

Task 1 -c

i.) **Why is it important to have an admissible heuristic in A* to ensure optimality ?**

An optimal solution is the one that has the lowest path cost among all solutions. A heuristic $h(n)$ is admissible if it never overestimates the true cost. An admissible heuristic $h(n)$ either gives the actual cost of how far I am from the goal or it gives an underestimate i.e. heuristic value is smaller than the actual cost it would take. However, admissible the heuristic $h(n)$ will never give an overestimate i.e. it should never tell that I am further away from the goal than I actually am. If the heuristic is not admissible, then it might cause us to visit states that we don't need and if that happens, the solution we will get will be not optimal.

ii.) **In addition to admissibility, A* also requires monotonicity in graph based problems. You are required to do some readings to understand monotonicity requirement of A*. Describe it in your own words.**

If we examine the search trees we saw in class, we can observe that along any path from the root, the value of $f(n)$ never decreases. In other words, the heuristic $h(n)$ is consistent i.e. for every node n and its successor n' with step c , $h(n) \leq h(n') + c$. This means that the estimated path cost to the goal of a new node in addition to the cost of transitioning to it from the previous node is greater or equal to the estimated path cost to the goal of the previous node. The heuristic $h(n)$ for which the above equation holds is said to exhibit monotonicity.