Intro. to Artificial Intelligence

Assignement 2

Wumpus Game

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Content Table :

Introduction :

For our second project , My teammate Kenza Rchi and I developed an intelligent agent to find solution for different states of the game Wumpus World. The game focus on an agent that is trying to explore a four-by-four layout of rooms in order to kill a wumpus. the main purpose of the game for the agent is to shoot the wumpus. During teh process of finding teh wumpus, the agent will try to get gold to increase the score with a 1000 and to avoid avoid the pits in the rooms using its senses.

To acheive the purpose of the game, we used Prolog in order to implement the game as well as all the inference rules

Predicates :

To implement our knowledge base, we focused on the following predicates:

adjacent([X,Y],L) :indicates if L and room [X,Y]

wall ([X,Y]) : indicates the limits of the room of [X,Y]

makestatement([X,Y]) : takes the perception of the hunter

pit([X,Y]) : indicates if there is a pit

wumpus([X,Y]) : indicates if there is a wumpus

gold([X,Y]) : indicates if there is gold

point_safe([X,Y]) : indicates if the room is safe from pits

wumpus_safe([X,Y]) : checks if the room is safe , free of wumpus

maybe([X,Y]) : check if the room may be dangerous

safe([X,Y]) : indicates if the room is safe (Wsafe and psafe)

good([X,Y]) : indicates if the room is good to move to

existgood(A): indicates if there's a good move to do

existmaybe(A): indicates the less risky move to do if there are no good moves

start : starts the game

action(X): determines the action to take

get_next([X,Y],[X1,Y1],[X2,Y2]) :the inference to get the next action

update_score(X):updates the score

update_timer(X):updates the timer

init : initializes the board and the position of each thing

Project constraints :

SWI-Prolog online version :

SWI-Prolog is a free Prolog environment with a lot of features. SWI-Prolog has been motivated by the demands of real-world applications since its inception in 1987. SWI-Prolog is widely used in commercial and academic applications, as well as in research and teaching.

SWI-Prolog online version ceased working from any device linked to AUI wifi three days before the deadline, maybe because everyone in the class was using the same wifi and browsing the website at the same time.

Time :

After installing tthe SWI prologue , we were able to finish our work . We could implement some of the important features f teh game and actions like grab, shoots , smell.Yet we could not implement the bump action (in teh case the agent walks into a wall.) due to time constraints. After testing the code multiple time , we wee able to detect some of the logical errors. So we were able to reciev insatisfied results after testing like visiting a room twice and detecting and grabing teh Gold twice. We were not been able to solve this problem due to time constraints.

Detected problems and future implementation :

As mentioned in eth previos part of teh reports, We were able to detect some logical problems in teh cide after testing it several time . And we received some results that shows that the rooms of Gold has been visisted twice and the Gold grabbed twice.

```
?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec, 28 clause
?- start.
Current position [1,1]
Current position [2,1]
I FEEL A  BREEZE IN POSITION [2,1]
Current position [1,1]
Current position [1,2]
Current position [2,2]
Current position [1,2]
Current position [1,3]
I FEEL A  BREEZE IN POSITION [1,3]
Current position [2,2]
Current position [3,2]
I FEEL A  BREEZE IN POSITION [3,2]
Current position [1,3]
I FEEL A  BREEZE IN POSITION [1,3]
Current position [2,3]
Current position [3,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 518
Current position [2,3]
Current position [2,4]
I FEEL A  BREEZE IN POSITION [2,4]
Current position [3,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 1015
Current position [4,3]
I SMELL A STENCH IN POSITION  [4,3]
Current position [4,2]
Current position [2,4]
I FEEL A  BREEZE IN POSITION [2,4]
Current position [3,4]
I SMELL A STENCH IN POSITION  [3,4]
Current position [4,2]
Current position [4,1]
I FEEL A  BREEZE IN POSITION [4,1]
The wumpus position is  [3,5]! shoooootttt !
 Current Score: 1009
timer: 21
I DID IT!
true.

?- ■
```

The future implementations :

If we have more time we will be implementing the following code in the **makestatement** part :
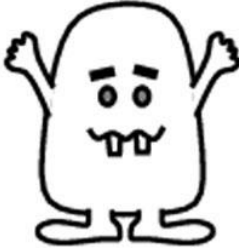
forall((gold_location(G),([X,Y] == G)),(assert(glitter([X,Y])),score(S), N is S + 500 , format('I have found GOLD, Score is now ~p~n',[N]), retractall(score()),retractall(glitter()),retractall(gold_location(_)), assert(score(N)))).

