ANA* Implementation Report

Overview:

ANA* is an anytime discrete search algorithm. Conventional A* search provides an optimal solution given an admissible heuristic. For higher dimensional search spaces, this approach may not be feasible for anytime applications where a feasible solution would be more important than a optimal solution. Weighing the heuristic can help tweak the A* algorithm by inflating the heuristic. Some variants that use this modification are the Weighted A* , ARA* and ANA*.

A* Search:
A* Search uses a heuristic to expand on the current nodes. The heuristics facilitate a guided search based on the selection of the heuristic. Given an admissible heuristic, an optimal solution is definitely found but for search in higher dimension, the time taken to return a search result may be too high for some real time applications.
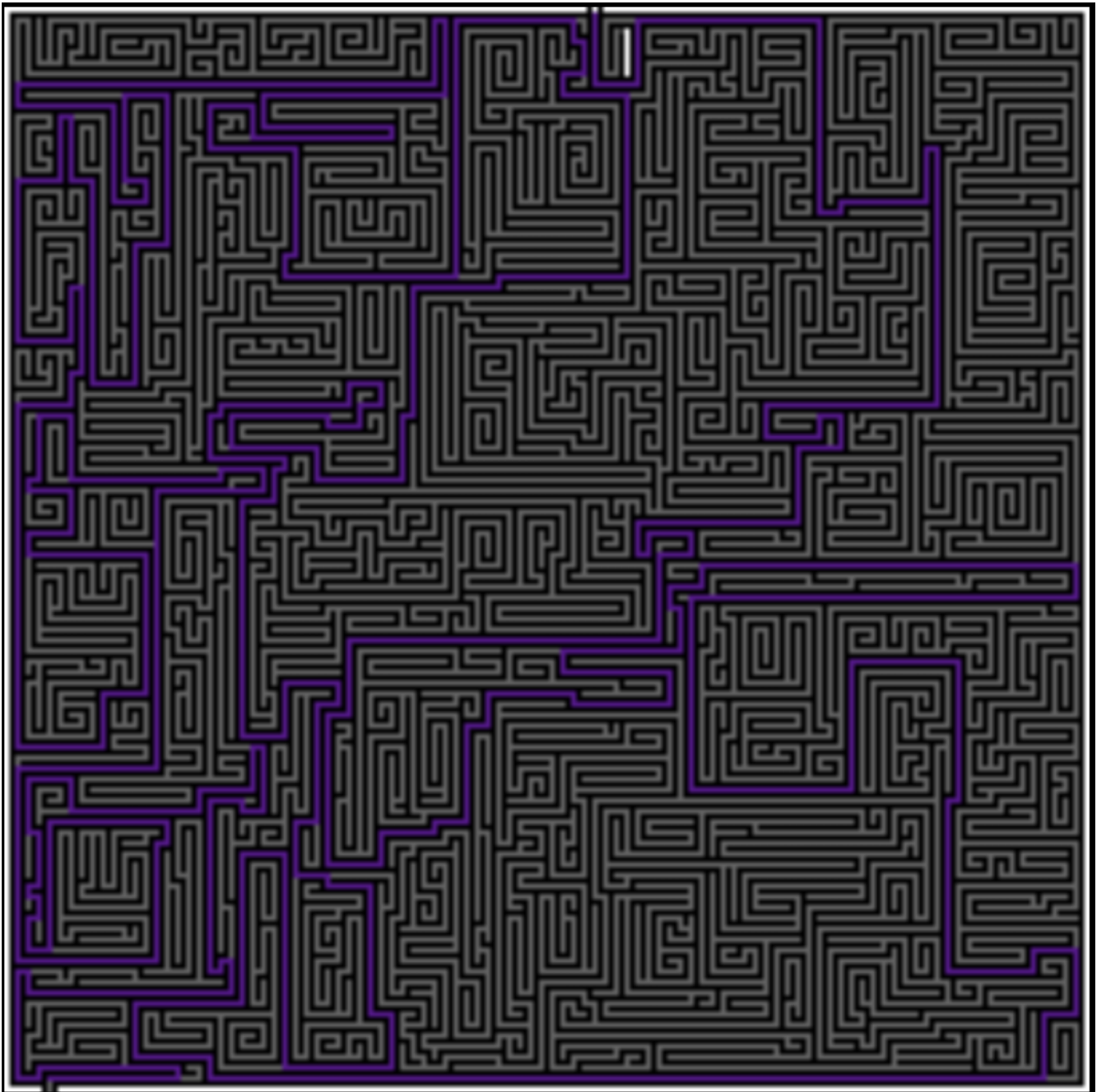**Experiment Results**

