CSC384 - Assignment 1 - Advanced Heuristic

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Task: Create an admissible heuristic that dominates the manhattan distance heuristic
Admissible heuristic: for every state n, 0<= h(n) <= h*(n) - that is the heuristic underestimates the true cost to the goal state
Dominant heuristic: h1(n) dominates h2(n) if and only if: h1(n) >= h2(n) for every state n and h1(n) > h2(n) for at least one state - that is, the heuristic estimates better in at least one state and performs the same in all other states than the other heuristic.

What is the heuristic: From class, we can take a relaxed solution (manhattan heuristic) and then add more to it - still keeping it admissible
My heuristic will still remain simple and will utilize the manhattan heuristic. Calculate the manhattan heurisitc and on top of that for every piece that the goal piece must move through add one cost to the heuristic. -> manhattan distance + pieces in the way of the path

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

The same way with the manhattan heuristic and when checking the manhattan distance path that you used to calculate the distance, find how many pieces are in the way for the goal piece to the goal state. This will actually mean you need to keep track of the path for the manhattan distance path used instead of just doing simple x and y coordinate math - and actually find the path used and see the pieces involved.

2. Why is your advanced heuristic admissible

This is admissible as if there are no pieces in the way of the goal piece to the goal state, then h(n) h*(n), and when there are pieces in the way, the minimum possible cost would to move the piece out of the way such that it is not in the way which would equate to a minimum possible cost of 1. Thus h(n) of my heuristic will always be <= to h*(n). h(n) will always be 0<=h(n) as the heuristic cannot be negative and when the goal state is reached the heuristic will be 0.

The true cost when a piece is in the way will always be equal to the manhattan distance + the number of pieces in the way of the path of the goal piece to the goal state + other. Where other are intangibles not being calculated and are out of the scope for this assignment. If a piece is in the way, it will take at minimum 1 cost to “clear” the path for the goal piece to reach the goal state - this means that h(n) of my heuristic will never be larger than the true cost and will always be >= to 0 as no negatives

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

It will always dominate the manhattan heuristic as it uses the manhattan heuristic and thus can never be less than the manhattan heuristic which satisfies the first statement in the def above. And if there is a piece in the way of the goal state, then the heuristic will be incremented by 1 whereas the manhattan heuristic otherwise would give a cost of one less. Thus satisfying the second statement to the dominant heuristic def.