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Algorithm A: Ant Colony Optimisation

Algorithm B: Particle Swarm Optimisation

Description of enhancement of Algorithm A:

I decided to experiment and implement both rank based and elitist improvements. Having tested both with differing parameters over various time periods I found that on average elitist provided better results for these city sets. The elitist works by adding an additional amount of pheromone, equal to 1/cost of the best tour found so far to each edge in the solution. This is done once every iteration. This improves results as it adds more weighting to the current best solution found. My implementation of rank based is still present in the code but commented out, it can be found in the main ACO function. With this enhancement I found that I could find better scores, for example finding solutions in the region of 48800, reducing the distances from around 49000-50000 that my initial implementation found without significantly affecting the amount of iterations that could be performed in a given time.

Description of enhancement of Algorithm B:

I found the biggest problem was that particle swarm started with bad tours, meaning the algorithm would take longer to converge towards a better solution. To improve this, I initially implemented nearest neighbour, and used that to advise the initial tours. However, after trying out 2opt I found that gave better tours in not much extra time. This nearest neighbour enhancement can still be found in the file as its used for 2opt. As a result of this I enhanced the algorithm by initially running a 2opt algorithm to generate a base tour length and tour. This tour is then used to start PSO. This is done by randomly generating small velocities and applying them to the 2opt best tour. I have 2opt running in around 8 seconds for 535 cities and so it is not a massive detriment to the running time. Additionally, it means that the algorithm produces a decent result even when run for a short period of time as well as converging towards a better solution faster when running for a longer period. It produces results better than that of 2opt but will never produce worse, setting a top bound for the tour length. This enhancement significantly reduced the length of tours produced; my unenhanced version produces tours in the region of 152000 whereas the enhanced versions produces tours of around 49000 in the same period of time.