

Artificial Intelligence Assignment-3 Report

GROUP No. – 26 : RAJAN GUPTA (210020041), ARYAN GUPTA (210010005)

DESCRIPTION ABOUT THE TRAVELLING SALESMAN PROBLEM

Given a set of cities and the distance between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and return to the starting point.

GREEDY ALGORITHM

The Greedy algorithm has only one shot to compute the optimal solution so that it never goes back and reverses the decision.

- Initialize an empty array called route.
- Start from any city and push the city in route.
- Find the closest neighbor of the initial city if the neighbor is not in route the push it in route else if second closest neighbor not in route push it in route else if third closest neighbor not in route push it in route and so on.
- Finally return this route array.

SIMULATED ANNEALING ALGORITHM

The Simulated Annealing algorithm is based upon Physical Annealing in real life. Physical Annealing is the process of heating up a material until it reaches an **annealing temperature** and then it will be **cooled down** slowly in order to change the material to a desired structure.

- Start from an initial solution (path in this case).
- Now, find the cost of this path by summing the distance of the cities from each other.
- Get the neighbors of this solution by interchanging any two cities.
- Find the new cost of this neighbor.
- If new cost is less than current cost then update current cost to this new cost and current path. Also update the best cost if this new cost is less than best cost.
- Otherwise Find $\Delta E = \text{new_cost} - \text{curr_cost}$
- If random no. between 0 and 1 $< \text{sigmoidFunction}(\Delta E)$ then change current cost to new cost and current path to new path.
- Finally return the best cost and best path.

CONCLUSION AND ITERATIVE IMPROVEMENTS

- We used the greedy algorithm to find the route and then used this route as the initial solution in simulated annealing algorithm which reduced the cost.
- Solution can be optimized by taking more no. of iteration in simulated annealing.
- Neighbors function generates any two random indices and reverse the array from starting index to ending index.
- Temperature is reduced slowly by the factor of 0.995. i.e., $T = T * 0.995$
- Our outputs for euc_100 and noneuc_100 were around 1600 and 5200 respectively. But these may change from one run to another due to probabilistic reasons.