Map: trivial.png
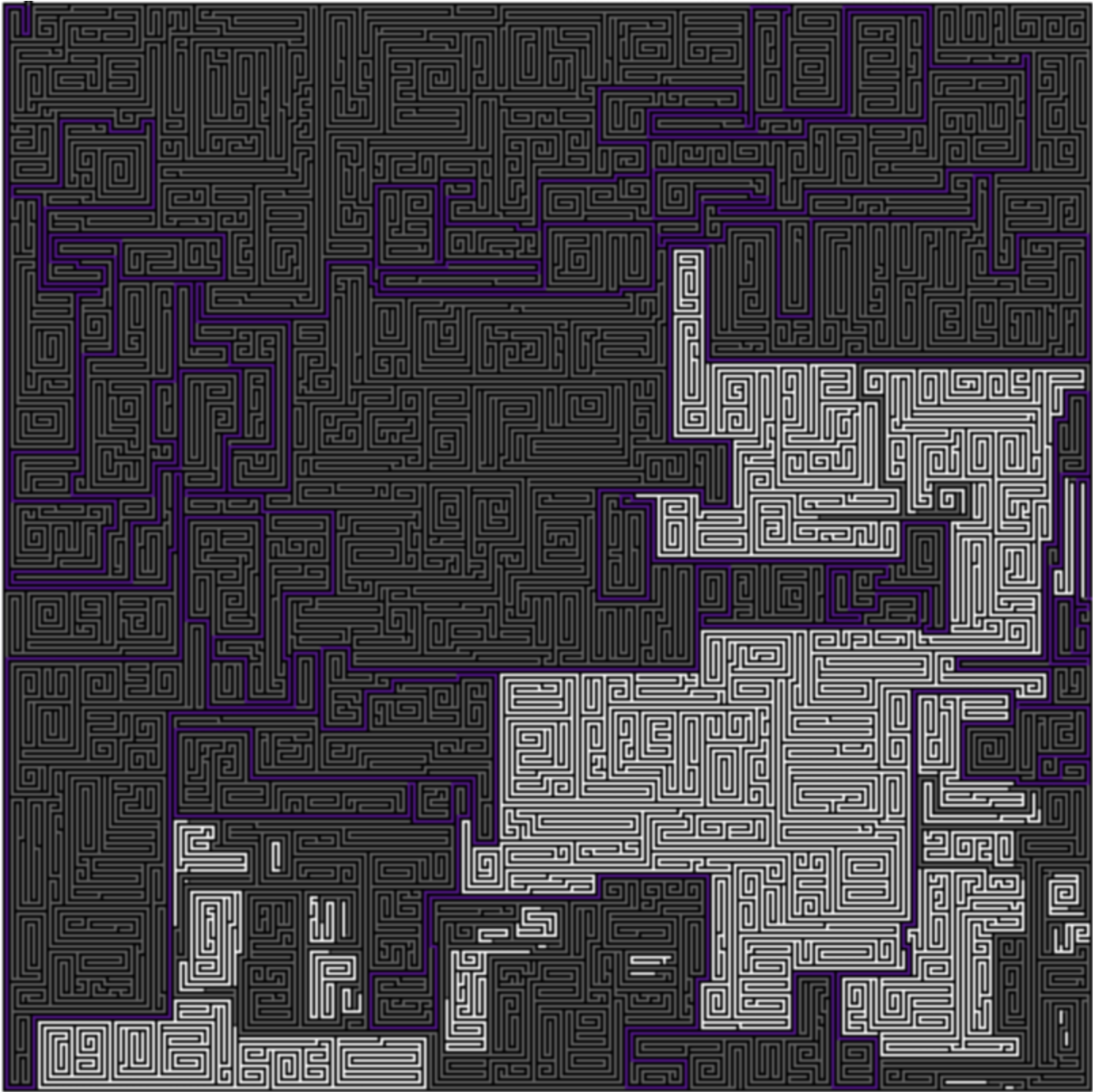A* Search took 0.00164914131165 seconds
Optimal Path Length 146 using L1 Heuristic

Map: medium.gif
A* Search took 0.194492101669 seconds
Optimal Path Length 3226 using L1 Heuristic

Map: hard.gifA* Search took 0.687083005905 seconds
Optimal Path Length 8286 using L1 Heuristic
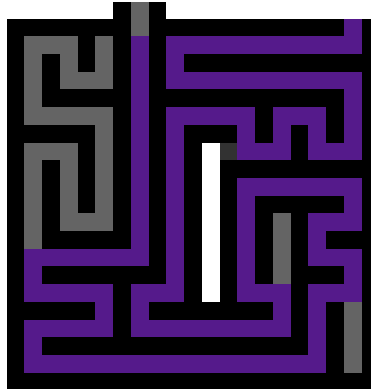
Map: very_hard.gif
A* Search took 7.17385792732 seconds
Optimal Path Length 18062 using L1 Heuristic

Weighted A* Search:

Weighted A* inflates the heuristic by a weighing factor which provides a suboptimal solution. The weighing factor controls the speed of convergence and optimality. This weighing factor needs to be set manually.
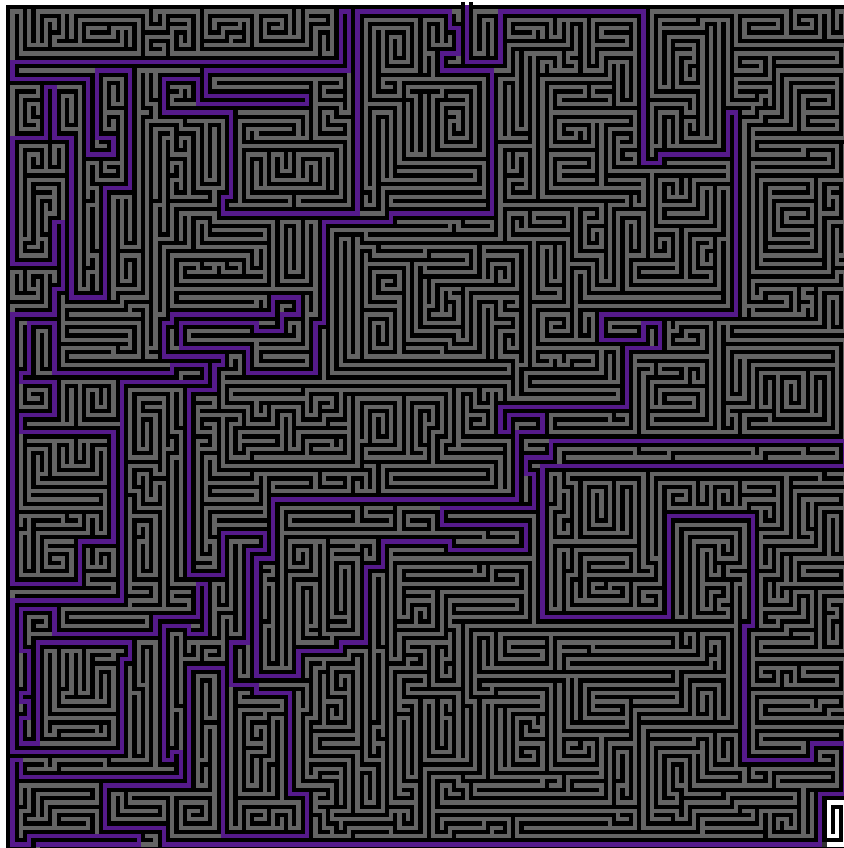
Experimental Results:

Map: trivial.gif
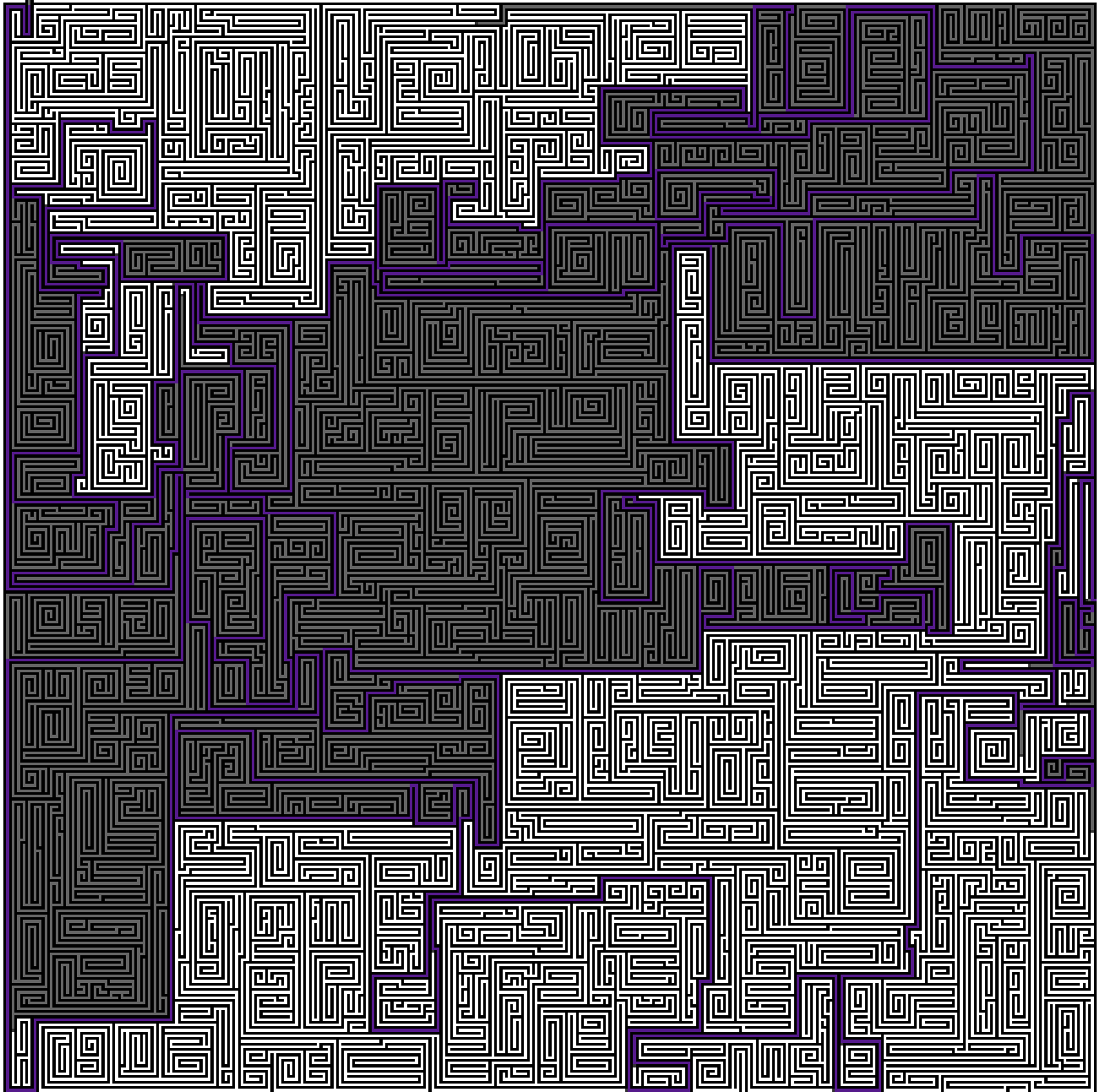WA* Search took 0.00152587890625 seconds with weight 200
Optimal Path Length 146 using L1 Heuristic

Map: medium.gif
WA* Search took 0.167681932449 seconds with weight 200
Optimal Path Length 3226 using L1 Heuristic

Map: hard.gif
WA* Search took 0.439811944962 seconds with weight 200
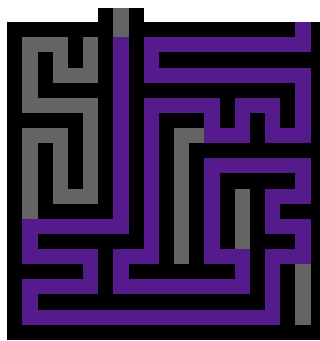Optimal Path Length 8286 using L1 Heuristic

Map: very_hard.gifWA* Search took 4.54029297829 seconds with weight 200
Optimal Path Length 18062 using L1 Heuristic
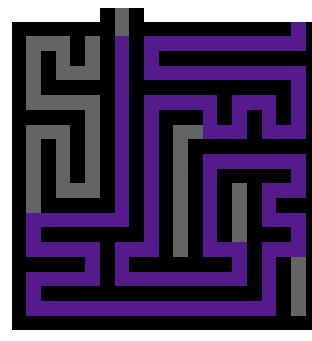
ANA* Search:

This approach doesn't need the selection of weight factor or other parameters. It expands nodes based on the deviation of cost from the current optimal cost. This adaptive selection initially emphasizes greedy search thus providing a feasible solution fast. These results are improved with iterations and each successive result is a strict improvement over the former.
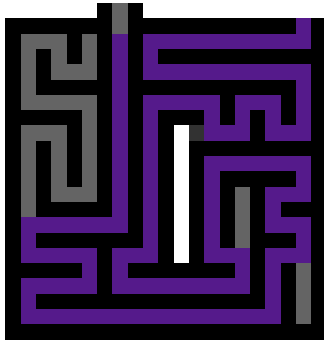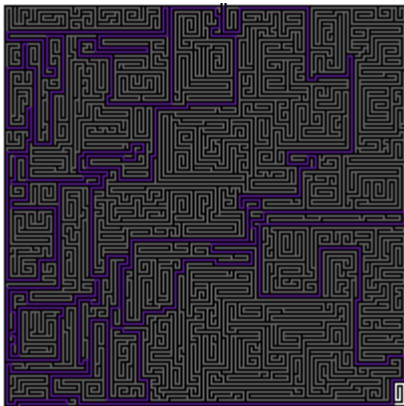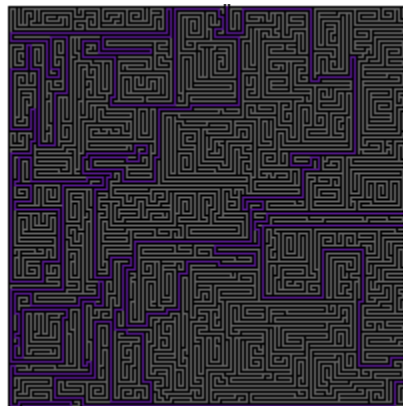

| Suboptimal 1 | Suboptimal 2 | Optimal |

Map: trivial.gif
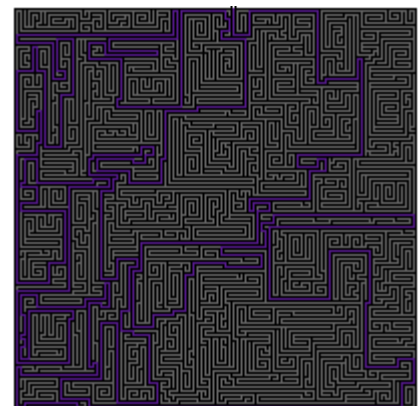ANA* Search took 0.0110740661621 seconds
Optimal Path Length 146 using L1 Heuristic

