CS 312, Assignment 4 - Report

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1 Problem Description:

Given a set of cities (coordinates) and distances between them, find the best (shortest) tour (visiting all cities exactly once and returning to the origin city) in a given amount of time, viz. Traveling Salesman Problem.

The list of cities ,the coordinates of each city and the distance between each pair of cities are provided.

2 Pseudo Code:

In the following subsections, pseudo codes for important functions in the code are explained.

2.1 Algorithm (Ant Colony Optimization):

For solving this problem we have used Ant Colony Optimization (ACO) Algorithm. In this algorithm we optimize the path found by Ant Colony. We basically use ACO because it has a very little chance to get stuck at local optimal positions. ACO follows probability based approach in its algorithm which gives better results.

Algorithm 1 ACO( )

```
1: procedure ACO( )
2:     Initialize()
3:     while TimeCriterion is not met do
4:         position_Ant ← startNode
5:             for each ant do
6:                 stateTransition(nextNode)
```

7: Update_pheromone()

8: update(best_Solution)

9: pheromone_Update()

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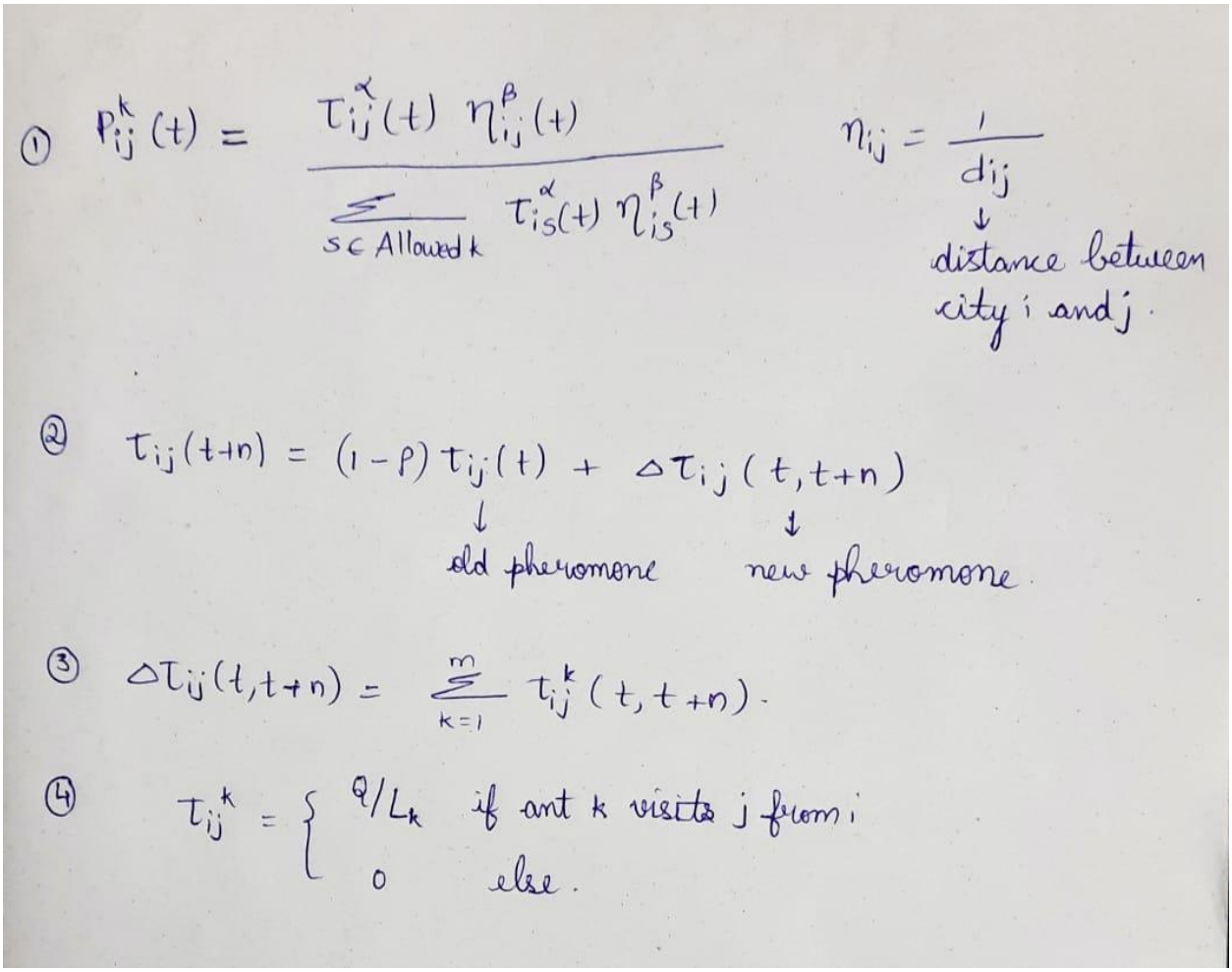
3 Results of Output:

In ACO instead of fixing the starting city, we randomly choose the starting city in the given cities for the tours. And if the tour cost is less in the next tours we can improve the solution. In ACO we use probabilistic approach and the formula for probability is as follows



The above picture has some of the formulas we use in our algorithm.

In the above formulas the parameters used are:

α : parameter to regulate the influence of τ.

β : parameter to regulate η.

τ : pheromone intensity.

η: visibility of city j from city i.

ρ: pheromone evaporation rate.

Q: is a constant value that determines the *updateValue* of the pheromones.

By using the above mentioned equations, we got good results.

Input File	**Cost of Tour**
euc_100	1609
noneuc_100	5273

Some of the results for the given input files: