COMP 3106 Assignment 1

Team Members

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Each group member has made significant contributions.
Each group member has made approximately equal contributions.

Contributions

Member	Contributions
Nico	Helper functions, Questions
Mark	A* search function, State node class
Adam	Graph creation functions, Proofs

Question 1

We implemented a goal-based agent, as our agent prioritizes acquiring the 5 total value coins before going to the goal square.

Question 2

- Fully Observable: Agent can see the whole grid with coins, walls, etc.
- Single Agent: Only 1 agent will be active.
- Deterministic: No randomness involved when Agent starts grabbing coins.
- Sequential: The actions the agents make effect future actions.
- Static: Environment doesn't change while agent makes decisions.
- Discrete: Only a finite number of states depending on the size of the graph.
- Known: Agent knows where coins, walls, and goal squares are.

Question 3

We use the Euclidean metric for the heuristic function. That is $h(n) = ||(x - x_g, y - y_g)||$ where (x, y) is the position of a node n and (x_g, y_g) for goal square. Then,

$$h(\text{goal}) = ||(x_g - x_g, y_g - y_g)|| = 0$$

For any node n' adjacent to n, we have $c(n, n') = 1$

$$\begin{aligned} ||(x - x_g, y - y_g)|| &\leq ||(x - x', y - y')|| + ||(x' - x_g, y' - y_g)|| \\ h(n) &\leq 1 + h(n') \\ &= c(n, n') + h(n') \end{aligned}$$

Hence, the heuristic h is consistent for all nodes n and successors n'.

Question 4

0	0	X	X	X	X
0	0	0	2	3	0
0	X	X	X	X	0
0	S	X	X	X	G
0	0	0	5	0	0

Running either algorithm, we start at (1,3) and then explore (0,3) and (1,4). Using uniform cost search, we would alternate between exploring the neighbors (0,3) and (1,4) and their neighbors and so on. Using A* search, we see that (1,4) is closer to the goal state with respect to the Euclidean distance so it would get explored first since they both travelled 1 square first (ie, the priority is the same). Consequently, its neighbors and neighbors neighbors will always be closest to the goal square and always gets explored first. Thus, we do not have to explore paths from (0,3) as in uniform cost search.

Question 5

5	X	X	0	0
S	0	2	2	G

In this example, when running a Greedy Heuristic Search on this graph, it would likely return the path where it goes directly immediately to the Goal square but not pick enough value of coins. Of course, this wouldn't be considered optimal. In our A* search, we will follow our heuristic to grab the 5 coin and then go to the Goal which would be the most optimal path.

Question 6

Our heuristic would still be consistent as, from the proof provided in 3, we could use the same parameters and it would result in the same answer even if the context was changed.