CS312:Artificial Intelligence Laboratory

Lab 4 Report Group 24

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1. Introduction

Given a set of cities (coordinates) and distances between them, find the best (shortest) tour (visiting all the cities exactly one and returning to the origin city) in a given amount of time. In other words, in this assignment we solve the Travelling Salesman Problem.

2. Ant Colony Optimization

The ACO algorithm can be seen as a parallel, randomized search algorithm that converges towards good solutions by a process of learning in which each agent communicates some information about the goodness of solution components toa common pool. As more and more agents explore the good components, more agents use them to build solutions. In some sense, this behaviour is similar to the one in GA, except that there it is the solutions themselves that make up the populations. In ACO, the solutions are not coded, but simple agents repeatedly construct solutions, exploiting the information (or experience) of earlier attempts by the entire population.

Pseudo Code:

```
1. Initialize tij = Small values for all segments i-j in the
   problem
2. repeat
3.      Construct the tour for each of the m ants
4.      Remember the best tour when a better one is found
5.      Update the pheromone levels for each segment tij(t+n)
6. until some termination criteria
7. return the best tour
```

Let N represent the number of cities in the problem. The values of the parameters used are:

Alpha = 8, Beta = 8, rho = 0.2, Q= 0.1

Input	Cost of tour Found		
	Ants=N/10	**Ants = N/5**	**Ants = N**
euc_100	1968.13	1936.77	1895.06

noneuc_100	5852.47	5870.55	5842.57

3. Conclusion

- Bigger alpha (pheromone factor) means the convergence speed increases but it may get stuck in local optima and lower alpha can lead to exceeded time-limit. So, we set alpha = 8.
- Bigger beta (visibility/cost factor) means almost greedy algorithm and smaller leaves it random. So we set beta = 8.
- Bigger rho (evaporation coefficient) reduced convergence speed and smaller rho increased the global search ability so we set rho = 0.2
- Bigger Q(pheromone deposit factor) will allow it to fall into local optimum whereas smaller will give slow optimization speed. Q=1
- Larger ants means a larger time period to complete 1 iteration but gives more optimum solutions at cost of time and smaller ants means less pheromone deposits and less directed next iteration. So we have chosen it to (no. of ants = no. of cities)