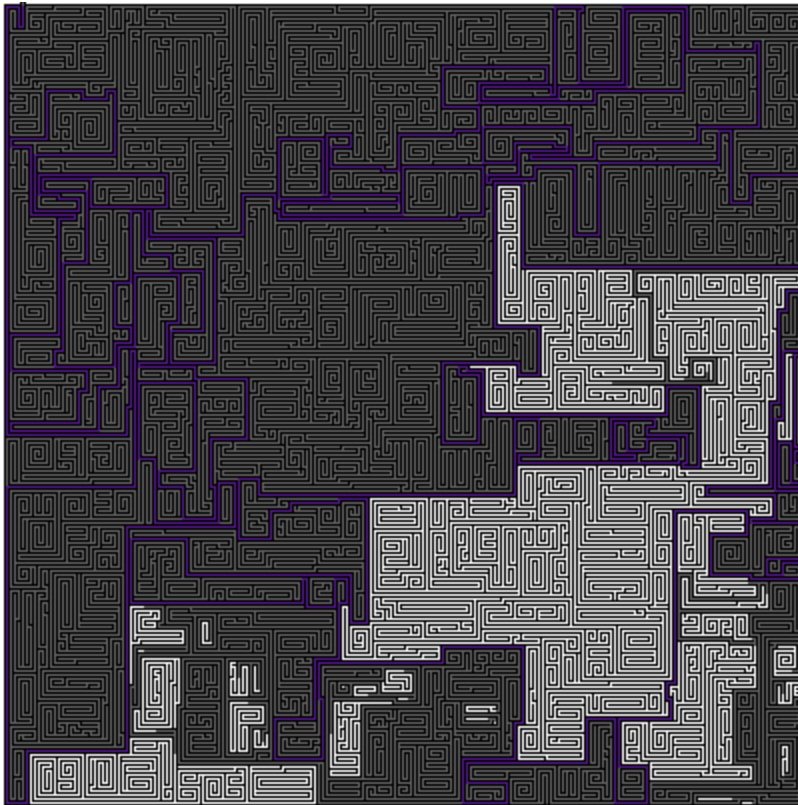

| Suboptimal 1 | Suboptimal 2 | Optimal |

Map: medium.gif
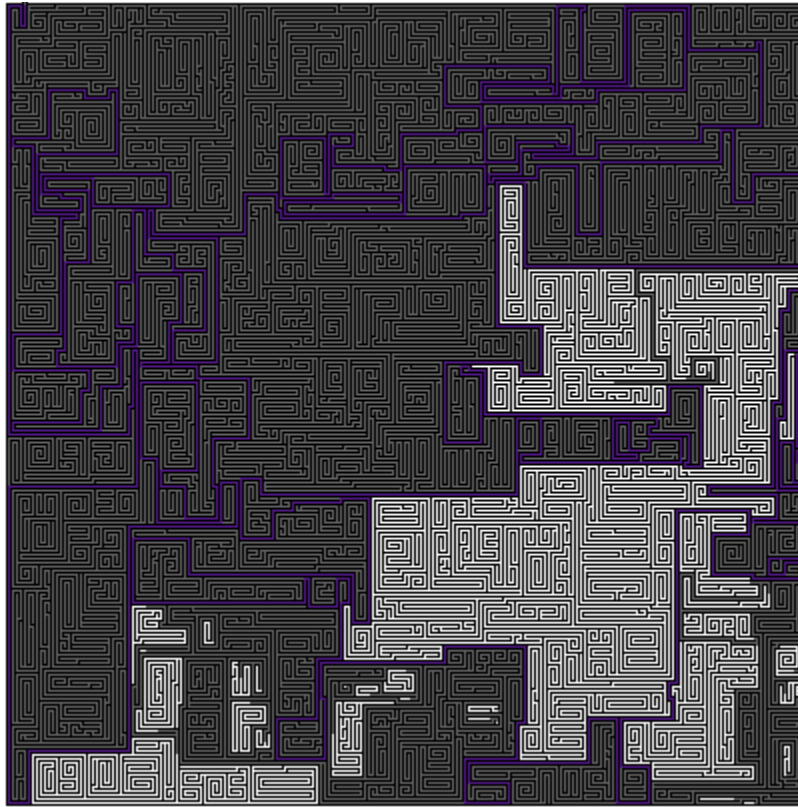ANA* Search took 0.253358125687 seconds
Optimal Path Length 3226 using L1 Heuristic

