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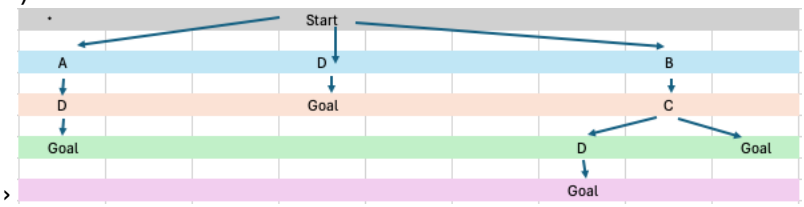
Assignment 2

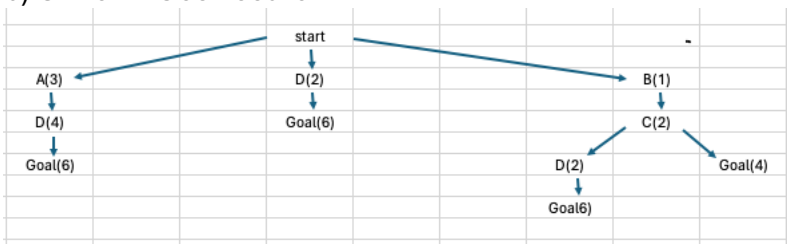
1) a) Breadth first search




Breadth first search explores level by level, along node depth level closest to start and then expands out to lower depths.

The expansion order for Breadth first search would be:
(start,
A, D, B,
D, Goal, C,
Goal, D, Goal,
Goal)

b) Uniform Cost search




Uniform cost search expands the node with the lowest cumulative cost from the start node at each step.

The expansion order for uniform cost search would be:
(start,
b(1), d(2), a(3), c(3), d(5), goal(7)
)

c) Greedy Best First search is a form of the best first search that expands the node with the lowest h(n) value according to the heuristic table.

The expansion order for greedy best first search would be :
(start,
D, Goal)

d) A* search is a search that uses both the path cost to a certain node, as well as the heuristic function that estimates the cost of the shortest path from that node to the goal state.

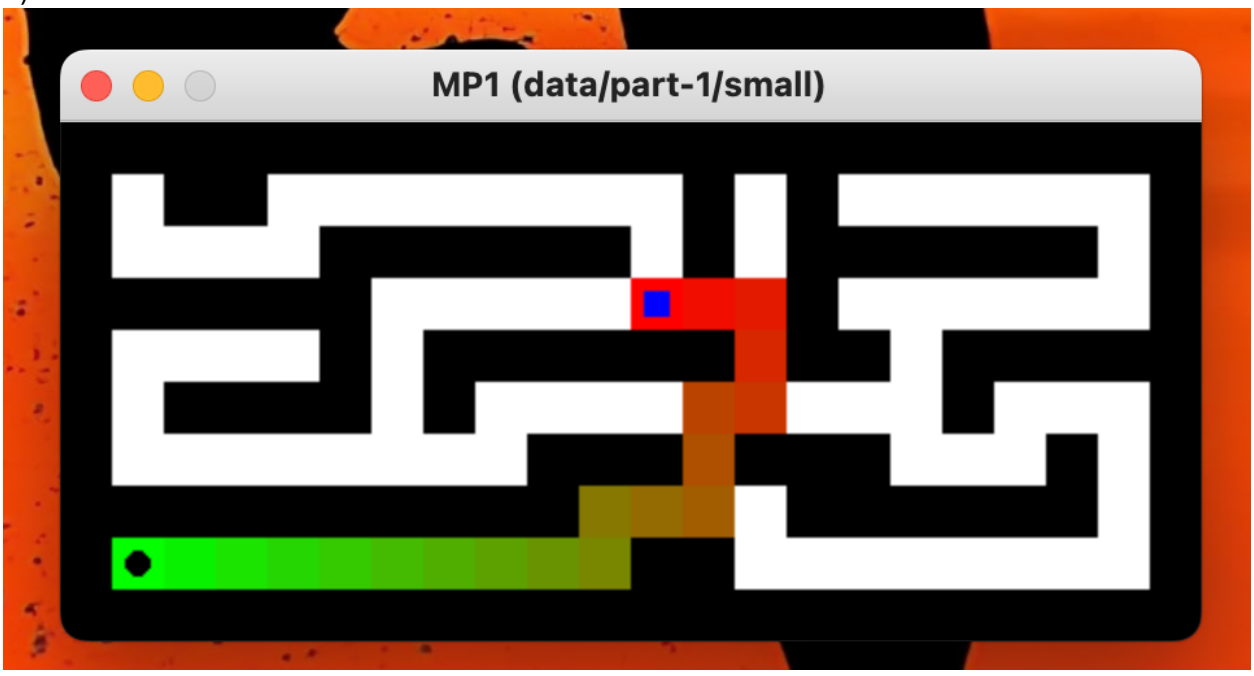
The expansion order for A* search would be:
(start,
B, C,
Goal)

