KINGS MAPS

“Real world” application



2022 A-Level Computer Science

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Analysis:

A look into the travelling salesman problem

The travelling salesman problem (TSP) has been a classic problem for mathematicians and computer scientist since the 1930s. While there exists no efficient algorithm to solve real world networks, a heuristic approach leads to a solution in most cases. This problem involves finding a path that visits any finite number of locations at least once, before returning to the starting point. There exist two variations of the TSP, classical and practical. The classical approach does not allow for locations to be visited more than once, where the practical allows multiple visits to a single location.

Hailing from pathfinding and optimisation, the TSP has obvious real-world parallels. One such example would be, believe it or not, a travelling salesman. The example that I am using for my project is a postman working for amazon. Applying the TSP to this client will reduce the overall time spend driving, as the total distance travelled will be minimised. This will not only save time, but money for the client’s employer (I’m sure he needs it).

The following interview was conducted with 42-year-old Amazon delivery driver, Robert Whithorn:

* What software is currently in use for getting to a client’s house?
  + “”
* What feature would be most useful in a revision of this software?
* Are there any obvious flaws in the software?

In order to abstract real world locations and roads to a model that can be computed, data needs to be extracted from the real world. This will be done through Google Maps distance matrix API, which takes an array of starting latitudes and longitude, returning the distance between each combination. Locations in the real world will be abstracted to “nodes” with an associated latitude and longitude, so that they can be displayed on a map once calculation is complete. Roads in the real world are abstracted to an integer value, an “arc”, that can represent the time taken to travel along it or the distance to travel along it from start to end. Connections between nodes, arcs, can be represented through an adjacency matrix. This is a dictionary type structure that lists all a node’s connections, arcs, and the associated weight. An adjacency matrix defines a network, or graph. The TSP algorithm that I will implement involves performing many algorithms on a graph to find upper and lower bounds, and testing if they are optimal. This requires knowledge of graph theory, which I have gained through my Further Maths A-Level.