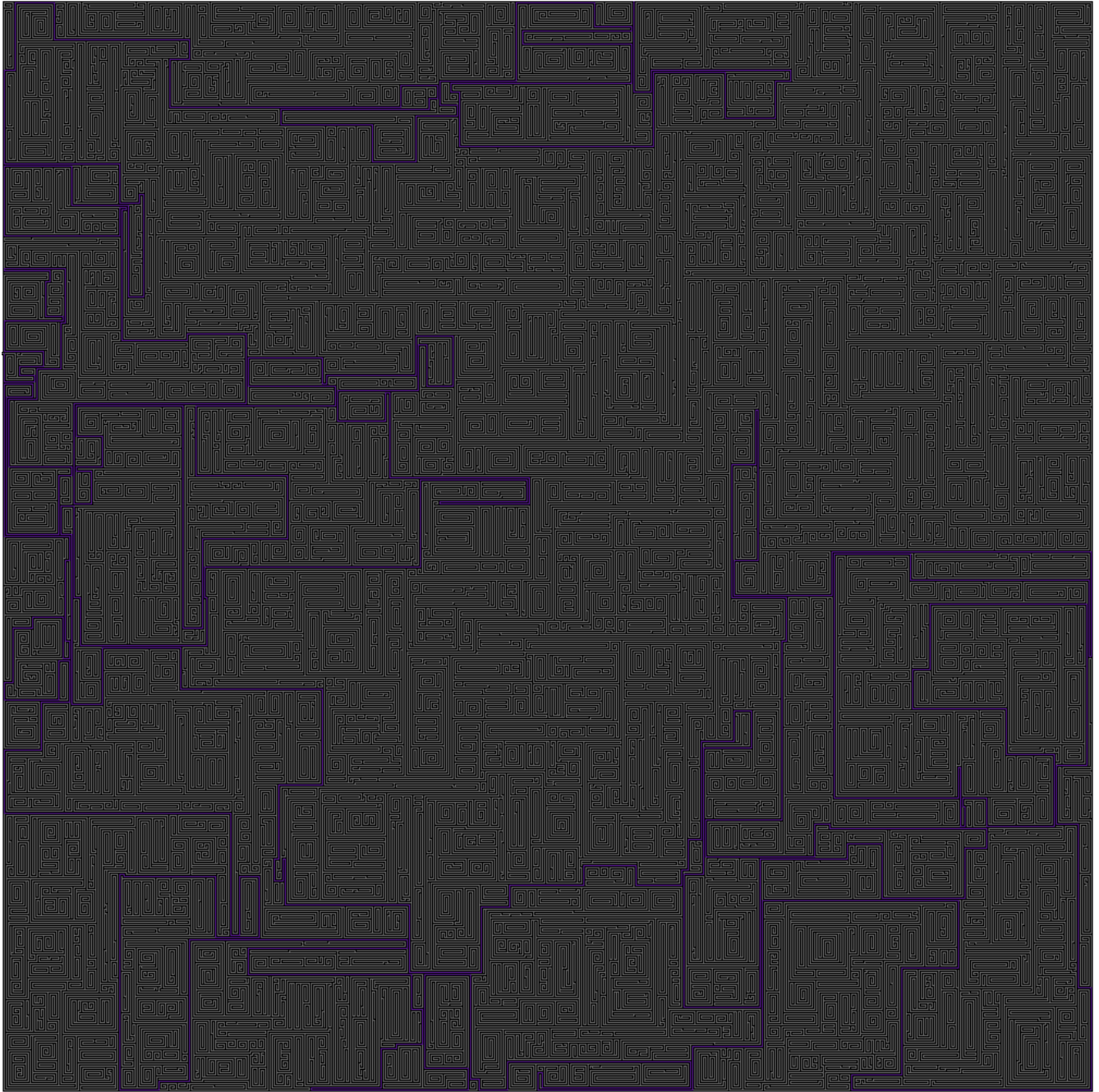Suboptimal 1

Suboptimal 2

Optimal

Map: hard.gif
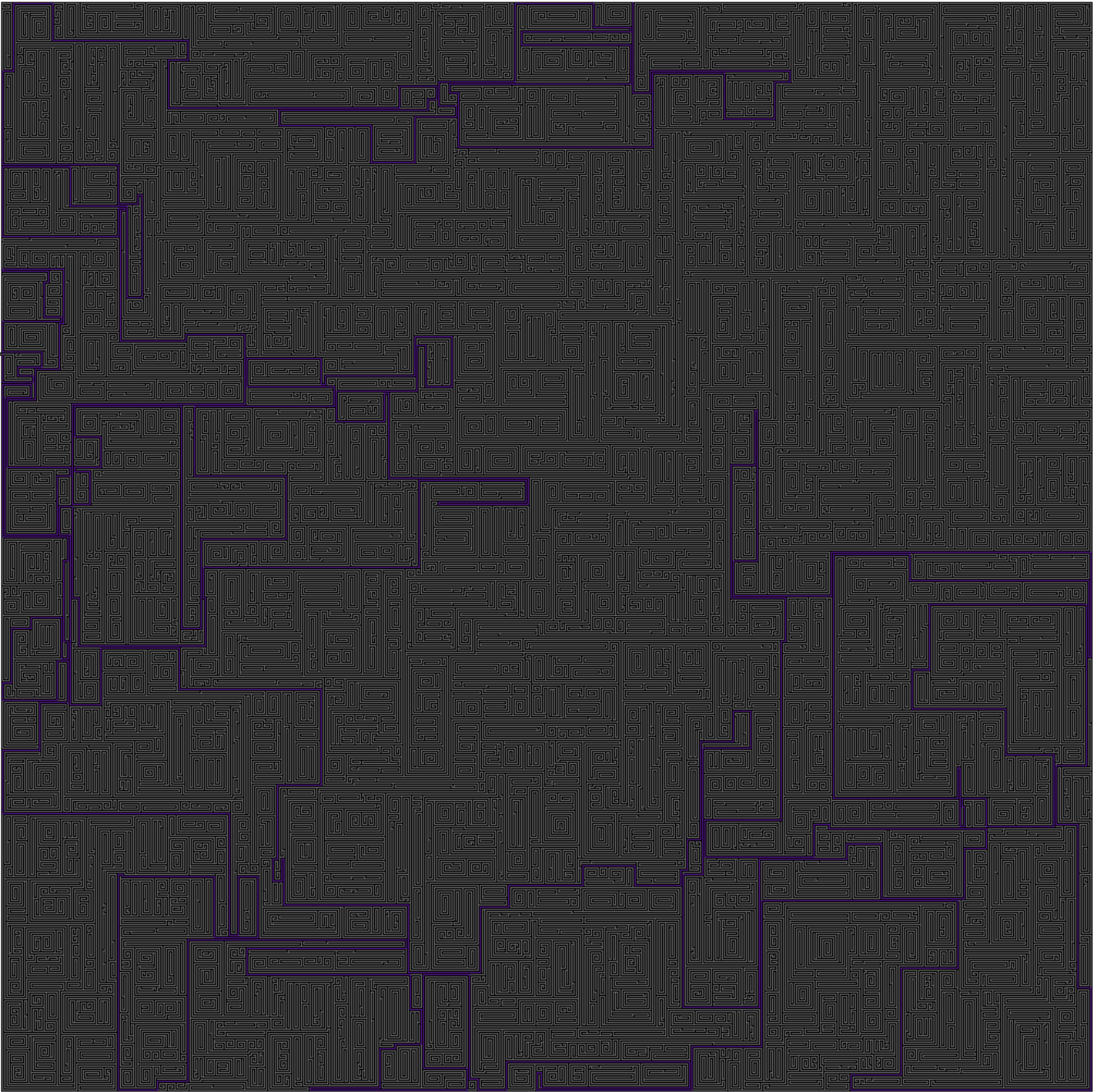ANA* Search took 0.957191944122 seconds
Optimal Path Length 8286 using L1 Heuristic

