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CSC 4301 01
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Report of Project 2: Wumpus World Game

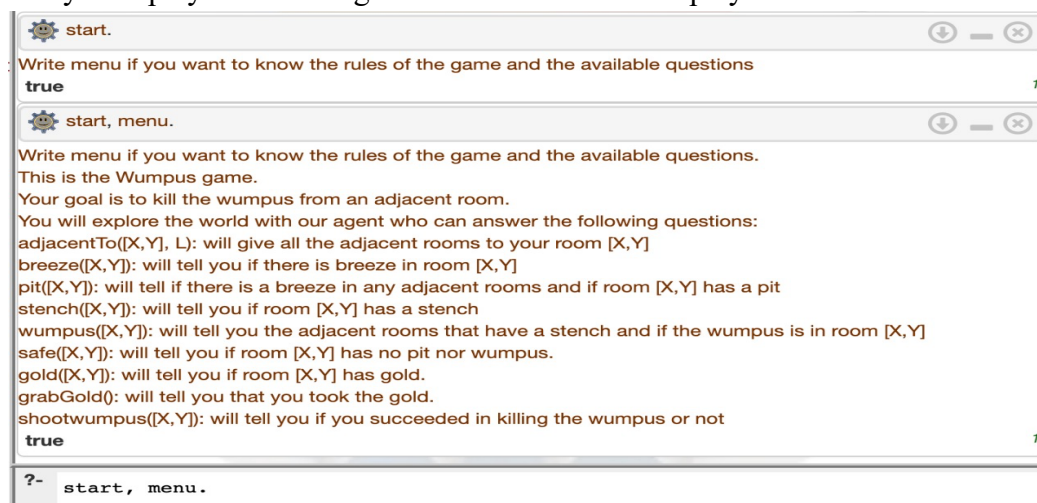
Introduction:

The Wumpus World Game is a simple game that illustrate the use of knowledge-based agent. The world is built as a 4x4 grid. It contains 16 rooms that the agent explores while trying to avoid pits, looking for the Wumpus to shoot him from an adjacent room, and looking for the gold.

In this assignment, me and my teammate built a single iteration logical agent that when asked a question about the world, it will return a reply. In this report, I will be explaining the code and the key predicate we wrote, sharing the different snapshots of the experiments we did and their results, and explaining the limitations of our program.

Key Predicates and the meaning of the Variables:

The logical agent we built was using Prolog programming language. To start the game, we create a predicate called “start”. Every query is written as following “?- start, (question).” In the figure below, the query was start, menu. The menu predicate was added to explain to every new player what the game is about and how to play it.



One of the key predicates is dynamic. It introduces the following variables. The variables pit_location, wumpus_location, gold_location, agent_location are world parameters set at the start of every iteration of the game. The variables breeze and stench are dynamically asserted to the knowledge base.

```
:- dynamic ([breeze/1,  
            stench/1,  
            wumpus_location/1,  
            pit_location/1,  
            gold_location/1,  
            agent_location/1]).
```

More explanation about the code and the variables was given as comments in the code submitted along with this report.

Experiments with different environments:

We tried this agent in 5 different environments. For each experiment, we provide a representation of the world that the Wumpus explores as well as the snapshots of the full game and the interaction between the human (us) and the agent. Out of 5 experiments, we were able to win in the game 3 times.

Environment 1: (Successful experiment)

Wumpus	Stench	Breeze	Pit
Stench	Breeze	Pit	Breeze
		Breeze, Gold	
Agent	Breeze	Pit	Breeze

Snapshot of the experiments:

```
start, safe([1,1]).
Write menu if you want to know the rules of the game and the available questions.
true

start, safe([2,1]).
Write menu if you want to know the rules of the game and the available questions.
true

start, safe([1,2]).
Write menu if you want to know the rules of the game and the available questions.
true

start, safe([1,3]).
Write menu if you want to know the rules of the game and the available questions.
true

start, breeze([1,2]).
Write menu if you want to know the rules of the game and the available questions.
There is no breeze in [1,2]
true

start, breeze([2,1]).
Write menu if you want to know the rules of the game and the available questions.
There is a breeze in [2,1]
true

start, pit([2,2]).
Write menu if you want to know the rules of the game and the available questions.
There is a breeze in [3,2]
There is no breeze in [1,2]
There is a breeze in [2,3]
There is a breeze in [2,1]
false
```

start, breeze([3,3]).

Write menu if you want to know the rules of the game and the available questions.
There is no breeze in [3,3]
true

start, safe([3,3]).

