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Algorithm A: Best First Search

Algorithm B: Christofides Algorithm

Description of enhancement of Algorithm A:

Insertion: During the algorithm, when the next city to visit is found, instead of adding it to the end of the tour, I considered the tours which would be created by inserting this city into the existing tour. I calculated the respective tour length for inserting the city into each position and ultimately inserted it into the position which would minimise the length. On the majority of tours, this technique did reduce the tour length, but it did also cause for some tour lengths to increase. This seemed to be the case particularly in tours where there was a large distance from the final city back to the starting city.

2-opt: To further reduce the tour length, I then ran an implementation of 2-opt on the resulting tour. The algorithm takes the initial tour and makes improvements by exchanging two edges in the tour with two other edges. If this exchange improves the tour length, this modified tour is saved, and the process is repeated on the modified tour. Because of this, 2-opt either shortened the length of the tour or made no improvement. There was no increase in tour length on any of the city files. I choose to use 2-opt over 3-opt or other k-opt algorithms simply due to the time complexities associated with each.

Description of enhancement of Algorithm B:

Removal of Duplications:

For each city that appears multiple times in the tour, I recorded the positions in which it appeared. I then removed the city from all of these locations and considered the tour length associated with putting the city in each one of these locations. I then inserted the city into position that yielded the minimum tour length and repeated this process until each city appeared only once in the tour. This reduced or kept the tour length the same for almost all of the tours, compared to my basic implementation of the algorithm.

2 opt: After this, I then also ran the same implementation of 2-opt algorithm that I produced for algorithm A on the tours produced by algorithm B. The algorithm did the same process of exchanging edges in the tour and checking for improvements. My 2-opt implementation worked really well on the tours produced by Christofides and significantly reduced the tour length of almost all of the city files.