LAB - 3

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Ant colony optimization for the Travelling salesman problem :

The foraging behaviour of ants has inspired the development of optimization algorithms that can solve complex problems such as the Travelling salesman problem (TSP). Ant colony optimization (ACO) simulates the way ants find the shortest path b/w food sources & their nest. Implement the ACO algorithm using python to solve the TSP, where the ojective is to find the shortest possible route that visits a list of cities and returns to the origin city.

Algorithm

initialize pheromone values $\forall i, j \in [1, n] : T_{ij} \to T_0$
repeat
  for each ant $l \in \{1, \ldots, m\}$ do
    initialize selection set $S \to \{1, \ldots, n\}$
    randomly choose starting city $i_0 \in S$ for ant l
    move to starting city $i \to i_0$
    while $S \neq \phi$ do
      remove current city from selection set $S \to S \mid \{i\}$
      chose next city j in tour with probability

$$P_{ij} = \frac{T_{ij}^{\alpha} \cdot \eta_{ij}^{\beta}}{\sum_{h \in S} T_{ih}^{\alpha} \cdot \eta_{ih}^{\beta}}$$

      update solution vector $\pi_l(i) \to j$
      move to new city $i \to j$
    end while
    finalize solution vector $\pi_l(i) \to i_0$
  end for

for each solution π_l, $l \in [1, \ldots, m)$ do
    calculate tourlength $f(\pi_l) \rightarrow \sum_{i=1}^{n} d_{i\pi_l(i)}$
end for
for all(i, j) do
    evaporate pheromone $\tau_{ij} \rightarrow (1-\rho) \cdot \tau_{ij}$
end for
determine best solution of iteration
for all $(i, j) \in \pi^+$ do
    reinforce $\tau_{ij} \rightarrow \tau_{ij} + \Delta/2$
end for
until condition for termination met

Output

Best route : [0, 7, 9, 3, 2, 4, 1, 5, 8, 6, 0]
Best distance : 272.5461

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