Write menu if you want to know the rules of the game and the available questions.
false

start, stench([1,3]).

Write menu if you want to know the rules of the game and the available questions.
there is a stench in [1,3]
true

start, wumpus([1,3]).

Write menu if you want to know the rules of the game and the available questions.
there is no stench in [2,3]
there is no stench in [1,4]
there is no stench in [1,2]
false

start, safe([1,4]).

Write menu if you want to know the rules of the game and the available questions.
false




start, shootwumpus([1,3]).

Write menu if you want to know the rules of the game and the available questions.
Wumpus killed in [1,4]

Environment 2: (Successful experiment)




Stench			Breeze
Wumpus	stench	Breeze	Pit
Pit, Stench	Breeze		Breeze
Agent, Breeze	Gold	Breeze	Pit

Snapshot of the experiments:


`start, safe([1,1]).`






Write menu if you want to know the rules of the game and the available questions.

true
1


`start, safe([1,2]).`






Write menu if you want to know the rules of the game and the available questions.

false


`start, safe([2,1]).`



Write menu if you want to know the rules of the game and the available questions.




true
1


`start, stench([2,1]).`



Write menu if you want to know the rules of the game and the available questions.

there is no stench in [2,1]




true
1


`start, stench([1,2]).`



Write menu if you want to know the rules of the game and the available questions.

there is a stench in [1,2]




true
1


`start, stench([1,1]).`



Write menu if you want to know the rules of the game and the available questions.

there is no stench in [1,1]

true
1


`start, safe([1,3]).`



Write menu if you want to know the rules of the game and the available questions.

false

`start, breeze([1,3]).`

Write menu if you want to know the rules of the game and the available questions.
There is a breeze in [1,3]
true 1

`start, breeze([1,2]).`

Write menu if you want to know the rules of the game and the available questions.
There is no breeze in [1,2]
true 1

`start, pit([2,1]).`

Write menu if you want to know the rules of the game and the available questions.
There is a breeze in [3,1]
There is a breeze in [1,1]
There is a breeze in [2,2]
false

`start, safe([1,4]).`

Write menu if you want to know the rules of the game and the available questions.
true 1

`start, stench([1,4]).`

Write menu if you want to know the rules of the game and the available questions.
there is a stench in [1,4]
true 1

`start, gold([1,4]).`

Write menu if you want to know the rules of the game and the available questions.
There is no gold in [1,4]
true 1

`start, gold([2,4]).`

Write menu if you want to know the rules of the game and the available questions.
There is no gold in [2,4]
true 1

`start, gold([2,1]).`

Write menu if you want to know the rules of the game and the available questions.
There is gold in [2,1]
true 1

`start, grabGold.`

Write menu if you want to know the rules of the game and the available questions.
We have the gold!
true 1

`start, shootwumpus([1,4]).`

Write menu if you want to know the rules of the game and the available questions.
Wumpus killed in [1,3]
true 1

Environment 3: (Failing experiment)

Breeze	Pit	Breeze	
Stench, Pit	Breeze	Breeze	Gold
wumpus	Stench	Pit	Breeze
Agent, Stench	Breeze	Pit	Breeze

Snapshot of the experiments:

start, safe([1,1]).

Write menu if you want to know the rules of the game and the available questions.

true

start, pit([1,1]).

Write menu if you want to know the rules of the game and the available questions.

There is a breeze in [2,1]

There is a breeze in [1,2]

false

start, wumpus([1,1]).

Write menu if you want to know the rules of the game and the available questions.

there is no stench in [2,1]

there is no stench in [1,2]

false

start, safe([1,3]).

Write menu if you want to know the rules of the game and the available questions.

false

start, safe([1,4]).

Write menu if you want to know the rules of the game and the available questions.

true

start, pit([1,4]).

Write menu if you want to know the rules of the game and the available questions.

There is no breeze in [2,4]

There is no breeze in [1,3]

false

`start, gold([1,4]).`

Write menu if you want to know the rules of the game and the available questions.

There is no gold in [1,4]

true 1

`start, gold([1,2]).`

Write menu if you want to know the rules of the game and the available questions.

There is no gold in [1,2]

true 1

`start, gold([2,1]).`

Write menu if you want to know the rules of the game and the available questions.

There is no gold in [2,1]

true 1

`start, safe([2,2]).`

Write menu if you want to know the rules of the game and the available questions.

true 1

`start, pit([2,2]).`

Write menu if you want to know the rules of the game and the available questions.

