Optimizations:

The purpose of optimization is to achieve the best, most efficient design. Adhereing to the criteria and constraints outlined by the assignment, we optimized our algorhythms by using various data structures, calculating h, g, and f values, and testing our project as we worked on it. We considered factors such as productivity, runtime, efficacy, space, and more.

Proposed Heuristics:

Admissible/consistent heuristic: Manhattan Distance
The manhattan distance is the safest option to calculate the heuristic value. If the value was overestimated, it would pose a problem in accuracy. Since it is counted block by block, the value will not be overestimated.

Inadmissible heuristics:
1. Euclidean Distance- Can be underestimated, but is still a good measurement.
2. Chebyshev distance- Provides a maximum distance.
3. Average of Euclidean and Manhattan Distance- Manhattan can potentially overestimate, and euclidean can underestimate. If we average them, a more accurate heuristic value can be found.
4. Manhattan/2 - Rough estimate which is an okay starting place.

Experimental Results:
(5)

Average of Euclidean and Manhattan

	Runtime	Path Length	Nodes Expanded	Memory
A Star	3479.92	180.5163281381490 5	435.44	2054.08
Uniform Cost	85339.1	100.6639346624336 6	10765.74	32934.04
Weighted AStar(1.25)	1440.4	199.3348672614299 6	180.56	1222.34
Weighted AStar(2.0)	984.3	208.6058414570998	123.54	1032.8

Chebyshev

	Runtime	Path Length	Nodes Expanded	Memory
A Star	22623.6	110.2950094990893	2839.18	9460.38
Uniform Cost	85339.1	100.66393466243366	10765.74	32934.04
Weighted AStar(1.25)	16443.88	125.20607604191908	2061.54	7131.88
Weighted AStar(2.0)	3724.7	178.29328414370298	466.72	2112.56

Euclidian

	Runtime	Path Length	Nodes Expanded	Memory
A Star	13961.82	112.98029483439484	1752.2	6212.88
Uniform Cost	85339.1	100.66393466243366	10765.74	32934.04
Weighted AStar(1.25)	7333.44	129.83744525108995	918.42	3665.18
Weighted AStar(2.0)	1286.4	179.77895350665239	160.86	1157.32

Manhattan

	Runtime	Path Length	Nodes Expanded	Memory
A Star	9230.88	133.43162489477584	1157.94	4402.28
Uniform Cost	85339.1	100.66393466243366	10765.74	32934.04
Weighted AStar(1.25)	6333.02	165.35989975712164	793.6	3200.14
Weighted AStar(2.0)	1317.5	207.6181998726367	165.4	1169.96

Manhattan/2

	Runtime	Path Length	Nodes Expanded	Memory
A Star	35739.58	112.0009925142368	4495.24	14433.5
Uniform Cost	85339.1	100.66393466243366	10765.74	32934.04
Weighted AStar(1.25)	24924.38	116.01451415	3133.52	10376.5

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Weighted AStar(2.0)	10096.74	132.01942845846065	1267.68	4798.64