Game Trials :

Game Trial1 :

• Here, the Wampus began at [1,1], then went to [2, 1], where it discovered nothing, then returned to [1,1] then to [1,2], where it discovered a stench, then continued on to [2,2], where it discovered a breeze and a stench at [2,3], then went to [3,2], [3,2], [2,2], [2,2], [2,2], [2,2], [2,2], [2,2], [2,2], [2,
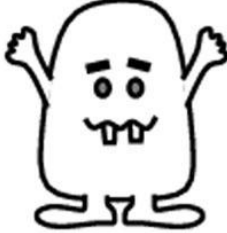
Configuration code ;

```prolog
%--------------Initialization------------------------------------------------
-------------
init:-
retractall(timer(_)),
assert(timer(0)),
retractall(score(_)),
assert(score(30)),
retractall(gold_location(_)),
assert(gold_location([4,3])),
retractall(wumpus_location(_)),
assert(wumpus_location([4,4])),
retractall(pit_location(_)),
assert(pit_location([4,1])),
assert(pit_location([2,2])),
assert(pit_location([2,4])),
retractall(agent_location(_)),
assert(agent_location([1,1])),
retractall(wumpus_final_location(_)),
assert(wumpus_final_location([-1,-1])).
```

Game trial 1 result :

```
?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec,
?- start.
Current position [1,1]
Current position [2,1]
Current position [1,1]
Current position [1,2]
Current position [2,1]
Current position [3,1]
I SMELL A STENCH IN POSITION  [3,1]
Current position [1,2]
Current position [2,2]
I FEEL A  BREEZE IN POSITION [2,2]
I SMELL A STENCH IN POSITION  [2,2]
Current position [1,2]
Current position [1,3]
I FEEL A  BREEZE IN POSITION [1,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 520
Current position [3,1]
I SMELL A STENCH IN POSITION  [3,1]
Current position [4,1]
Current position [4,2]
I SMELL A STENCH IN POSITION  [4,2]
The wumpus position is  [5,2]! shooooootttt !
 Current Score: 517
timer: 13
I DID IT!
true.

?- ∎
```

Game Trial 2 :
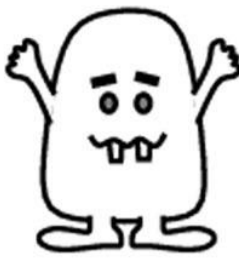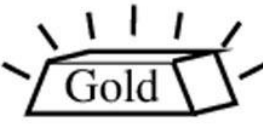
PIT	Breeze	Stench	(Wumpus)
Breeze		Gold	Stench
		Breeze	
START	Breeze	PIT	Breeze

Configuration Code :

```
%--------------Initialization---------------
------------
init:-
    retractall(timer(_)),
    assert(timer(0)),
    retractall(score(_)),
    assert(score(30)),
    retractall(gold_location(_)),
    assert(gold_location([3,3])),
    retractall(wumpus_location(_)),
    assert(wumpus_location([4,4])),
    retractall(pit_location(_)),
    assert(pit_location([3,1])),
    assert(pit_location([1,4])),
    retractall(agent_location(_)),
    assert(agent_location([1,1])),
    retractall(wumpus_final_location(_)),
    assert(wumpus_final_location([-1,-1])).
```

Game trial 2 solution :

```
?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec, 28 clauses
?- start.
Current position [1,1]
Current position [2,1]
I FEEL A  BREEZE IN POSITION [2,1]
Current position [1,1]
Current position [1,2]
Current position [2,2]
Current position [1,2]
Current position [1,3]
I FEEL A  BREEZE IN POSITION [1,3]
Current position [2,2]
Current position [3,2]
I FEEL A  BREEZE IN POSITION [3,2]
Current position [1,3]
I FEEL A  BREEZE IN POSITION [1,3]
Current position [2,3]
Current position [3,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 518
Current position [2,3]
Current position [2,4]
I FEEL A  BREEZE IN POSITION [2,4]
Current position [3,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 1015
Current position [4,3]
I SMELL A STENCH IN POSITION  [4,3]
Current position [4,2]
Current position [2,4]
I FEEL A  BREEZE IN POSITION [2,4]
Current position [3,4]
I SMELL A STENCH IN POSITION  [3,4]
Current position [4,2]
Current position [4,1]
I FEEL A  BREEZE IN POSITION [4,1]
The wumpus position is  [3,5]! shoooootttt !
 Current Score: 1009
timer: 21
I DID IT!
true.

?- █
```

Game Trai l3

Code configuration : :

```
    assert(timer(2)).
%--------------Initialization------------------------------------------------------
init:-
    retractall(timer(_)),
    assert(timer(0)),
    retractall(score(_)),
    assert(score(30)),
    retractall(gold_location(_)),
    assert(gold_location([3,3])),
    retractall(wumpus_location(_)),
    assert(wumpus_location([4,4])),
    retractall(pit_location(_)),
    assert(pit_location([1,3])),
    assert(pit_location([1,4])),
    retractall(agent_location(_)),
    assert(agent_location([1,1])),
    retractall(wumpus_final_location(_)),
    assert(wumpus_final_location([-1,-1])).
```

Game trial 3 solutrion :

```
SWI-Prolog (AMD64, Multi-threaded, version 8.4.2)

File  Edit  Settings  Run  Debug  Help
Welcome to SWI-Prolog (threaded, 64 bits, version 8.4.2)
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).

?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec, 28 clauses
?- start.
Current position [1,1]
Current position [2,1]
Current position [1,1]
Current position [1,2]
I FEEL A  BREEZE IN POSITION [1,2]
Current position [2,1]
Current position [3,1]
Current position [1,2]
I FEEL A  BREEZE IN POSITION [1,2]
Current position [2,2]
Current position [3,1]
Current position [4,1]
Current position [2,2]
Current position [3,2]
Current position [2,2]
Current position [2,3]
I FEEL A  BREEZE IN POSITION [2,3]
Current position [3,2]
Current position [4,2]
Current position [2,3]
I FEEL A  BREEZE IN POSITION [2,3]
Current position [3,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 512
Current position [4,3]
I SMELL A STENCH IN POSITION  [4,3]
Current position [3,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 1010
Current position [3,4]
I SMELL A STENCH IN POSITION  [3,4]
Current position [2,4]
I FEEL A  BREEZE IN POSITION [2,4]
The wumpus position is  [3,5]! shoooootttt !
 Current Score: 1008
timer: 22
I DID IT!
true.

?- ▮
```

Game Trial 4 :

Stench Breeze	PIT	Breeze	PIT
(monster)	Stench Breeze		Breeze Gold
Stench			
START			

Code configuration :

```
%--------------Initialization-------------------------
init:-
retractall(timer(_)),
assert(timer(0)),
retractall(score(_)),
assert(score(30)),
retractall(gold_location(_)),
assert(gold_location([4,3])),
retractall(wumpus_location(_)),
assert(wumpus_location([1,3])),
retractall(pit_location(_)),
assert(pit_location([4,2])),
assert(pit_location([4,4])),
retractall(agent_location(_)),
assert(agent_location([1,1])),
retractall(wumpus_final_location(_)),
assert(wumpus_final_location([-1,-1])).
```

Game trial 4 solution :

```
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.02 sec, -1 clauses
?- start.
Current position [1,1]
The wumpus position is  [3,5]! shoooootttt !
 Current Score: 29
timer: 1
I DID IT!
true.
```

Game Trail5 :

		Breeze	PIT
Gold	Breeze		Breeze Stench
Breeze	PIT	Breeze Stench	(Wumpus)
START			Stench

Code configuration :

```
%-------------Initialization---------------------------

init:-

retractall(timer(_)),
assert(timer(0)),
retractall(score(_)),
assert(score(30)),
retractall(gold_location(_)),
assert(gold_location([1,3])),
retractall(wumpus_location(_)),
assert(wumpus_location([4,2])),
retractall(pit_location(_)),
assert(pit_location([2,2])),
assert(pit_location([4,4])),
retractall(agent_location(_)),
assert(agent_location([1,1])),
retractall(wumpus_final_location(_)),
assert(wumpus_final_location([-1,-1])).
```

Game trial 5 solution :

```
SWI-Prolog (AMD64, Multi-threaded, version 8.4.2)

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Please run ?- license. for legal details.

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

?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.02 sec, 28
?- start.
Current position [1,1]
Current position [2,1]
I FEEL A  BREEZE IN POSITION [2,1]
Current position [1,1]
Current position [1,2]
I FEEL A  BREEZE IN POSITION [1,2]
 Oh ?? Where is the Wumpus ?
FAILED !
true.

?- █
```

Game Trail 6 :

PIT	Breeze	Breeze	PIT
Breeze / Gold	Breeze		Breeze / Stench
Breeze	PIT	Breeze / Stench	(Wumpus)
START			Stench

Coe configuration ;

```
    assert(timer(2)).
%--------------Initialization----------------------
------------

init:-
retractall(timer(_)),
assert(timer(0)),
retractall(score(_)),
assert(score(30)),
retractall(gold_location(_)),
assert(gold_location([1,3])),
retractall(wumpus_location(_)),
assert(wumpus_location([4,2])),
retractall(pit_location(_)),
assert(pit_location([2,2])),
assert(pit_location([4,4])),
assert(pit_location([1,4])),
retractall(agent_location(_)),
assert(agent_location([1,1])),
retractall(wumpus_final_location(_)),
assert(wumpus_final_location([-1,-1])).
```

Game trial 6 solution :

```
SWI-Prolog (AMD64, Multi-threaded, version 8.4.2)

File  Edit  Settings  Run  Debug  Help
Welcome to SWI-Prolog (threaded, 64 bits, version 8.4.2)
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).

?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec, 28 clauses
?- start.
Current position [1,1]
Current position [2,1]
I FEEL A  BREEZE IN POSITION [2,1]
Current position [1,1]
Current position [1,2]
I FEEL A  BREEZE IN POSITION [1,2]
 Oh ?? Where is the Wumpus ?
FAILED !
true.

?- ■
```

Trail 7 :

PIT	Breeze	Breeze	Gold
Breeze	Breeze Stench	PIT	Breeze
Stench	(monster)	Breeze Stench	
START	Breeze Stench	PIT	Breeze

Code configuration :

```
    assert(timer(0)).
%--------------Initialization----------------------------------
-------------
init:-
retractall(timer(_)),
assert(timer(0)),
retractall(score(_)),
assert(score(30)),
retractall(gold_location(_)),
assert(gold_location([4,4])),
retractall(wumpus_location(_)),
assert(wumpus_location([2,2])),
retractall(pit_location(_)),
assert(pit_location([3,1])),
assert(pit_location([3,3])),
assert(pit_location([1,4])),
retractall(agent_location(_)),
assert(agent_location([1,1])),
retractall(wumpus_final_location(_)),
assert(wumpus_final_location([-1,-1])).
```

Game trial 7 solution :
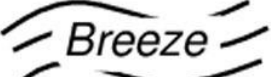
```
For online help and background, visit https://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).

?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec, 28 clauses
?- start.
Current position [1,1]
Current position [2,1]
I FEEL A  BREEZE IN POSITION [2,1]
I SMELL A STENCH IN POSITION  [2,1]
Current position [1,1]
Current position [1,2]
I SMELL A STENCH IN POSITION  [1,2]
Current position [2,1]
I FEEL A  BREEZE IN POSITION [2,1]
I SMELL A STENCH IN POSITION  [2,1]
Current position [3,1]
Current position [4,1]
I FEEL A  BREEZE IN POSITION [4,1]
Current position [3,1]
Current position [3,2]
I FEEL A  BREEZE IN POSITION [3,2]
I FEEL A  BREEZE IN POSITION [3,2]
I SMELL A STENCH IN POSITION  [3,2]
Current position [2,2]
Current position [2,3]
I FEEL A  BREEZE IN POSITION [2,3]
I SMELL A STENCH IN POSITION  [2,3]
The wumpus position is  [0,2]! shoooootttt !
 Current Score: 19
timer: 11
I DID IT!
true.

?- ▮
```
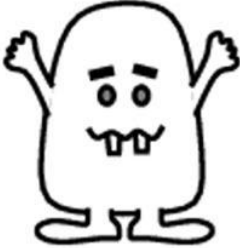
Game Trail 8 :
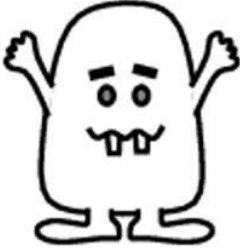
PIT	Breeze	Stench	(monster)
Breeze			Stench
		Breeze	Gold
START	Breeze	PIT	Breeze

Code configuration :

```
%--------------Initialization-------------------------------------------------
-------------
init:-
retractall(timer(_)),
assert(timer(0)),
retractall(score(_)),
assert(score(30)),
retractall(gold_location(_)),
assert(gold_location([4,2])),
retractall(wumpus_location(_)),
assert(wumpus_location([4,4])),
retractall(pit_location(_)),
assert(pit_location([3,1])),
assert(pit_location([1,4])),
retractall(agent_location(_)),
assert(agent_location([1,1])),
retractall(wumpus_final_location(_)),
assert(wumpus_final_location([-1,-1])).
```