e) An admissible heuristic is one that never overestimates the true cost to reach the goal.

| Actual cost | Value | Heuristic | value |
|---|---|---|---|
| From goal to goal | 0 | h(goal) | 0 |
| From D to goal | 6 | h(D) | 1 |
| From C to goal | 4 | h(C) | 2 |
| From B to goal | 6 | h(B) | 4 |
| From A to goal | 10 | h(A) | 2 |
| From start to goal | 7 | h(start) | 6 |

Therefor the heuristic function is admissible, as all the heuristic values are less than the actual costs to reach the goals from any node.

2) a) breadth first search

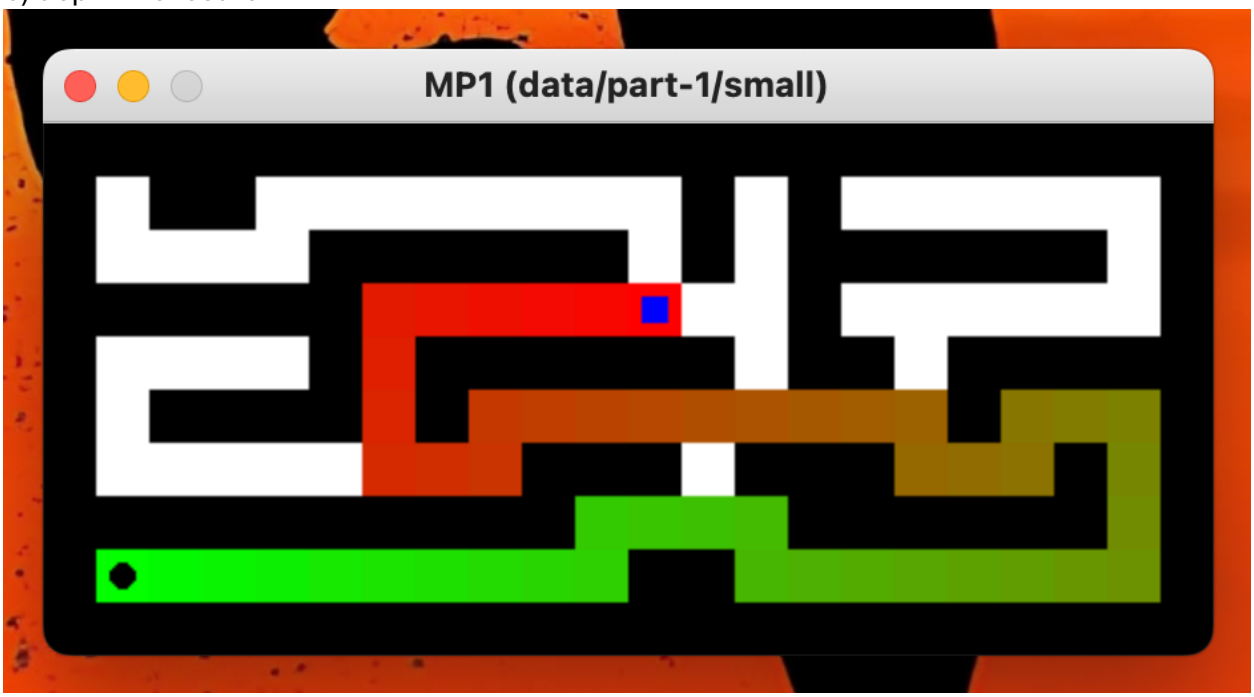


```
(base) marcosondruska@Marcoss-MacBook-Pro maze_puzzle % python3 main.py data/part-1/small --search bfs
pygame 2.5.2 (SDL 2.28.3, Python 3.8.1)
Hello from the pygame community. https://www.pygame.org/contribute.html

Results
{
    path length         : 20
    states explored     : 92
    total execution time: 0.00 seconds
}

(base) marcosondruska@Marcoss-MacBook-Pro maze_puzzle %
```

