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TUTORIAL-3

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1) Discuss in points travelling salesman problem of graph theory.

(a) A salesman wants to visit a certain number of cities allotted to him. He knows the distance of the journey between every pair of cities.

(b) The salesman starts from a home city, passes through each city exactly once and return to his home city the shortest distance possible.

(c) This means, we are finding an Hamiltonian cycle of minimum length.

(d) In a graph, if we have n vertices (cities) then there are $(n-1)!$ edges and total number of Hamiltonian circuits will be $\frac{(n-1)!}{2}$.

Method 1:

1) Let $C = v_1 v_2 v_3 \dots v_{n-1} v_n$ be any Hamiltonian cycle of weighted graph G and let w be the weight of C .

2) Set $i=1$ and $j=i+2$.

3) Let $C_{ij} = v_1 v_2 v_3 \dots v_i v_j v_{j-1} \dots v_{i+1} v_{j+1} v_{j+2} \dots v_n v_1$ be Hamiltonian cycle and let w_{ij} denote weight of C_{ij} .

4) If $w_{ij} < w$, replace C by C_{ij} and w by w_{ij} and return to step 1.

5) Set $j=j+1$. If $j < n$, do step 3, or else set $i=i+1$. If $i < n-2$ do step 2. otherwise stop.

(2) Chinese postman problem using graph theory

- The postman's job is to deliver all of the town's mail using the shortest route possible. In order to do so, they must pass each street once and then return to the origin.

Algorithm \Rightarrow

1) List all odd vertices.

2) List all possible pairings of odd vertices.

3) For each pairing find the edges that connect the vertices with the minimum weight.

4) Find the pairing such that the sum of the weights is minimised.

5) On the original graph add the edges that have been found in step 4.

6) The length of an optimal Chinese postman route is the sum of all the edges added to the total found in step 4.

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8) A route corresponding to this minimum weight can then be easily found.