Artificial Intelligence
Coursework – Report – C1722325

Part 1

The trivial heuristic of always returning 0 as an estimated distance to goal makes it equivalent to breadth-first search. It goes through layer by layer until finding the solution which in our case can be very costly. On the contrary, the heuristic I have chosen can estimate the distance to the goal using 2 factors that can help the A* algorithm choose a more optimal move that brings it closer to the goal. Firstly, I check the number of cars blocking the main car to the goal. If there is the estimated distance would be the number of cars plus 1 for the extra move the car would make to reach the goal. If there is no car blocking the car the result would be 0. Secondly, I check again the number of cars blocking those cars from moving. If the car is blocked from both direction a car blocking them has to make a move to free them in order to move to a possible solution. Adding both of these heuristics up gives making it a hybrid gives us much better results in the overall outcome comparing to the trivial solution. With results that had been gathered I have seen a significant improvement in every aspect.

Trivial Heuristic: random1.txt 423 627 6
Hybrid Heuristic: random1.txt 105 92 6

Without any change in the testing environment I have observed a 402% improvement in time taken to reach the goal and a 581% improvement for number of nodes expanded while still having the same cost when executing the program on the random1.txt file that was given. These findings show us that there is an obvious and significant improvement when using the hybrid heuristic over the trivial heuristic.

Part 2

The hybrid heuristic I have chosen can be considered admissible since it never overestimates the true cost to reach the goal state. The first part being the number of cars blocking our main car is admissible since they have to move in order for the car to reach the goal. We get this estimated distance by counting the number of those cars and we also add 1 since we have to consider the move the car has to make when going to the goal. For the second part of the heuristic we test if those cars are blocked too. To count this estimate we go through all of the cars in the 1st part and check if each car is blocked in both sides and add 1. Since they are unable to move, we know that another move needs to be made to free them. The factors used never overestimate the cost function, so they are admissible.

Part 3

A strategy that can further improve my chosen heuristic is to add another factor in my already chosen heuristic which would be the distance of the car to the goal. Since the distance can be bigger than the actual cost needed to reach the goal it will make my heuristic inadmissible. This can cause an increase in the cost of the moves made to reach the goal, but I have observed a substantial improvement in the time taken and the number nodes expanded.

Hybrid Heuristic: random5.txt 8111 8454 8
Triple Heuristic: random5.txt 1634 960 8