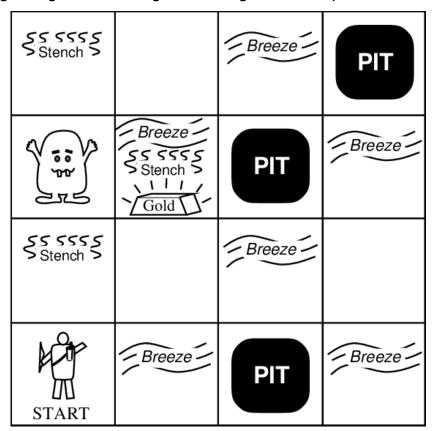# Project

# Wumpus World

## 1. Description

The purpose of this project is to design and implement a logical search agent and AI agent for a partially-observable environment. This will be accomplished by implementing an agent that navigates through the Wumpus World.
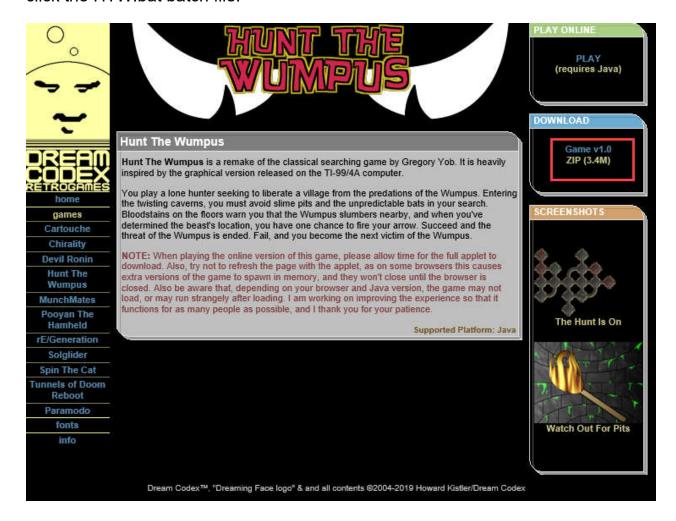


The basic properties of the Wumpus World are described in the textbook (Artificial Intelligent: A Modern Approach).

In summary, it is a game with:

- 2D cave connected by passages.
- Some rooms contain a pit into which we fall and perish.
  - o We feel a breeze if near a pit.
- One room contains a Wumpus that will eat us.

- o    We have one arrow that we can shoot in the direction we are facing.
- o    We smell a stench if near the Wumpus.
- Somewhere, there is a pot of gold.
- We can move forward or backward, turn left by 90 degrees or right by 90 degrees.
- Find gold (if possible) and try and kill the Wumpus.

You can download and play game on http://www.dreamcodex.com/wumpus.php. Java RE must be installed in your computer. You should download zip and double-click the HTW.bat batch file.



Note that: we just play game for understanding more about Wumpus World. Don't be downed in the game and forgot your mission.

## 2. New Wumpus World

We will modify the Wumpus world as such:

- The world will be limited in 10x10 instead of 4x4. Room (1,1) will still be the bottom-left one, and Room (10,10) the top-right one. First number is room position in horizontal coordinate and second number is room position in vertical coordinate.

- Agent can appear in any Room $(x_a, y_a)$ and always facing to the right. This room is the only room have the cave door.

- There may be any number of pits and gold in the world.

- There is at least one Wumpus.

- The agent carries an infinite number of arrows.

- The agent only has a limited time to explore the rooms, before the cave door collapses and the agent becomes trap inside forever. The agent only has time to visit 150 rooms. If the agent isn't back at Room $(x_a,y_a)$ by that time, he will be trapped and die.

The scores are as such:

- Add 100 points for picking up each gold.

- Reduce 100 points for shooting an arrow.

- Reduce 10000 points for dying (by being eaten by the Wumpus, falling in a pit, or being trapped inside the cave).

- Add 10 point for climbing out of the cave

- There is no cost for moving from one room to the next. However, the agent can go to at most 150 rooms, and it must be back at Room (1,1) by the 150th move in order to exit the cave.

Example:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| G | G | | B | P | B | | | | |
| G | G | S | B | P | B | | | G | |
| | BS | W | BS | P | B | | | | |
| B | P | BS | | B | | | | | |
| P | B | | | | | | | | |
| B | | | | | | B | | | |
| | | | | | B | P | B | | |
| | | | | | | B | G | B | |
| | | | | | | | B | P | B |
| A | | | | | | | | B | |

Figure 1: The Wumpus World to test the agent for the report. The Agent's starting position is marked A. The other notes are: P = Pit, B = Breeze, W = Wumpus, S = Stench, G = Gold.

# 3. Tasks

Your group is required to finish this project at 2 levels of agent:

- Level 1: agent created by using logical search
- Level 2: agent created by using machine learning

## 3.1. Level 1: Logical Search Agent

For this level, you must implement code to explore the Wumpus World and get the

highest score possible, using either Propositional Logic or First-Order Logic (or both).

Your implementation should output information about the search, including the precepts at every room the agent enters, the content of or change in the knowledge base after each new precept, and the action decided upon by the agent. The program should also output the score of the agent.

Having your implementation generate Wumpus Worlds randomly can help you test your agent. However, it must also be able to load the world setup of Figure 1.

## 3.2. Level 2: Try With Learning

You required to research some machine learning to apply to Wumpus World. One of algorithm can use for this level is Q-Learning. However, you are free to choose any other algorithm (Neuron Networking also can applied).

You can reference about Q-Learning in this material:

https://www.cc.gatech.edu/~bhroleno/cs6601/wumpus.pdf

At least you need to report:

- How does the algorithm work? (how to learn, …)
- Why can it be used to solve the problem?
- Comparing with logical search.

Moreover, you can implement the algorithm to Wumpus World.

## 4. Specifications

- **Input:** the given map is represented by matrix, which is stored in the input file, for example, **map1.txt**. The input file format is described as follows:
    - The first line contains an integer N, which is the size of map.
    - N next lines with each line represents a string. If room empty, it is marked by hyphen character (-). If room has some things or signal such as **W**umpus, **P**it, **B**reeze, **S**tench, or **A**gent, it is marked by first capitalized

character in name of each type and written next to each other. Between two adjacent rooms is separated by a dot (.) For example:

| | BS | W | BS | P | B | | | | |
|---|---|---|---|---|---|---|---|---|---|

This row is represented: -.BS.W.BS.P.B.-.-.-.-

- **Output**: a result with path for agent, game point will be displayed on screen and/or written in output text file such as **result1.txt**.

## 5. Requirements

| No. | Specifications | Scores |
|---|---|---|
| 1 | Finish level 1 successfully. | 40% |
| 2 | Finish level 2 successfully. | 20% |
| 3 | Graphical demonstration of each step of the running process. You can demo in console screen or use any other graphical library. | 10% |
| 4 | Generate at least 5 maps with difference structures such as position and number of Pit, Gold and Wumpus. | 10% |
| 5 | Report your algorithm, experiment with some reflection or comments. | 20% |
| **Total** | | 100% |

## 6. Notice

- This is a **GROUP** assignment. Each group has a maximum of 2 members.
- Duration: 4 weeks.
- Your group can use any programming language to do.
- Beside above requirements, report must also give the following information:
  - Your detail information (Student Id, Full Name)
  - Assignment Plan
  - Environment to compile and run your program.

- Estimating the degree of completion level for each requirement.
- References (if any)

• Any plagiarism, any tricks, or any lie will have 0 point for course grade.