CS 440 : Intro to Artificial Intelligence

Assignment 1 : Fast Trajectory Replanning

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Part 1

a The first move of the agent is to the east because the first step of A* is to proceed along the "shortest presumed unblocked path". The agent "knows" that the cell is unblocked, because it is included in the original knowledge about the environment available to the agent.

b Since the grid is a finite number, 101 by 101 cells, the target will ultimately be reached. In the worst case scenario, the agent will visit all unblocked nodes and the target would have been visited. There are two different possibilities that can occur: one of them being that the target has been reached and added to the open list or the target hasn't been reached and the open list is empty. Regarding the latter, if this is the case, then the algorithm stops running and the target has not been visited meaning it hasn't been found.

Part 4

a The Manhattan distance is the distance between two points on a grid based on a strictly horizontal and/or vertical path. It is considered consistent because it is computed summing up the shortest possible horizontal and vertical distances, especially since the agent will not be moving diagonally in any direction. If the agent were to move diagonally, it wouldn't be considered consistent as the heuristic would overestimate the target.

b To show the stronger condition of consistency, we will use the form of the general triangle inequality: h(n) <= c(n,a,n') + h(n'). A heuristic h(n) is consistent if, for every node n and every successor n' of n generated by any action a, the estimated cost of reaching the goal from n is no greater than the step cost of getting to n' plus the estimated cost of reaching the goal from n'. Using this inequality, if there is an action cost increase, c would be the action cost before increase and c' would be the action cost after increase. The hnew(n) <= hnew(n') + c(n,a,n') <= hnew(n') + c'(n,a,n'). Looking at this, we can see the heuristic is left consistent.