

PEAS for the program's System:

Performance:

Win rate, survivability, possible walkthrough optimization, getting to the exit with the book (completing the task), speed

Environment: a 9x9 map with 2 enemies with 5x5 (Filch) and 3x3 (Ms. Norris) danger zones, 1 invisibility cloak, 1 book and 1 exit.

Actuators: Harry can move by 1 cell at any direction

Sensors: Harry can see cells around in one of 2 possible modes (perception types), also given rules don't prohibit memorizing cells along the trial path, so Harry possesses the map, by means of which he can avoid some obstacles (might be crucial for 2nd perception type). As of the code, those are methods like `inDangerZone(cell)` and different map checks

Backtracking:

At first it's a classical backtracking algorithm implemented by means of DFS. Harry picks some cell from those that are available around, goes there and does so until he gets to the book or has no cell to go to. In that case he backtraces his way to the last cell he had some options to go to at. Continues movement unless there's no cell with options to move to or he gets to the book.

As it gets to the book, it starts from the beginning and goes to it knowing where it is, choosing each next cell as the closest one from available cells. After that Harry does the same, but towards the exit.

A*:

It's classical BFS based algorithm implementation with at first random destination that randomizes until Harry accidentally finds the book. After that, Harry starts from initial point, then he fills priority queue PQ with it's neighbours, then moves into the one with the smallest cost ($\text{Cost} = \text{Distance} + \text{Heuristic}$; $\text{Heuristic} = \sqrt{(dX)^2 + (dY)^2}$), adds its neighbour cells into PQ and again chooses a cell with the smallest cost. Continues until he reaches the book and then the exit.

- Backtracking (variant 1) compared to A* algorithm (variant 1)

Backtracking statistics:

Average time: 265059.4754

Average steps: 42.32299

Win rate: 80.69%

A* statistics:

Average time: 329992.29097

Average steps: 8.26803

Win rate: 75.985%

- Backtracking (variant 2) compared to A* algorithm (variant 2)

Backtracking statistics:

Average time: 474013.293333333333

Average steps: 34.826666666666667

Win rate: 65.3333333333333333%

A* statistics:

Average time: 1617701.38

Average steps: 6.4466666666666666

Win rate: 64.0%

- Backtracking (variant 1) compared to A* (variant 2)

```
Backtracking statistics:  
Average time: 270982.44666666666  
Average steps: 43.4  
Win rate: 82.66666666666667%  
  
A* statistics:  
Average time: 1421073.3733333333  
Average steps: 7.42  
Win rate: 67.33333333333333%
```

- A* algorithm (variant 1) compared to Backtracking algorithm (variant 2)

Backtracking statistics:

Average time: 200497.01294

Average steps: 34.96839

Win rate: 66.989%

A* statistics:

Average time: 365122.16264

Average steps: 8.34813

Win rate: 76.512%