Partner 1: Gordon McCulloh

UWNet ID: mcculloh

SN: 2027940

Partner 2: Arnav Khera

UWNet ID: akhera29

Assignment 2 Report – Heuristic Search

CSE 415: Introduction to Artificial Intelligence

Spring, 2021

1. Results with Heuristics for the Eight Puzzle

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Puzzle** | **Heuristic** | **Solved?** | **# Soln Edges** | **Soln Cost** | **# Expanded** | **Max OPEN** |
| A | None (UCS) | Y | 7 | 7.0 | 166 | 101 |
| A | Hamming | Y | 7 | 7.0 | 7 | 6 |
| A | Manhattan | Y | 7 | 7.0 | 7 | 6 |
| B | None (UCS) | Y | 12 | 12.0 | 1490 | 898 |
| B | Hamming | Y | 12 | 12.0 | 95 | 72 |
| B | Manhattan | Y | 12 | 12.0 | 34 | 25 |
| C | None (UCS) | Y | 14 | 14.0 | 4070 | 2290 |
| C | Hamming | Y | 14 | 14.0 | 195 | 127 |
| C | Manhattan | Y | 14 | 14.0 | 56 | 39 |
| D | None (UCS) | Y | 16 | 16.0 | 7982 | 4700 |
| D | Hamming | Y | 16 | 16.0 | 592 | 368 |
| D | Manhattan | Y | 16 | 16.0 | 155 | 98 |

Puzzle A: [3,0,1,6,4,2,7,8,5]

Puzzle B: [3,1,2,6,8,7,5,4,0]

Puzzle C: [4,5,0,1,2,8,3,7,6]

Puzzle D: [0,8,2,1,7,4,3,6,5]

1. Evaluating Our Custom Heuristics

We see that implementing an admissible heuristic greatly improves the performance of the search algorithm. Both the number of states expanded and the maximum open list decrease exponentially, indicating less cost to computing power and memory required to solve the puzzle. We also note that the Manhattan distance is a better heuristic than Hamming, which likely comes from the fact that the former dominates the latter (i.e. greater or equal static evaluation for each possible state away from the goal node). This dominance becomes more evident for more difficult solution paths, which tells us that a well-designed heuristic function is important to more difficult problems that encroach upon our computing power.