8-Puzzle Performance Analysis

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**CSC 480- Artificial Intelligence I**

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This will present and briefly analyze the performance output for the 8-Puzzle project.

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| **Easy Puzzle** | 134862705 |  |  |
| **Search Type** | **Solution Length** | **Nodes Visited** | **Time (msec)** |
| Breadth First | 5 | 40 | 1 |
| Depth First | 24001 | 161686 | 355 |
| Iterative Deepening | 5 | 105 | 2 |
| Greedy Min Wrong | 5 | 6 | 0 |
| Greedy Min Distance | 5 | 6 | 0 |
| A\* Min Wrong | 5 | 6 | 1 |
| A\* Min Distance | 5 | 6 | 0 |
| A\* Iterative Deepening | 5 | 71 | 3 |

* All (except breadth-first) found optimal solution. Greedy is not guaranteed to find optimal solution but it was a trivial puzzle so it did.
* Depth-first search found a fascinatingly awful solution deep in the tree. This shows the major shortcoming of breadth-first in a domain with multiple solutions.
* Informed searches were better than uninformed.

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| **Medium Puzzle** | 281043765 |  |  |
| **Search Type** | **Solution Length** | **Nodes Visited** | **Time (msec)** |
| Breadth First | 9 | 400 | 1 |
| Depth First | 23 | 181420 | 245 |
| Iterative Deepening | 9 | 1103 | 5 |
| Greedy Min Wrong | 23 | 24 | 1 |
| Greedy Min Distance | 23 | 150 | 8 |
| A\* Min Wrong | 9 | 25 | 1 |
| A\* Min Distance | 9 | 15 | 0 |
| A\* Iterative Deepening | 9 | 718 | 21 |

* The expected searches all found optimal solution. Depth-first and Greedy did not find optimal solution; however they are not guaranteed to do so.
* Depth-first search visited ~99.9% of the reachable puzzle states before finding solution, again showing its shortcomings.
* Informed searches were better than uninformed.

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| **Hard Puzzle** | 567408321 |  |  |
| **Search Type** | **Solution Length** | **Nodes Visited** | **Time (msec)** |
| Breadth First | 30 | 181364 | 898 |
| Depth First | 4578 | 4702 | 10 |
| Iterative Deepening | 30 | 1723095 | 6638 |
| Greedy Min Wrong | 116 | 602 | 19 |
| Greedy Min Distance | 60 | 208 | 2 |
| A\* Min Wrong | 30 | 115158 | 21799 |
| A\* Min Distance | 30 | 749 | 6 |
| A\* Iterative Deepening | 30 | 1542480 | 98477 |

* The expected searches all found optimal solution. Depth-first and Greedy did not find optimal solution; however they are not guaranteed to do so.
* Depth-first search again found very sub-optimal solution.
* Breadth-first search visited ~99.9% of the reachable puzzle states before finding solution.
* Informed searches were mostly better than uninformed, however A\* min wrong must have unluckily avoided the best path to the solution as it worked through its queue.

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| **Impossible** | 123456780 |  |  |
| **Search Type** | **Solution Length** | **Nodes Visited** | **Time (msec)** |
| Breadth First |  | 181440 | 856 |
| Depth First |  | 181440 | 213 |
| Iterative Deepening |  | 1819407 | 7133 |
| Greedy Min Wrong |  | 181440 | 15300 |
| Greedy Min Distance |  | 181440 | 15632 |
| A\* Min Wrong |  | 181440 | 40010 |
| A\* Min Distance |  | 181440 | 18377 |
| A\* Iterative Deepening |  | 1819407 | 134819 |

* All searches visited all of the reachable puzzle states from the starting position 123456780; however these are all unreachable from the 123804765 goal state, thus failure.