bob eats crisps.').`
		`Bob eats crisps.`	`Bob eats crisps.`	✔

✔	`/* This example shows how our incomplete definition of rules can lead to unexpected (nonsense) answers. */`
	
	`likes(alice, rock).`
	`likes(alice, jazz).`
	`edible(pizza).`
	`hungry(bob).`
	
	`test_answer :- eats(alice, rock),`
	`writeln('Alice eats rock!').`
		`Alice eats rock!`	`Alice eats rock!`	✔

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

Information

Unification (matching)

Prolog provides a built-in predicate which takes two arguments and checks whether they unify (match). This predicate is `=/2`. Prolog allows you to use = as a prefix or infix operator (both with the same meaning). For example, you can write `=(harry,harry)` or `harry = harry`.

How does Prolog answer the following queries? Think about it first, and then type it into Prolog to check whether you are right.

```
?- =(harry,harry).
?- =(harry,'Harry').
?- =(harry,Harry).
?- =(f(a,b),f(a(b))).
```

When matching, Prolog may instantiate variables. For example:

```
?- X = harry, Y = hermione.
X = harry
Y = hermione
```

Instantiating turns variables to new terms. For example, the following fails:

```
?- X = harry, X = hermione.
false.
```

This is because after the first goal (`X = harry`) is processed, the variable `X` is instantiated to `harry` which no longer unifies with `hermione` (as they are different constants), thus the second goal fails.

The built-in predicate `\=/2` works in the opposite way: `Arg1 \= Arg2` is true if `Arg1 = Arg2` fails, and vice versa. (Note that not all Prolog implementations provide \=/2. SWI Prolog does, but Sicstus, for example, doesn't.) [Negation requires some special machinery to achieve.]

Try some queries involving = and `\=. For example:`

```
?- s(np(pn(dobby)),vp(v(likes),np(pn(harry)))) = s(np(pn(dobby)),v(likes),np(pn(harry))).
?- s(X,vp(v(sings))) = s(np(pn(dobby)),Y).
?- s(X,vp(v(sings))) = s(np(pn(dobby)),vp(X)).
?- father(X) = X.
?- sarah = AName.
?- lora = AName, sarah \= AName.  % this succeeds.
```

Question 2

Correct

Mark 1.00 out of 1.00

Which of the following *unifies*?

Select one or more:

- [x] `christchurch = Christchurch` ✔
- [x] `f(g(X)) = f(g(Y))` ✔
- [ ] `brothers(bob, sam) = brothers(sam, bob)`
- [x] `Auckland = Wellington` ✔
- [x] `chch = Christchurch` ✔
- [x] `f(X) = f(2)` ✔
- [x] `anything = anything` ✔
- [ ] `2 * 2 = 4` (you may want to try this in Prolog first)
- [x] `2 * 2 = 2 * 2` ✔

Your answer is correct.

Correct

Marks for this submission: 1.00/1.00.

Question 3

Correct

Mark 1.00 out of 1.00

Let `point(X,Y)` represent a point in a 2D Euclidean space. Define a predicate `reflection/2` that takes two points and is true when the two points are the reflection of each other across the line *y=x*.

For example:

Test	Result

`test_answer :-`
`  reflection(point(3, 6), point(6, 3)),`
`  writeln('OK').`
	`OK`

`test_answer :-`
`  reflection(point(-5, 8), point(X, Y)),`
`  writeln(point(X, Y)).`
	`point(8,-5)`

Answer: (penalty regime: 0, 15, ... %)

```
1 reflection(point(X,Y), point(Y,X)).
```

	Test	Expected	Got	

✔	`test_answer :-`
	`\treflection(point(3, 6), point(6, 3)),`
	`  writeln('OK').`
		`OK`	`OK`	✔

✔	`test_answer :-`
	`\treflection(point(-5, 8), point(X, Y)),`
	`  writeln(point(X, Y)).`
		`point(8,-5)`	`point(8,-5)`	✔

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

Information

Here is a tiny lexicon and mini grammar with only one rule which defines a sentence as consisting of five words: an article, a noun, a verb, and again an article and a noun.

```
word(article,a).
word(article,every).
word(noun,criminal).
word(noun,'big kahuna burger').
word(verb,eats).
word(verb,likes).
```

```
sentence(Word1,Word2,Word3,Word4,Word5) :-
        word(article,Word1),
        word(noun,Word2),
        word(verb,Word3),
        word(article,Word4),
        word(noun,Word5).
```

What query do you have to pose in order to find out which sentences the grammar can generate? In which order will Prolog generate the sentences? Make a prediction about the order, then try it out.

Question 4

Correct

Mark 1.00 out of 1.00

Consider the following Prolog program.

```
f(a).
f(b).
f(c).
g(b).
g(c).
h(c).
k(X):-f(X), g(X), h(X).
```

Assume the user asks the query `?- k(X).` When searching for the proof (solution), which of the listed (sub)goals are tried, and in what order? If the search stops in fewer than 10 steps, use '.' for the remaining steps.

You may want to see the lecture notes or read section 2.2 of the Prolog book on proof search.

1	f(a)	✔
2	g(a)	✔
3	f(b)	✔
4	g(b)	✔
5	h(b)	✔
6	f(c)	✔
7	g(c)	✔
8	h(c)	✔
9	.	✔
10	.	✔

Your answer is correct.

Correct

Marks for this submission: 1.00/1.00.

Question 5

Correct

Mark 1.00 out of 1.00

Prolog is commonly used in implementing *expert systems*. In simple words, an expert system emulates the decision-making ability of a human expert. In this question you have to define a set of rules that together work as a very simple expert system to give advice on what type of lenses (if any) should be prescribed for a patient.

First create a new knowledge base and include the following predicates in it:

```
/* tear rate related clauses */
normal_tear_rate(RATE) :- RATE >= 5.
low_tear_rate(RATE) :- RATE < 5.

/* age-related clauses */
young(AGE) :- AGE < 45.
```

Now add a new predicate of the form `diagnosis(Recommend, Age, Astigmatic, Tear_Rate)` to the knowledge base where the arguments are:

- `Recommend` is either `hard_lenses`, `soft_lenses`, or `no_lenses`;
- `Age` will be an integer;
- `Astigmatic` will be either `yes` or `no` (note that these are atoms 'yes' and 'no' not true or false.); and
- `Tear_Rate` will be a positive integer.

The predicate must be the translation of the following natural-language rules to logic:

1. If the patient is young and has a normal tear rate then the type of lenses will depend on astigmatism. If the patient is astigmatic then hard lenses must be recommended, otherwise soft lenses.
2. If the person has a low tear rate then 'no lenses' must be recommended.

Once finished, paste the entire knowledge base into the answer box.

Note that there are some questions (queries) that this expert system cannot answer. For example it cannot recommend anything for people who are over 45 years old and do not have low tear rate.

For example:

Test	Result

`test_answer :-`
`  diagnosis(hard_lenses, 21, yes, 11),`
`  writeln('OK').`
	`OK`

`test_answer :-`
`  diagnosis(X, 45, no, 4),`
`  writeln(X).`
	`no_lenses`

`test_answer :-`
`  diagnosis(X, 19, no, 5),`
`  writeln(X).`
	`soft_lenses`

Answer: (penalty regime: 0, 15, ... %)

```
1  /* tear rate related clauses */
2  normal_tear_rate(RATE) :- RATE >= 5.
3  low_tear_rate(RATE) :- RATE < 5.
4
5  /* age-related clauses */
6  young(AGE) :- AGE < 45.
7
8  diagnosis(Recommend, Age, Astigmatic, Tear_Rate) :- young(Age), normal_tear_rate(
9  diagnosis(Recommend, Age, Astigmatic, Tear_Rate) :- young(Age), normal_tear_rate(
10 diagnosis(Recommend, Age, Astigmatic, Tear_Rate) :- low_tear_rate(Tear_Rate), Rec
```

	Test	Expected	Got	

✔	`test_answer :-`
	`  diagnosis(hard_lenses, 21, yes, 11),`
	`  writeln('OK').`
		`OK`	`OK`	✔

✔	`test_answer :-`
	`  diagnosis(X, 45, no, 4),`
	`  writeln(X).`
		`no_lenses`	`no_lenses`	✔

✔	`test_answer :-`
	`  diagnosis(X, 19, no, 5),`
	`  writeln(X).`
		`soft_lenses`	`soft_lenses`	✔

Passed all tests! ✔

Correct

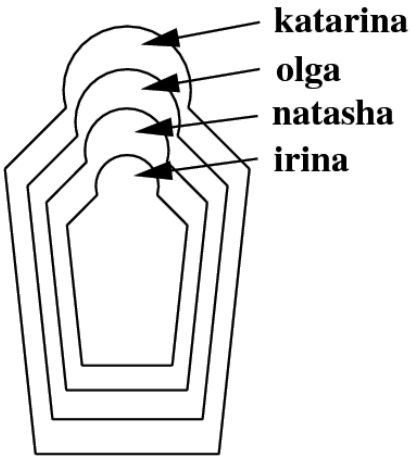
Marks for this submission: 1.00/1.00.

Question 6

Correct

Mark 1.00 out of 1.00

Do you know these wooden Russian dolls (Matryoshka dolls) where the smaller ones are contained in bigger ones? Here is a drawing of them:



In this question, you have to write a knowledge base that describes the nestedness in the above drawing. You have to:

- First, write a number of facts using the predicate `directlyIn/2` where `directlyIn(X,Y)` means that X is directly in Y. For example, `irina` is directly in `natasha` but `irina` is not directly in `olga` (thus do not write any fact about the latter).
- Then, define a recursive predicate `contains/2` , that tells us which doll (directly or indirectly) contains which other doll. For example, the query `contains(katarina,natasha)` should succeed (be true), while `contains(olga, katarina)` should fail.

Notes

- You have to write `contains` as two rules (or one rule with a disjunction in its body).
- Note the spelling of `katarina` and other names.
- In some test cases you may see the symbol "\+" which means negation (not). The goal `\+ some_term` succeeds if `some_term` fails (cannot be proved).

For example:

Test	Result

`test_answer :-`
`  directlyIn(irina, natasha),`
`  writeln('OK').`
	OK

`test_answer :-`
`  \+ directlyIn(irina, olga),`
`  writeln('OK').`
	OK

`test_answer :-`
`  contains(katarina, irina),`
`  writeln('OK').`
	OK

`test_answer :-`
`  contains(katarina, natasha),`
`  writeln('OK').`
	OK

`% Here we look for all of the dolls that contain irina.`
 	
`test_answer :-`
`  findall(P, contains(P, irina), Output),`
`  sort(Output, SortedOutput),`
`  foreach(member(X,SortedOutput), (write(X), nl)).`
	katarina
	natasha
	olga

Answer: (penalty regime: 0, 15, ... %)

```
directlyIn(irina, natasha).
directlyIn(natasha, olga).
directlyIn(olga, katarina).

contains(X, Y) :- directlyIn(Y, X).
contains(X, Y) :- directlyIn(Y, Z), contains(X, Z).
```

	Test	Expected	Got	

✔	`test_answer :-`
	`  directlyIn(irina, natasha),`
	`  writeln('OK').`
		OK	OK	✔

✔	`test_answer :-`
	`  \+ directlyIn(irina, olga),`
	`  writeln('OK').`
		OK	OK	✔

✔	`test_answer :-`
	`  contains(katarina, irina),`
	`  writeln('OK').`
		OK	OK	✔

✔	`test_answer :-`
	`  contains(katarina, natasha),`
	`  writeln('OK').`
		OK	OK	✔

✔	`% Here we look for all of the dolls that contain irina.`
	
	`test_answer :-`
	`  findall(P, contains(P, irina), Output),`
	`  sort(Output, SortedOutput),`
	`  foreach(member(X,SortedOutput), (write(X), nl)).`
		katarina
		natasha
		olga
			katarina
			natasha
			olga
				✔

✔	`directlyIn(patty, lettuce).`
	`directlyIn(lettuce, bread).`
	`directlyIn(bread, wrapper).`
	
	`test_answer :-`
	`  contains(wrapper, patty),`
	`  writeln('OK').`
		OK	OK	✔

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

Question 7

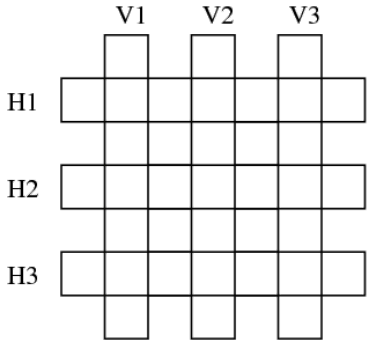
Correct

Mark 1.00 out of 1.00

Here are six Italian words:

astante , astoria , baratto , cobalto , pistola , statale .

They have to be assigned to rows and columns (crossword puzzle fashion) in the following grid:



The following knowledge base represents a lexicon containing these words:

```
word(astante, a,s,t,a,n,t,e).
word(astoria, a,s,t,o,r,i,a).
word(baratto, b,a,r,a,t,t,o).
word(cobalto, c,o,b,a,l,t,o).
word(pistola, p,i,s,t,o,l,a).
word(statale, s,t,a,t,a,l,e).
```

Write a predicate `solution/6` in the form of `solution(V1,V2,V3,H1,H2,H3)` that tells us how to fill in the grid.

Notes

- In this question, the same word can appear in different rows or columns. [As an additional exercise for yourself, think what rule needs to be added in order to have each word used only once.]
- The rules you provide will be used with different sets of six-letter words.
- Prolog has some facilities that make it possible to solve this sort of problems in simpler ways but at this stage we have to solve it in a somewhat tedious way (you need some copy and paste).

For example:

Test	Result

`word(astante, a,s,t,a,n,t,e).`
`word(astoria, a,s,t,o,r,i,a).`
`word(baratto, b,a,r,a,t,t,o).`
`word(cobalto, c,o,b,a,l,t,o).`
`word(pistola, p,i,s,t,o,l,a).`
`word(statale, s,t,a,t,a,l,e).`
 	
`test_answer :-`
`  findall((V1,V2,V3,H1,H2,H3), solution(V1,V2,V3,H1,H2,H3), L),`
`  sort(L,S),`
`  foreach(member(X,S), (write(X), nl)).`
 	
`test_answer :- write('Wrong answer!').`
	`astante,baratto,statale,astante,baratto,statale`
	`astante,cobalto,pistola,astoria,baratto,statale`
	`astoria,baratto,statale,astante,cobalto,pistola`
	`astoria,cobalto,pistola,astoria,cobalto,pistola`
	`baratto,baratto,statale,baratto,baratto,statale`
	`cobalto,baratto,statale,cobalto,baratto,statale`

Test	Result
word(abalone,a,b,a,l,o,n,e). word(abandon,a,b,a,n,d,o,n). word(enhance,e,n,h,a,n,c,e). word(anagram,a,n,a,g,r,a,m). word(connect,c,o,n,n,e,c,t). word(elegant,e,l,e,g,a,n,t). test_answer :- findall((V1,V2,V3,H1,H2,H3), solution(V1,V2,V3,H1,H2,H3), L), sort(L,S), foreach(member(X,S), (write(X), nl)). test_answer :- write('Wrong answer!').	abalone,anagram,connect,abandon,elegant,enhance abandon,elegant,enhance,abalone,anagram,connect

Answer: (penalty regime: 0, 15, ... %)

```
1 solution(V1,V2,V3,H1,H2,H3) :- word(V1, A1, C1, A2, C2, A3, C3, A4), word(V2, B1,
```

	Test	Expected	Got
✔	word(astante, a,s,t,a,n,t,e). word(astoria, a,s,t,o,r,i,a). word(baratto, b,a,r,a,t,t,o). word(cobalto, c,o,b,a,l,t,o). word(pistola, p,i,s,t,o,l,a). word(statale, s,t,a,t,a,l,e). test_answer :- findall((V1,V2,V3,H1,H2,H3), solution(V1,V2,V3,H1,H2,H3), L), sort(L,S), foreach(member(X,S), (write(X), nl)). test_answer :- write('Wrong answer!').	astante,baratto,statale,astante,baratto,statale astante,cobalto,pistola,astoria,baratto,statale astoria,baratto,statale,astante,cobalto,pistola astoria,cobalto,pistola,astoria,cobalto,pistola baratto,baratto,statale,baratto,baratto,statale cobalto,baratto,statale,cobalto,baratto,statale	astante,baratto,statale,astante,baratto,stat astante,cobalto,pistola,astoria,baratto,stat astoria,baratto,statale,astante,cobalto,pist astoria,cobalto,pistola,astoria,cobalto,pist baratto,baratto,statale,baratto,baratto,stat cobalto,baratto,statale,cobalto,baratto,stat

	Test	Expected	Got

✔	word(abalone,a,b,a,l,o,n,e).
	word(abandon,a,b,a,n,d,o,n).
	word(enhance,e,n,h,a,n,c,e).
	word(anagram,a,n,a,g,r,a,m).
	word(connect,c,o,n,n,e,c,t).
	word(elegant,e,l,e,g,a,n,t).
	
	test_answer :-
	
	findall((V1,V2,V3,H1,H2,H3),
	solution(V1,V2,V3,H1,H2,H3),
	L),
	  sort(L,S),
	  foreach(member(X,S),
	(write(X), nl)).
	
	test_answer :- write('Wrong
	answer!').
		abalone,anagram,connect,abandon,elegant,enhance
		abandon,elegant,enhance,abalone,anagram,connect
			abalone,anagram,connect,abandon,elegant,enha
			abandon,elegant,enhance,abalone,anagram,conn

✔	word(cookies,c,o,o,k,i,e,s).
	word(squawks,s,q,u,a,w,k,s).
	word(balloon,b,a,l,l,o,o,n).
	word(banquet,b,a,n,q,u,e,t).
	word(bejewel,b,e,j,e,w,e,l).
	word(bloated,b,l,o,a,t,e,d).
	
	test_answer :-
	
	findall((V1,V2,V3,H1,H2,H3),
	solution(V1,V2,V3,H1,H2,H3),
	L),
	  sort(L,S),
	  foreach(member(X,S),
	(write(X), nl)).
	
	test_answer :- write('Wrong
	answer!').
		balloon,squawks,bejewel,banquet,bloated,cookies
		banquet,bloated,cookies,balloon,squawks,bejewel
		bejewel,bejewel,bejewel,bejewel,bejewel,bejewel
		bloated,banquet,bejewel,bloated,banquet,bejewel
			balloon,squawks,bejewel,banquet,bloated,cook
			banquet,bloated,cookies,balloon,squawks,beje
			bejewel,bejewel,bejewel,bejewel,bejewel,beje
			bloated,banquet,bejewel,bloated,banquet,beje

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

Question 8

Correct

Mark 1.00 out of 1.00

Binary trees are trees where all internal nodes have exactly two children. The mirror of a binary tree is obtained by exchange all the left and right children. For example the following two trees are the mirror of each other:

The smallest binary trees consist of only one leaf node. We will represent leaf nodes as `leaf(Label)` . For instance, `leaf(1)` and `leaf(3)` are leaf nodes, and therefore small binary trees. Given two binary trees `B1` and `B2` we combine them into one binary tree by `tree(B1,B2)`.So, from the leaves `leaf(2)` and `leaf(3)` we can build the binary tree `tree(leaf(2),leaf(3))` . And from the binary trees `leaf(1)` and `tree(leaf(2),leaf(3))` we can build the binary tree `tree(leaf(1), tree(leaf(2), leaf(3)))`.

Define a predicate `mirror/2` that succeeds when the two arguments are binary trees and are the mirror of each other.

For example:

Test	Result

`test_answer :-`
`  mirror(leaf(foo), leaf(foo)),`
`  write('OK').`
 	
`test_answer :-`
`  write('Wrong answer!').`
	OK

`test_answer :-`
`  mirror(tree(leaf(foo), leaf(bar)), tree(leaf(bar), leaf(foo))),`
`  write('OK').`
 	
`test_answer :-`
`  write('Wrong answer!').`
	OK

`test_answer :-`
`  mirror(tree(tree(leaf(1), leaf(2)), leaf(4)), T),`
`  write(T).`
 	
`test_answer :-`
`  write('Wrong answer!').`
	`tree(leaf(4),tree(leaf(2),leaf(1)))`

`test_answer :-`
`  mirror(tree(tree(leaf(1), leaf(2)), tree(leaf(3), leaf(4))), T),`
`  write(T).`
 	
`test_answer :-`
`  write('Wrong answer!').`
	`tree(tree(leaf(4),leaf(3)),tree(leaf(2),leaf(1)))`

Answer: (penalty regime: 0, 15, ... %)

```
1 mirror(X, X) :- X = leaf(Y). %base
2 mirror(tree(L1, L2), tree(L3, L4)) :- mirror(L1, L4), mirror(L2, L3).
3
```

	Test	Expected	Got

✔	`test_answer :-`
	`  mirror(leaf(foo), leaf(foo)),`
	`  write('OK').`
	
	`test_answer :-`
	`  write('Wrong answer!').`
		OK	OK

✔	`test_answer :-`
	
	`mirror(tree(leaf(foo), leaf(bar)), tree(leaf(bar), leaf(foo))),`
	`  write('OK').`
	
	`test_answer :-`
	`  write('Wrong answer!').`
		OK	OK

✔	`test_answer :-`
	
	`mirror(tree(tree(leaf(1), leaf(2)),  leaf(4)), T),`
	`  write(T).`
	
	`test_answer :-`
	`  write('Wrong answer!').`
		`tree(leaf(4),tree(leaf(2),leaf(1)))`	`tree(leaf(4),tree(leaf(2),leaf(1)))`

✔	`test_answer :-`
	
	`mirror(tree(tree(leaf(1), leaf(2)),  tree(leaf(3), leaf(4))), T),`
	`  write(T).`
	
	`test_answer :-`
	`  write('Wrong answer!').`
		`tree(tree(leaf(4),leaf(3)),tree(leaf(2),leaf(1)))`	`tree(tree(leaf(4),leaf(3)),tree(leaf(2),leaf(`

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.