1. Describe how one can calculate the advanced heuristic value for any state of the puzzle.

   For heuristic value, we also include the empty space. Calculate the horizontal difference and vertical difference between the target 2*2 chess and goal state same as the Manhattan distance, and + 1 if the two empty spaces are not both inside the vertical difference * horizontal difference area. The final calculation will be the new advanced heuristic value.

2. Why is your advanced heuristic admissible?

   The rectangle area we consider is made by the top left angel of the target 2*2 chess with the bottom right angel of the goal states, if the two space are in this area, it is same as Manhattan distance. If the two space are not in the area, we decrease it's priority by plus one, for two space in the area , the priority is same as Manhattan distance. For two space not in the area, since to move the target 2*2 chess to the destination require 2 empty space adjacent each other on one side of the 2*2 chess. If the empty spaces are not in the area. The target 2*2 chess is not possible to get closer to the goal state before these two empty inside the area. To make those two empty spaces inside the area take at least one step. So, we add one to this case and it will not overestimate.

3. Why does your advanced heuristic dominate the Manhattan distance heuristic?

   2 cases. 1. two empty spaces in the area 2. two empties in the area. If two empties in the area. The heuristic value is equal to the Manhattan distance. If there are not two empties in this area. The heuristic value is Manhattan distance + 1. Therefore, according to the dominating heuristics, for all states n, h(n) <= h(n)*, and there exist at least one n such that h(n) < h(n)*