Game trial 8 solution :

```
?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec, 28 clauses
?- start.
Current position [1,1]
Current position [2,1]
I FEEL A  BREEZE IN POSITION [2,1]
Current position [1,1]
Current position [1,2]
Current position [2,2]
Current position [1,2]
Current position [1,3]
I FEEL A  BREEZE IN POSITION [1,3]
Current position [2,2]
Current position [3,2]
I FEEL A  BREEZE IN POSITION [3,2]
Current position [1,3]
I FEEL A  BREEZE IN POSITION [1,3]
Current position [2,3]
Current position [3,3]
Current position [2,3]
Current position [2,4]
I FEEL A  BREEZE IN POSITION [2,4]
Current position [3,3]
Current position [4,3]
I SMELL A STENCH IN POSITION  [4,3]
Current position [4,2]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 513
Current position [2,4]
I FEEL A  BREEZE IN POSITION [2,4]
Current position [3,4]
I SMELL A STENCH IN POSITION  [3,4]
Current position [4,2]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 1010
Current position [4,1]
I FEEL A  BREEZE IN POSITION [4,1]
The wumpus position is  [3,5]! shoooootttt !
 Current Score: 1009
timer: 21
```

Trail 9 :

PIT	Breeze Gold	Breeze Stench	(monster)
Breeze	Breeze	PIT	Breeze Stench
		Breeze	
START	Breeze	PIT	Breeze

Code configuration

```prolog
    assert(timer(Z)).
%-------------Initialization--------------------------
------------
init:-
retractall(timer(_)),
assert(timer(0)),
retractall(score(_)),
assert(score(30)),
retractall(gold_location(_)),
assert(gold_location([4,3])),
retractall(wumpus_location(_)),
assert(wumpus_location([4,4])),
retractall(pit_location(_)),
assert(pit_location([4,1])),
assert(pit_location([2,2])),
assert(pit_location([2,4])),
retractall(agent_location(_)),
assert(agent_location([1,1])),
retractall(wumpus_final_location(_)),
assert(wumpus_final_location([-1,-1])).
```

Game trial 9 solution :

```
?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec, 28 clauses
?- start.
Current position [1,1]
Current position [2,1]
I FEEL A  BREEZE IN POSITION [2,1]
Current position [1,1]
Current position [1,2]
I FEEL A  BREEZE IN POSITION [1,2]
 Oh ?? Where is the Wumpus ?
FAILED !
true.

?- █
```

Trial 10 :

Code configuration :

```prolog
%-------------Initialization-----------------------------------------------
init:-
    retractall(timer(_)),
    assert(timer(0)),
    retractall(score(_)),
    assert(score(30)),
    retractall(gold_location(_)),
    assert(gold_location([3,3])),
    retractall(wumpus_location(_)),
    assert(wumpus_location([4,4])),
    retractall(pit_location(_)),
    assert(pit_location([1,3])),
    assert(pit_location([1,4])),
    retractall(agent_location(_)),
    assert(agent_location([1,1])),
    retractall(wumpus_final_location(_)),
    assert(wumpus_final_location([-1,-1])).
```

Trial 10 solution

SWI-Prolog (AMD64, Multi-threaded, version 8.4.2)

File   Edit   Settings   Run   Debug   Help

```
Welcome to SWI-Prolog (threaded, 64 bits, version 8.4.2)
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For built-in help, use ?- help(Topic). or ?- apropos(Word).

?-
% c:/Users/HP/Downloads/wumpus2.pl compiled 0.00 sec, 28 clauses
?- start.
Current position [1,1]
Current position [2,1]
Current position [1,1]
Current position [1,2]
I FEEL A  BREEZE IN POSITION [1,2]
Current position [2,1]
Current position [3,1]
Current position [1,2]
I FEEL A  BREEZE IN POSITION [1,2]
Current position [2,2]
Current position [3,1]
Current position [4,1]
Current position [2,2]
Current position [3,2]
Current position [2,2]
Current position [2,3]
I FEEL A  BREEZE IN POSITION [2,3]
Current position [3,2]
Current position [4,2]
Current position [2,3]
I FEEL A  BREEZE IN POSITION [2,3]
Current position [3,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 512
Current position [4,3]
I SMELL A STENCH IN POSITION  [4,3]
Current position [3,3]
YAAYY !! IT IS GOLD, SCORE UPDATED NOW TO : now 1010
Current position [3,4]
I SMELL A STENCH IN POSITION  [3,4]
Current position [2,4]
I FEEL A  BREEZE IN POSITION [2,4]
The wumpus position is  [3,5]! shoooootttt !
 Current Score: 1008
timer: 22
I DID IT!
true.
```