Traveling Salesman Problem

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PROBLEM DESCRIPTION

Travelling salesman problem describes a salesman must travel N cities, each city exactly once such that he returns to the city from where he started in order to minimize the total cost of path. It is very often called TSP.
It is NP-hard problem. So to solve this problem an approximate solution is required for larger N. This document provides one such implementation of algorithm. The coordinates of N cities are given with the distances between each pair of cities in a file. The output of the program is the best/shortest path available.

METHODOLOGY

One such algorithm to find the approximate solution is Simulated Annealing. This process is inspired by metallurgy process name **Annealing.** Annealing is the process in which the randomness of molecules in metals or glasses is increased by heating and allowed to cool slowly in order to remove stress and toughens it.
In a similar manner in Simulated Annealing the randomness of the selecting a neighboring city is high and slowly the variable similar to Temperature is allowed to decrease so as to get the tighter bound of cost along the path. This probabilistic technique is used to find the global optimum of a given function.
The probability function used is (where f is cost function):

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p = 1/(1 + e^(-delta(f)/T))
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SOLUTION

To solve the given problem the Simulated Annealing is modified using a reverse operator to move to the next neighbor. This operator inverses the path between randomly selected indices ‘i’ and ‘j’. And then the probability function is used to find probability of selecting the move. As temperature decreases we come closer to optimal solution required.

RESULT

Results are displayed in table:

Test Case	Distance
Euc_100	1652.24651291062
Euc_250	2730.00507528521
Euc_500	3781.05805703443
NonEuc_100	5324.57794986620
NonEuc_250	13012.4409655095
NonEuc_500	25656.5499723088

REFERENCES:

1. *AI Lecture on Simulated Annealing*