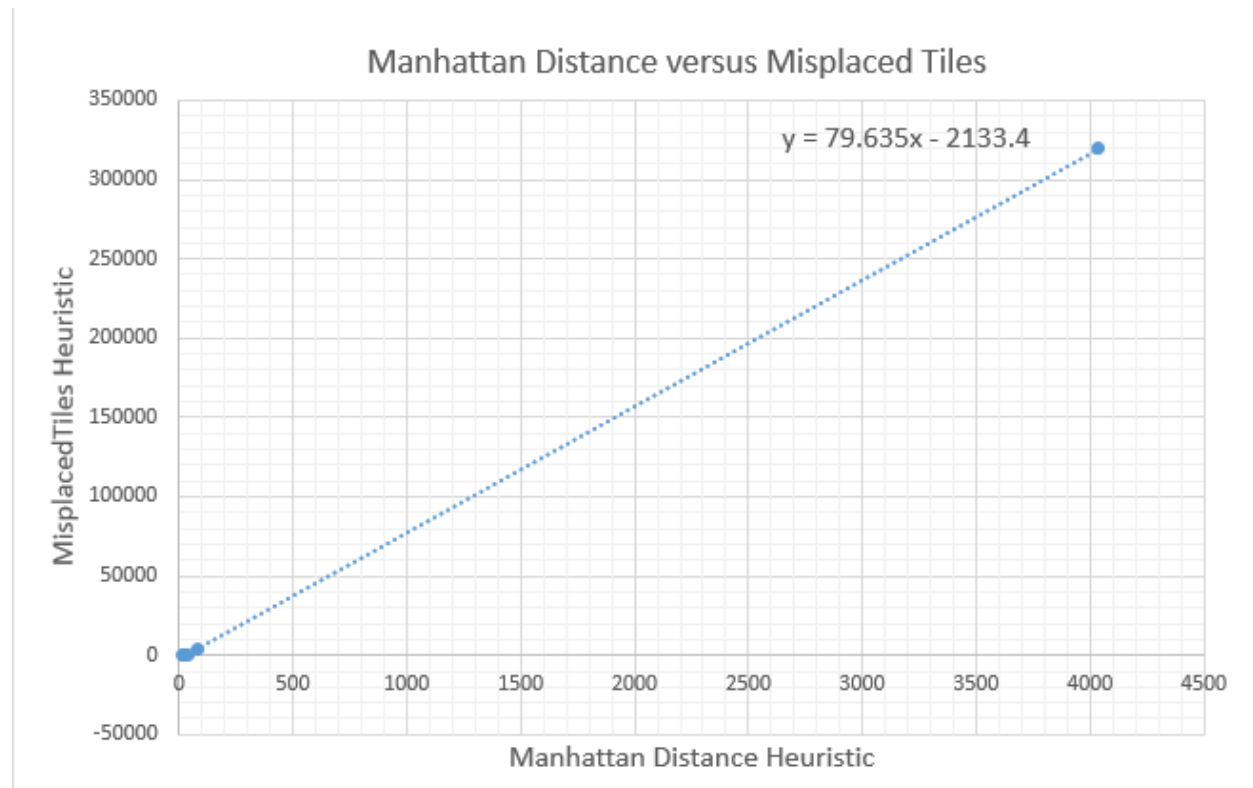


Introduction to Artificial Intelligence: Assignment 1

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Question 1

- a) Both Manhattan distance and misplaced tiles produced solutions of equal cost; however, Manhattan distance reaches the goal state with consistently less nodes expanded (leading to less search time) and therefore is a better heuristic.
- b) Excluding Hard Test 1, the relationship between Manhattan Distance and Misplaced Tiles resemble that of an exponential function. Adding in the point for Hard Test 1 greatly increases the domain and range of the graph and shows the function of be approximately linear with a steep slope of ≈ 80 : for every 1 node Manhattan Distance explores, Misplaced Tiles explores 80 nodes.



Question 2

- a) Both sum delivery cost and max delivery cost are admissible heuristics. If the courier is allowed to only carry one package at a time, both heuristics will still underestimate future lost revenue because lost revenue is calculated assuming we will immediately travel to deliver the package.
- b) The purpose of the hashable_state is to implement full cycle checking for a specific problem and each problem is defined by a single unique map. The location map is

information that is common to all states in this problem and therefore need not be included in the hashable_state.

- c) If the other parts of the state are all included in the hashable_state, then the derived state need not be included.
- d) Forbidding pickup actions to be made at drop-off locations for jobs they are currently carrying affects neither the existence of a solution nor the cost of the optimal solution. Blocking these actions can make the search more efficient because the heuristics are designed to favour pickups compared to drop-offs, but delaying drop-offs decreases the potential profit to be made.
- e) If the pickup can be made immediately, then the courier should pick-up the package because in essence, no time is lost. However, if the courier must wait for a certain amount of the time before the package is available for pickup, then it might be more efficient for the courier to complete other actions (such as traveling to other locations for drop-offs) instead of the waiting for the package to be ready for pickup.
- f) Pertaining to specifically this problem, we can ignore the current time and only use the achievements of the state (jobs currently being carried, current location, current money earned, and unstarted jobs) to create hashable_state.