b) depth first search

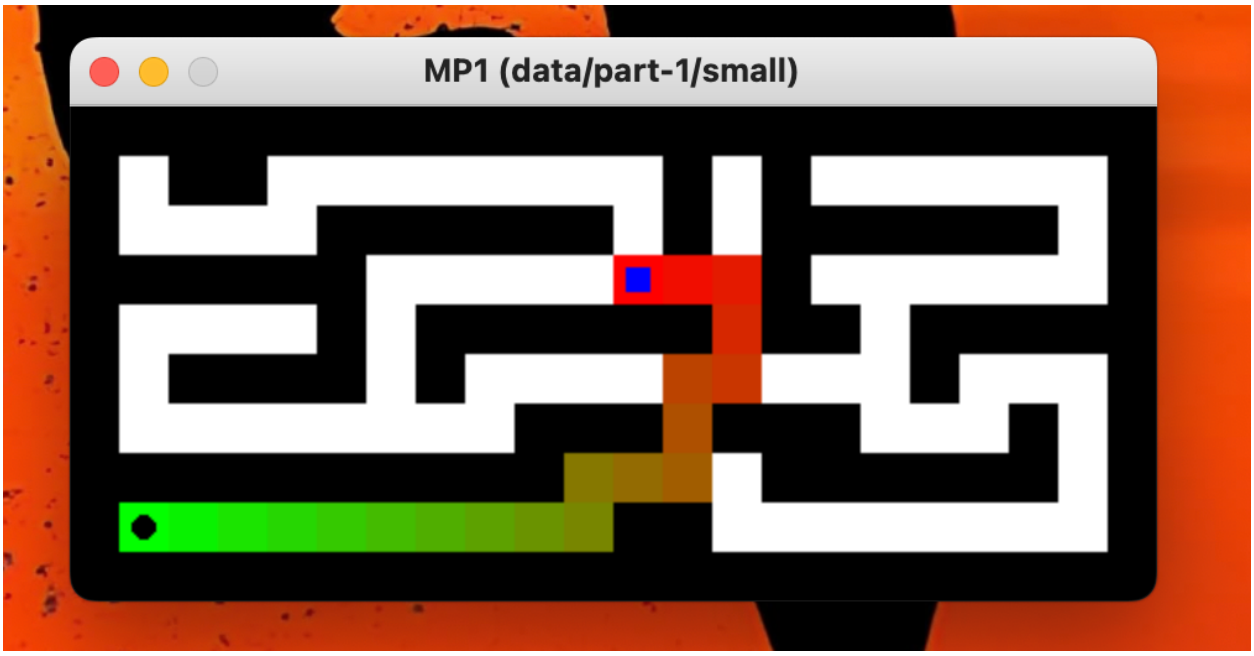



```
(base) marcosondruska@Marcoss-MacBook-Pro maze_puzzle % python3 main.py data/part-1/small --search dfs
pygame 2.5.2 (SDL 2.28.3, Python 3.8.1)
Hello from the pygame community. https://www.pygame.org/contribute.html

Results
{
    path length         : 50
    states explored     : 73
    total execution time: 0.00 seconds
}

(base) marcosondruska@Marcoss-MacBook-Pro maze_puzzle %
```

c) A* search




```
(base) marcosondruska@Marcoss-MacBook-Pro maze_puzzle % python3 main.py data/part-1/small --search astar_single
pygame 2.5.2 (SDL 2.28.3, Python 3.8.1)
Hello from the pygame community. https://www.pygame.org/contribute.html

Results
{
    path length         : 20
    states explored     : 56
    total execution time: 0.00 seconds
}

(base) marcosondruska@Marcoss-MacBook-Pro maze_puzzle %
```