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CSE 4101: Assignment 1

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Assignment Part 1. Use `OSM`(Open Street Map) data to determine the shortest path between 2 pairs of coordinates using mainly the `A* Search` Algorithm and its variations, the `Best-First Search` and `Weighted A* Search` Algorithms.

- Design a robust heuristic that involves crime and/or traffic data.
- Look at the time and memory comparisons.
- Plot the paths generated and the heatmap from the fanout of each algorithm.

Results: `Heuristic Implemented:`

$$h(u,v) = \left(\frac{d_{geo}(c(u),c(v))}{d_{max}}\right) \times w_1 + (|P(c(u),r)| + |P(c(v),r)|) \times w_2$$

where:

- $h(u,v)$ is the heuristic function for nodes u and v.
- $d_{geo}(c(u),c(v))$ represents the geodesic distance between the coordinates of nodes u and v.
- $c(u)$ and $c(v)$ are the coordinates (latitude and longitude) of nodes u and v, respectively.
- d_{max} is the maximum distance calculated between all pairs of points in the dataset.
- $|P(c(u),r)|$ and $|P(c(v),r)|$ denote the number of points within a certain radius r from nodes u and v, respectively.
- w_1 and w_2 are variable weights, which in your function are 10 and 90, respectively.

`Time & Memory Comparisons`

Algorithm	**Time (seconds)**	**Memory (MB)**
Greedy Best-First Search	2.5625	5317.78
A* Search	2.5606	5317.78
Weighted A* Search	2.5806	5317.78

Table 1: Comparison of Pathfinding Algorithms

`Plotted Path with Heatmap`

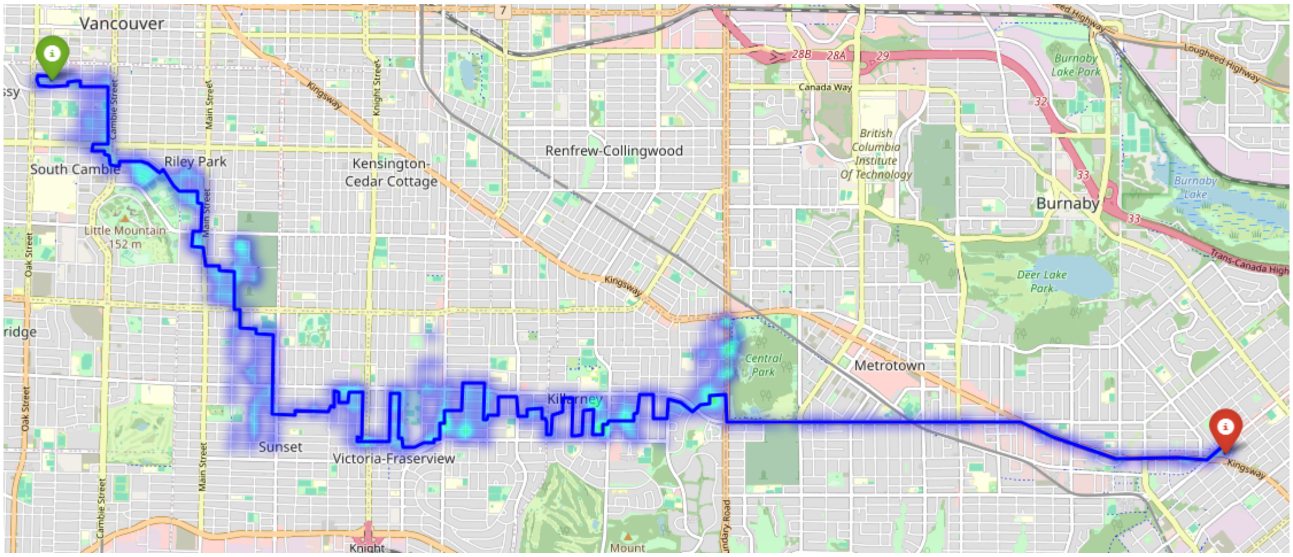

Figure 1: Plot of A* Search Path

Assignment Part 2. Google Search for a `Query` and look at all immediate links in a `DFS` and `BFS` manner and look for a `Prompt` about said `Query`.

- Implement internet search with DFS/BFS
- Summarize Points from Links related to `Prompt`

Results: Summary and out are all provided in a txt file along with the submission. As the results are too big to show here.