A-star Improvements

Selected puzzle: AFB0DEGCMOJKHILN (Depth 31)

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| Version | Improvement/Investigation | Time (s) | Kept? |
| Astar1 | - Starting code | 32.764 |  |
| Astar3bkt | - Implemented bucketing in search | 14.362 |  |
| AstarHeapQ | - Switched out PriorityQueue for heapq (going off Astar1) | 10.543 | yes |
| AstarMNHT | - created a global variable mnhtDict = {(from, to) : Δx+Δy}  - instead of doing the subtraction/addition for each tile in the puzzle, just get Δx+Δy from mnhtDict and add them all  - after writing working for-loops, switched them to comprehensions | 4.756 | yes |
| AstarNBR1 | - used comprehension rather than nbrs.append  - changed swapping – made separate method ‘swapChars’ and slice once rather than twice | 3.028 | yes |
| AStarNBR2 | - changed neighbors to return [(neighbor, location of its space), (nbr, space), etc] rather than just list of neighbors  - purpose is to avoid using .find(space) each time neighbors is called | 2.289 | yes |
| AStarMNHTbkt | - applied the same improvement from AStarMNHT to my bucketed code to see how it’d turn out  - created a global variable mnhtDict = {(from, to) : Δx+Δy}  - instead of doing the subtraction/addition for each tile in the puzzle, just get Δx+Δy from mnhtDict and add them all  - after writing working for-loops, switched them to comprehensions | 4.007 | no |
| AstarNBR1bkt | - applied same improvement from AstarNBR1 to bucketed code to see how it’d turn out  - used comprehension rather than nbrs.append  - changed swapping – made separate method and slice once rather than twice | 3.665 | no |
| AstarMNHT3 | - idea to put the previous manhattan distance into openSet and compare it to the to\_ and from\_ values of the neighbor, adding or subtracting 1 to get the new manhattan distance rather than recalculating entirely  - to\_ and from\_ in my code represent where the space moved to, and where from  - as of now some bug is preventing it from running correctly but would like to make it work |  |  |