**Wumpus World Final AI Report**

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## I. Minimal AI

### I.A. Briefly describe your Minimal AI algorithm:

For the Minimal AI, the agent only explores the first row of the maze and grabs the gold if gold is reachable in first row, otherwise agent simply climbs out of the maze without exploring any other row.

### I.B. Describe your Minimal AI algorithm's performance:

| Cave Size | Sample size | Mean Score | Standard Deviation | 99% Confidence Interval |
|---|---|---|---|---|
| **4x4** | 2500 | 65.9 | 255.0 | 65.9 ± 13.1 |
| **5x5** | 2500 | 49.0 | 225.3 | 49.0 ± 11.6 |
| **6x6** | 2500 | 35.0 | 195.3 | 35.0 ± 10.0 |
| **7x7** | 2500 | 57.6 | 240.4 | 57.6 ± 12.4 |
| **Total Summary** | 10000 | 51.9 | 230.4 | 65.9 ± 5.9 |

## II. Draft AI

### II.A. Briefly describe your Draft AI algorithm, focusing mainly on the changes since Minimal AI:

For the Draft AI, the agent performs Depth-First Search (DFS) using stack as a tool to find a gold in the cave. It explores the forward path if neighboring cells are safe and pushes the current cell on the stack before moving forward. Also, during the exploration, the important information such as visited, safe and unsafe cells are added to our knowledge base. On the other hand during backtracking, if no safe neighboring cells exist, the agent pops out an entry from the stack and move to this popped location. If gold is found, agent will simply backtrace it's path by continuously popping entries out of the stack till the stack is empty and finally climbs out.

### II.B. Describe your Draft AI algorithm's performance:

| Cave Size | Sample size | Mean Score | Standard Deviation | 99% Confidence Interval |
|---|---|---|---|---|
| **4x4** | 2500 | 245.6 | 432.2 | 245.6 ± 22.3 |
| **5x5** | 2500 | 203.3 | 408.3 | 203.3 ± 21.0 |
| **6x6** | 2500 | 158.9 | 376.6 | 158.9 ± 19.4 |

| | | | | |
|---|---|---|---|---|
| **7x7** | 2500 | 235.0 | 425.8 | 235.0 ± 21.9 |
| **Total Summary** | 10000 | 210.7 | 412.7 | 210.7 ± 10.6 |

## III. Final AI

### III.A. Briefly describe your Final AI algorithm, focusing mainly on the changes since Draft AI:

For the Final AI, we further improved our Draft AI algorithm by adding more functionalities and fixing previous edge cases to the main rule engine. The first added functionality is to take the shortest path to return to the starting position after grabbing the gold by using modified shortest path graph algorithm. The next added functionality is to kill the wumpus by an arrow by locating the wumpus with 100% accuracy. For locating the wumpus, we have deduced one algorithm which increases the risk factors of neighboring cells everything we encounter the stench. Using this algorithm, just after exploring the two stench percepts, we can pin-point the location of wumpus accurately. Further, knowledge base is constantly updated to take the next best profitable action instead of just randomly guessing.

### III.B. Describe your Final AI algorithm's performance:

| Cave Size | Sample size | Mean Score | Standard Deviation | 99% Confidence Interval |
|---|---|---|---|---|
| **4x4** | 2500 | 338.3 | 473.1 | 338.3 ± 24.4 |
| **5x5** | 2500 | 267.8 | 447.8 | 267.8 ± 23.0 |
| **6x6** | 2500 | 198.1 | 409.0 | 198.1 ± 21.0 |
| **7x7** | 2500 | 326.0 | 468.9 | 326.0 ± 24.1 |
| **Total Summary** | 10000 | 282.5 | 453.8 | 282.5 ± 11.7 |

## IV. In about 1/4 page of text or less, provide suggestions for improving this project.

In this project, we have used our created knowledge-base exhaustively to locate and kill the wumpus by effectively utilizing the . But, we have not use our knowledge base up to large extent in order to locate the pit using breeze percepts. We can also improve the algorithm by possibly integrating probabilistic models to the main algorithm. There exits a specific problem in using the knowledge base to locate the pit in a similar fashion to locate the wumpus logic. The problem is that in a maze, a wumpus can be only one, but this constraint does not exist for the pit, and this makes it harder to pin-point the pit in the maze. Since, there can be many overlapping breeze percepts due to adjacent pits, but there can never be a case of the overlapping stench percepts since wumpus can be only one in the maze.

Overall, we are pretty happy with our final AI algorithm which performs effectively and handles most of the edge cases efficiently.