Programs1

Name: Kaichen Zhang ID:4000016

Heuristic 1: Straight Line distance can always find the optimal solutions without overestimate the cost. Because it will be even more accurate than Manhattan distance.
For example:
Goal:{1,2,3,8,B,4,7,6,5} input Board:{2,8,3,1,6,4,7,B,5}
H = 1+1.41+1+1+1=5.41 which is not higher than the lowest possible cost from current board state to the goal.

Heuristic 2: Sum of Permutation Inversions. This heuristic is inadmissible because that the sum of permutation inversions could overestimate the cost.
For example:
Goal:{1,2,3,8,B,4,7,6,5} input Board:{2,8,3,1,6,4,7,B,5}
H = 1+6+1+1+1+2+0+0=12 which is overestimated.

Running Test

	Straight Line Distance	Sum of Permutation Inversions
Input list	2 8 3 1 6 4 7 B 5	2 8 3 1 6 4 7 B 5
Time cost	7milliseconds	8milliseconds
Solution steps	6	6

	Straight Line Distance	Sum of Permutation Inversions
Input list	3 7 5 8 2 1 4 B 6	3 7 5 8 2 1 4 B 6
Time cost	4396milliseconds	1532milliseconds
Solution steps	20	40

	Straight Line Distance	Sum of Permutation Inversions
Input list	4 3 5 7 B 1 2 8 6	3 7 5 8 2 1 4 B 6
Time cost	2267milliseconds	1227milliseconds
Solution steps	19	37

	Straight Line Distance	Sum of Permutation Inversions
Input list	7 2 5 4 3 1 6 8 B	7 2 5 4 3 1 6 8 B
Time cost	5376milliseconds	2908milliseconds
Solution steps	21	51

	Straight Line Distance	Sum of Permutation Inversions
Input list	5 4 1 3 6 2 7 B 8	5 4 1 3 6 2 7 B 8
Time cost	35278milliseconds	1024milliseconds
Solution steps	24	34

	Straight Line Distance	Sum of Permutation Inversions
Input list	3 2 B 4 1 5 7 6 8	3 2 B 4 1 5 7 6 8
Time cost	4439milliseconds	407milliseconds
Solution steps	21	35

	Straight Line Distance	Sum of Permutation Inversions
Input list	4 7 5 2 B 6 8 3 1	4 7 5 2 B 6 8 3 1
Time cost	24636milliseconds	1288milliseconds
Solution steps	23	39

	Straight Line Distance	Sum of Permutation Inversions
Input list	7 5 6 4 3 2 8 1 B	7 5 6 4 3 2 8 1 B
Time cost	65336milliseconds	3782milliseconds
Solution steps	25	39

From these 5 tables we can see that admissible heuristic is costing more time than inadmissible heuristic. Because it never overestimate the cost, the admissible heuristic can output the optimal solution, the solution of inadmissible heuristic is worse or equal to the solution of admissible heuristic.

For the inadmissible heuristic, it prefers to output more quickly rather than output the most efficient solution, because it will overestimate. Inadmissible heuristic is more time efficiently than admissible heuristic, but less effectively than admissible heuristic.

I test about 20 solvable puzzle boards input, and 5 unsolvable puzzle boards input to check the correctness of my program.