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Project 1, A* algorithm

I wrote an AStar base class which can be found in astar.py. The AStar class implements the astar search function. The PermutationAStar class inherits from the AStar class and overrides the h_score and children functions. My implementation can handle permutations of up to size 11 in a 10 minute time frame. This code can likely be improved to permutations of size 12 or 13 by optimizing the structure and perhaps using a lower level language, but in terms of the algorithm and big O everything appears to be working correctly. Below are some examples of permutation size 9 - 11. The code can be run by executing the following command: python project1.py

Sample Inputs

What is the size of the permutation?
9
What is the permutation? Ex: 8 7 2 6 9 3 1 5 4
8 7 2 6 9 3 1 5 4
Input : [8, 7, 2, 6, 9, 3, 1, 5, 4]
Move 1: [8, 7, 2, 1, 3, 9, 6, 5, 4]
Move 2: [8, 9, 3, 1, 2, 7, 6, 5, 4]
Move 3: [2, 1, 3, 9, 8, 7, 6, 5, 4]
Move 4: [1, 2, 3, 9, 8, 7, 6, 5, 4]
Move 5: [1, 2, 3, 4, 5, 6, 7, 8, 9]
Nodes visited: 1482
time elapsed: 753 milliseconds

What is the size of the permutation?
10
What is the permutation? Ex: 8 3 1 2 10 4 7 9 6 5
8 3 1 2 10 4 7 9 6 5
Input : [8, 3, 1, 2, 10, 4, 7, 9, 6, 5]
Move 1: [8, 3, 1, 2, 7, 4, 10, 9, 6, 5]
Move 2: [8, 7, 2, 1, 3, 4, 10, 9, 6, 5]
Move 3: [8, 9, 10, 4, 3, 1, 2, 7, 6, 5]
Move 4: [2, 1, 3, 4, 10, 9, 8, 7, 6, 5]
Move 5: [1, 2, 3, 4, 10, 9, 8, 7, 6, 5]
Move 6: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
Nodes visited: 11912
time elapsed: 8175 milliseconds

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What is the size of the permutation?
10
What is the permutation? Ex: 5 4 2 10 3 6 8 9 7 1
1 10 2 9 3 8 4 7 5 6
Input : [1, 10, 2, 9, 3, 8, 4, 7, 5, 6]
Move 1: [1, 2, 10, 9, 3, 8, 4, 7, 5, 6]
Move 2: [1, 2, 10, 9, 8, 3, 4, 7, 5, 6]
Move 3: [1, 2, 10, 9, 8, 7, 4, 3, 5, 6]
Move 4: [1, 2, 3, 4, 7, 8, 9, 10, 5, 6]
Move 5: [1, 2, 3, 4, 5, 10, 9, 8, 7, 6]
Move 6: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
Nodes visited: 6331
time elapsed: 4399 milliseconds

What is the size of the permutation?
10
What is the permutation? Ex: 5 2 7 6 1 10 4 8 3 9
5 2 7 6 1 10 4 8 3 9
Input : [5, 2, 7, 6, 1, 10, 4, 8, 3, 9]
Move 1: [5, 6, 7, 2, 1, 10, 4, 8, 3, 9]
Move 2: [5, 6, 7, 8, 4, 10, 1, 2, 3, 9]
Move 3: [5, 6, 7, 8, 4, 10, 9, 3, 2, 1]
Move 4: [5, 6, 7, 8, 9, 10, 4, 3, 2, 1]
Move 5: [10, 9, 8, 7, 6, 5, 4, 3, 2, 1]
Move 6: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
Nodes visited: 5371
time elapsed: 3812 milliseconds