# Project 1 Solution

### October 12, 2024

## **Question 7a:**

I chose to use the Manhattan distance formula for the DoubleMove heuristic (h3) because, like the **original Manhattan heuristic**, it does not overestimate the optimal cost, ensuring the heuristic is admissible. This means h3 is consistent with the property of triangular inequality, allowing it to guide the search effectively without compromising optimality.

However, the key improvement in h3 lies in its allowance for double moves during a single best-neighbor search, which enables the algorithm to explore more distant states in fewer steps. By permitting these double moves, h3 offers a significant advantage over single-move heuristics, especially in cases where a sequence of single moves would otherwise be required. This efficiency opens up opportunities to skip certain intermediate states, potentially reducing the number of iterations needed in the search.

Importantly, A\* remains optimal when using h3, as it still guarantees the shortest path to the goal. The combination of the Manhattan distance's admissibility and the flexibility of double moves ensures that the A\* algorithm not only finds the optimal solution but also does so more efficiently in certain cases, making h3 a powerful heuristic for this problem.

