Advanced Heuristic

The distance-to-goal heuristic function is the proposed advanced heuristic function for this Hua Rong Dao puzzle algorithm, which is calculated by the distance between the tiles and their goal states combined with the number of blocking tiles in between.

The Manhattan distance is the sum of horizontal and vertical distances between the initial point and the goal point which is the simple heuristic function of the problem. For the blocking tiles, calculate the Manhattan distances of them to get out of the way to let the key tile which is the 2 by 2 tile be able to move the goal state, and add all the distances together which is the new heuristic value. To be clear, there might be few possible movements or paths to achieve this task, and the smaller the heuristic value means closer to the goal state.

The value for the Manhattan distances for the blocking tiles will always be smaller than the actual costs since there is no consideration of the conflict between different tiles. It is not an actual step to achieve the goal state, so it will always be smaller or equal to the exact steps needed. In summary, the Distance-to-Goal Heuristic is admissible because it provides a lower bound estimate of the number of moves required to reach the goal state, which ensures that the search algorithm will find the optimal solution if one exists.

This is the advanced version of the Manhattan distance heuristic since it takes consideration of blocking tiles in between, the value will be greater or greater than the original Manhattan distance which approves the condition for h(2) >= h(1) for all cases, and for all the cases that there is blocking tiles between the goal state, h(2) > h(1). The Distance-to-Goal Heuristic can dominate the Manhattan distance heuristic in the Hua Rong Dao puzzle by providing a more accurate estimate of the number of moves required to reach the goal state, and by leading to a faster and more efficient search.