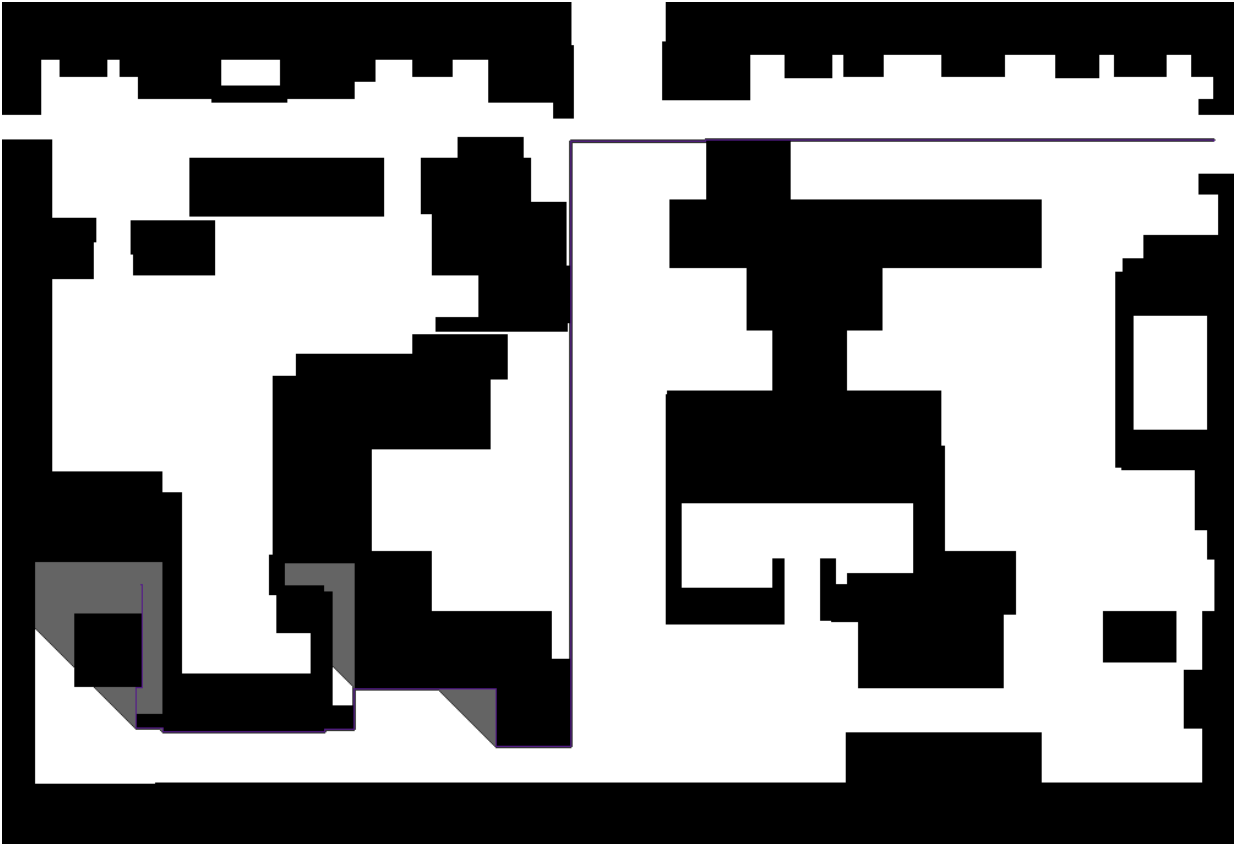Suboptimal 1

Suboptimal 2

Optimal

Map: very_hard.gif
ANA* Search took 7.27157306671 seconds
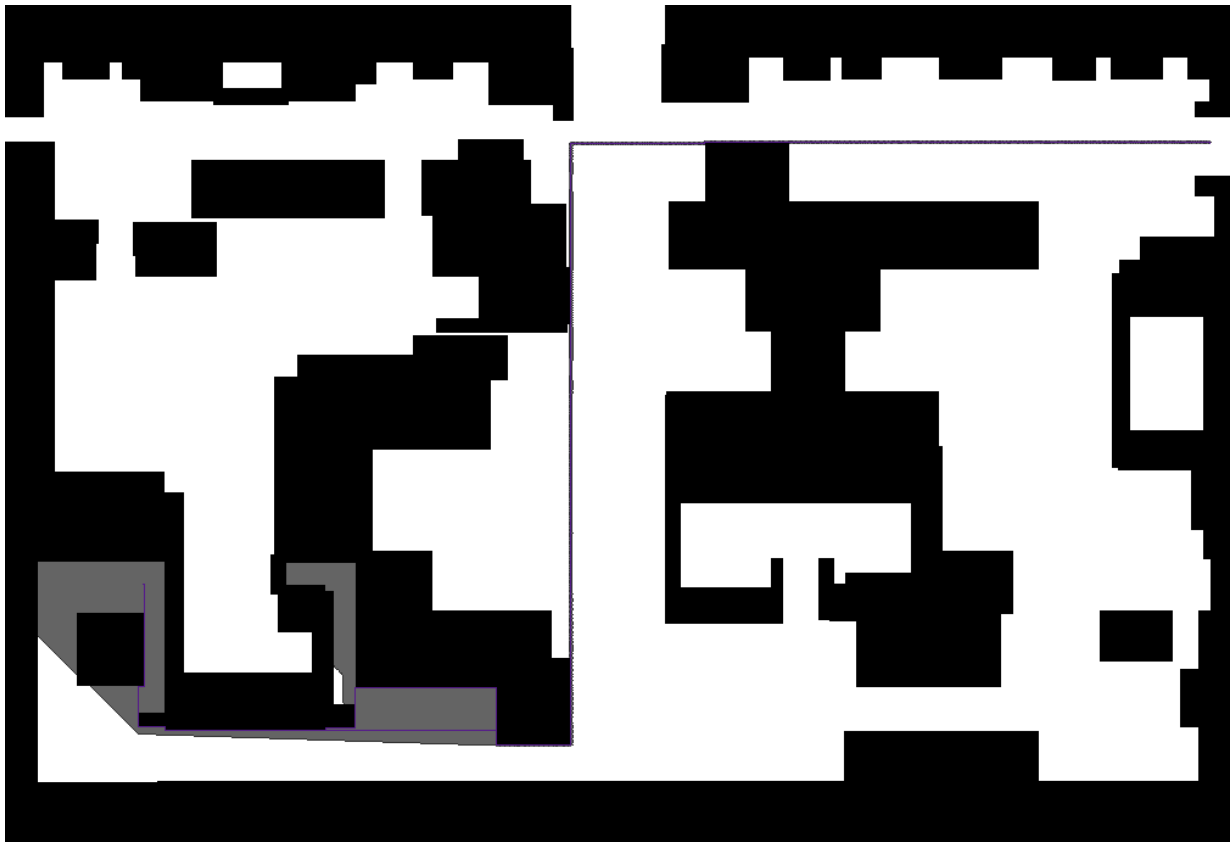Optimal Path Length 18062 using L1 Heuristic

Custom Map
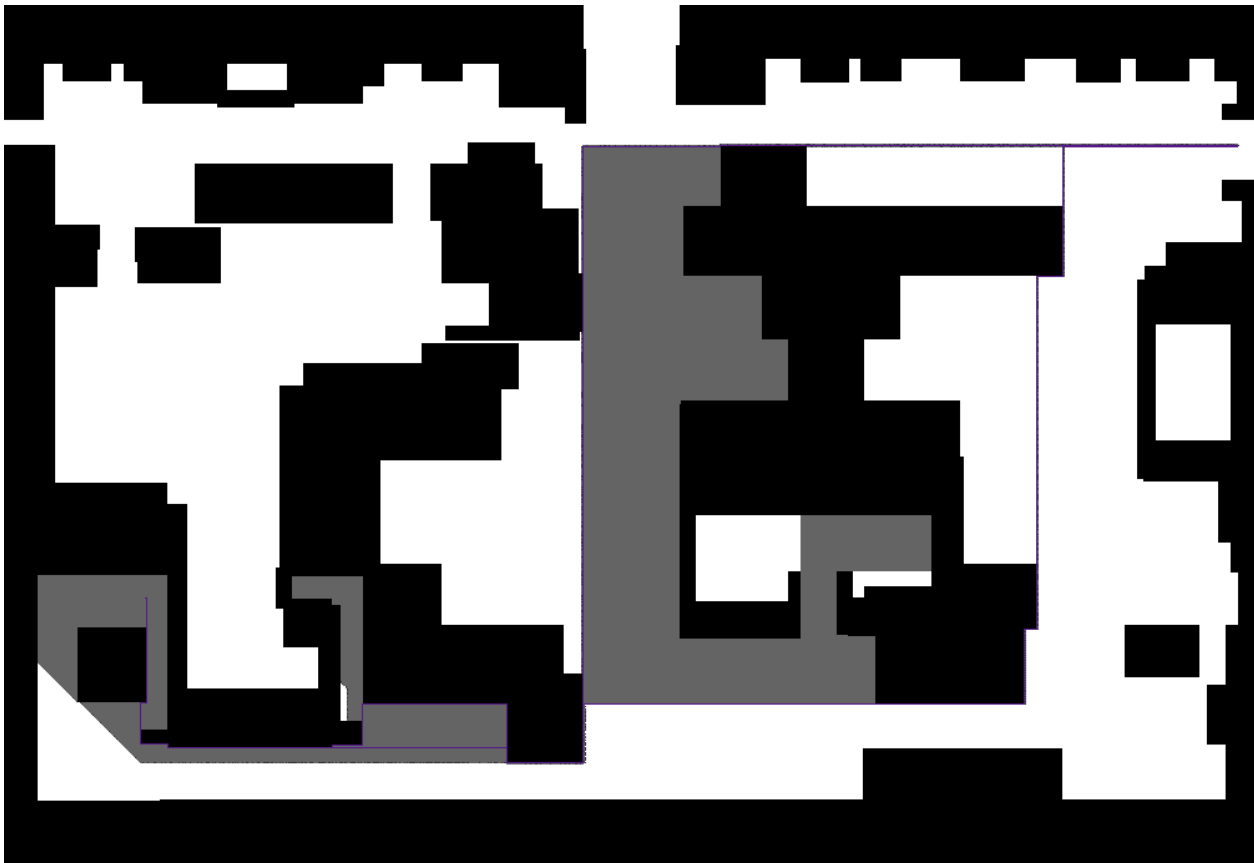

Suboptimal 1: Runtime 2.7 seconds

Suboptimal 2: Runtime 7.46 seconds

Suboptimal 3: Runtime 12.17 seconds

Optimal Solution: Runtime 0.13 seconds

ANA* Search took 22.4645080566 seconds
Optimal Path Length 4613 using L1 Heuristic