There is a breeze in [3,2]

There is a breeze in [1,2]

There is a breeze in [2,3]

There is a breeze in [2,1]

false

`start, safe([3,1]).`

Write menu if you want to know the rules of the game and the available questions.

false

`start, wumpus([2,2]).`

Write menu if you want to know the rules of the game and the available questions.

there is no stench in [3,2]

there is no stench in [1,2]

there is no stench in [2,3]

there is no stench in [2,1]

false

`start, wumpus([1,4]).`

Write menu if you want to know the rules of the game and the available questions.

there is no stench in [2,4]

there is a stench in [1,3]

false

`start, shootwumpus([1,3]).`

Write menu if you want to know the rules of the game and the available questions.

You fell in a pit, and you missed your shot!

true 1

Environment 4: (Successful experiment)

Wumpus	Breeze		
Breeze	Pit	Breeze	
Gold	Breeze		
Agent	Pit	Breeze	

Snapshot of the experiments:

start, safe([1,1]).

Write menu if you want to know the rules of the game and the available questions.

true

start, pit([1,1]).

Write menu if you want to know the rules of the game and the available questions.

There is no breeze in [2,1]
There is no breeze in [1,2]
false

start, wumpus([1,1]).

Write menu if you want to know the rules of the game and the available questions.

there is no stench in [2,1]
there is no stench in [1,2]
false

start, breeze([1,1]).

Write menu if you want to know the rules of the game and the available questions.

There is a breeze in [1,1]
true

start, safe([1,2]).

Write menu if you want to know the rules of the game and the available questions.

true

start, safe([2,1]).

Write menu if you want to know the rules of the game and the available questions.

false

`start, wumpus([1,2]).`

Write menu if you want to know the rules of the game and the available questions.

there is no stench in [2,2]
there is a stench in [1,3]
there is no stench in [1,1]
false

`start, safe([1,3]).`

Write menu if you want to know the rules of the game and the available questions.

true 1

`start, gold([1,3]).`

Write menu if you want to know the rules of the game and the available questions.

There is no gold in [1,3]
true 1

`start, gold([1,2]).`

Write menu if you want to know the rules of the game and the available questions.

There is gold in [1,2]
true 1

`start, grabGold.`

Write menu if you want to know the rules of the game and the available questions.

We have the gold!
true 1

`start, safe([1,4]).`

Write menu if you want to know the rules of the game and the available questions.

false

`start, safe([1,4]).`

Write menu if you want to know the rules of the game and the available questions.

false

`start, shootwumpus([1,3]).`

Write menu if you want to know the rules of the game and the available questions.

Wumpus killed in [1,4]
true

Environment 5: (Failing experiment)

	Breeze	Breeze	Pit
Breeze	Pit	Pit	Gold
Pit	Breeze, stench	Wumpus	Breeze, Stench
Agent, Breeze	Pit	Breeze, stench	Pit

Snapshot of the experiments:

start, safe([1,1]).

Write menu if you want to know the rules of the game and the available questions.

true

start, pit([1,1]).

Write menu if you want to know the rules of the game and the available questions.

There is no breeze in [2,1]
There is no breeze in [1,2]

false

start, wumpus([1,1]).

Write menu if you want to know the rules of the game and the available questions.

there is no stench in [2,1]
there is no stench in [1,2]

false

start, breeze([1,1]).

Write menu if you want to know the rules of the game and the available questions.

There is a breeze in [1,1]

true

start, pit([1,2]).

Write menu if you want to know the rules of the game and the available questions.

There is a breeze in [2,2]
There is a breeze in [1,3]
There is a breeze in [1,1]
You fell in the pit!

true

Limitations of our solution:

After trying the code for 5 different environments, we won 3 out of 5 times, as you can see in the Environments and snapshots above. I believe the reasons for the limitation of our solution is that it first relies heavily on the human to make the decision. As seen in the experiment 3, we made an error and took the wrong step which resulted in us losing the game. Humans are flawed and even a moment of inattention can cause us to lose the game.

As for the second case where we lost the game, the environment was very difficult say impossible to solve. In the 5th environment, both the adjacent rooms to the agent's starting position contain pits. It was therefore impossible to win in this case and whatever decision we took, it was impossible to win.

Eventual future remedies to the limitations:

A way to solve the first limitation of our solution is by having an intelligent agent exploring the world and taking the best action instead of relying on the human to do so.

As for the 2nd case where we lost, it would have been impossible to solve either way considering the rules of the game.