Heuristic Algorithm Path Planning Verification

1. Selected Algorithms for Path Planning Verification:

- a. Traditional Algorithms
- **b. Heuristic Algorithms** (Genetic Algorithm, Simulated Annealing)

The traditional algorithms, such as Greedy and Dijkstra, choose the nearest distance at each step, which often leads to getting stuck in a local optimum, failing to obtain the global optimum. Thus, they cannot always find the best route in practical scenarios. Another disadvantage is that the time complexity can be very high, resulting in longer computation times for more complex calculations.

Heuristic algorithms (HA) can accurately find the optimal solution, and their time complexity becomes increasingly advantageous with higher complexity cases. However, the disadvantage is that the "optimal solution" might not always be the "best solution." Based on the complexity of our data's path planning, we can obtain a satisfactory solution within a relatively short period. The data used consists of the latitude and longitude of actual orders from Kaggle, as shown below:

1476786	**43.013425**	**-81.2768629**
1476794	42.9923696	-81.2742454
1476933	42.983249	-81.2848146
1477049	43.0104333	-81.2735103
1477093	43.0180602	-81.281657
1477110	42.9861887	-81.2970252
1477119	42.9503241	-81.2864436
1477750	43.0118888	-81.2575926
1477878	43.0139866	-81.2799819

2. Comparison of Results from Implemented Heuristic Algorithms and Traditional Algorithms

(Output: Optimal path as per data index order, minimum distance)

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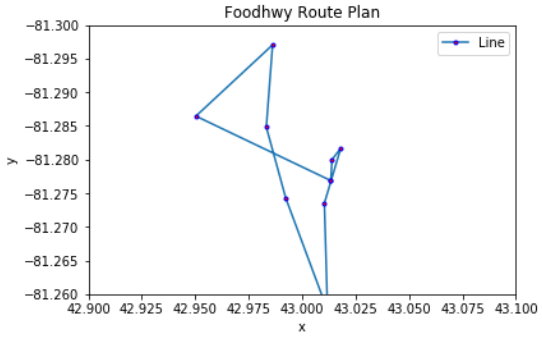
a. Greedy

- Optimal Path: [0, 8, 4, 3, 7, 1, 2, 5, 6]
- Minimum Distance: 188.11217727991738
- Path visualization for the Greedy algorithm is shown below:



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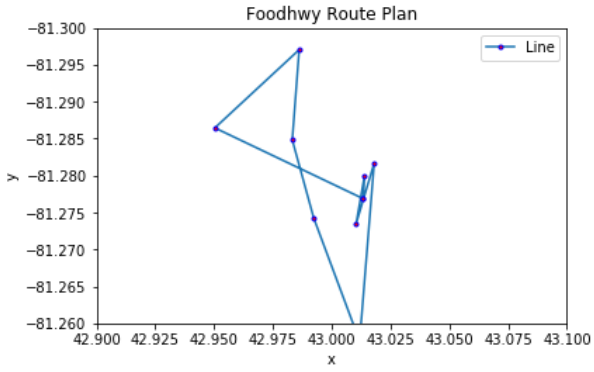
b. Dijkstra

- Optimal Path: [0, 8, 3, 4, 7, 1, 2, 5, 6]
- Minimum Distance: 183.79714557074675
- Path visualization for the Dijkstra algorithm is shown below:



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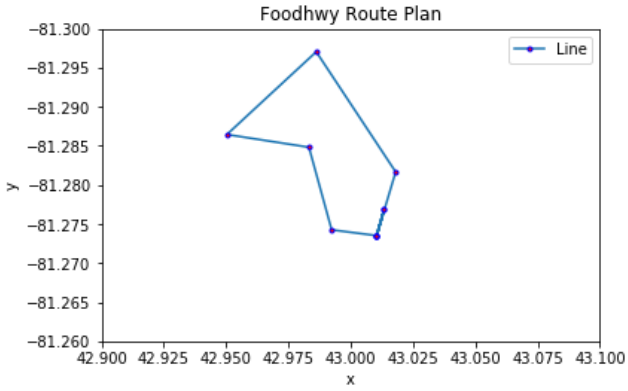
c. Genetic Algorithm

- Optimal Path: [0, 3, 7, 1, 2, 6, 5, 4, 8]
- Minimum Distance: 0.17250545785920712



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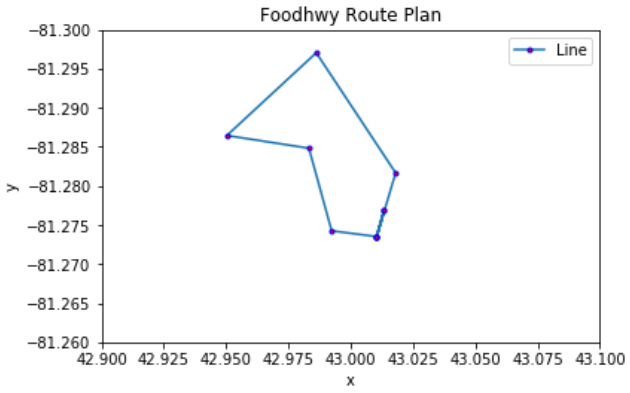
d. Simulated Annealing

- Optimal Path: [0, 3, 7, 1, 2, 6, 5, 4, 8]
- Minimum Distance: 0.17250545785920712



From the comparison above, it can be concluded that the **Heuristic Algorithm** can achieve a globally optimal result. Therefore, for route planning, it is recommended to select from the Heuristic Algorithm methods.