Group B : DAA | TE-IO 33213

Assignment No - 10

Title :- Travelling Salesman Problem (Dynamic Programming)

Problem Statement :-
write a program to solve the travelling salesman progr problem and to print the path & the cost using dynamic programming

Objective :-
To understand and implement dynamic programming algorithm for solving travelling Sales person problem & study dynamic programming.

Theory :-
Dynamic programing strategy
Without loss generality, regard a tour to be a simple path that start & ends at Vertex 1.
Every tour consist of an edge <1, k> for some $k \in V-\{1\}$ & a path from Vertex k to Vertex 1. The path from vertex k to vertex 1 must be a shortest k to 1 path going through all vertices in $V-\{1,k\}$
Hence, the principle of optimality holds at $g(i,s)$ be the length of a shortest path starting at Vertex i, going through

all vertices in S & terminating at vertex 1
$g(1, V-\{i\})$ is the length of an optimal sales person tour from the principle of optimality

Algorithm for TSP using DP

Step 1 $g(1, \{i\}) = 0$
Step 2 for $S = 2$ to n do
Step 3 for all subsets S of size S & containing 1
Step 4 for $g(1,S) = \infty$
Step 5 for all $j \in S$; $j \neq 1$ do
Step 6 $g(i,S) = \min_{j \in S} \{(ij + g(j, S-\{j\})\}$
Step 7 return $\min(g(i,S))$

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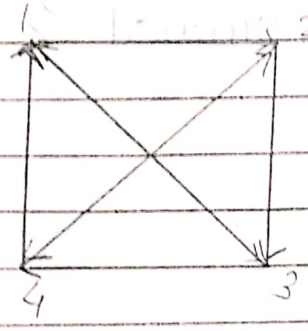
By dynamic programming
There are at most $2^n * n$ subproblems & each one takes linear time to solve
The total running time is therefore
$O(n^2 2^n)$

example



0	10	15	20
5	0	9	10
6	13	0	12
8	8	9	0

$g(2,\phi) = c21 = 5$; $g(3,\phi) = c31 = 6$ & $g(4,\phi) = c41 = 8$

$g(2,\{3\}) = c23 + g(3,\phi) = 15$; $g(2,\{4\}) = 18$
$g(3,\{2\}) = 18$; $g(3,4) = 20$
$g(4,\{2\}) = 13$; $g(4,\{3\}) = 15$

$g(2,\{3,4\}) = \min\{c23 + g(3,\{4\}), c24 + g(4,\{3\})\} = 25$
$g(3,\{2,4\}) = \min\{c32 + g(2,\{4\}), c34 + g(4,\{2\})\} = 25$
$g(4,\{2,3\}) = 25$

finally
$g(1,\{2,3,4\}) = \min\{c12 + g(2,\{3,4\}), c13 + g(3,\{2,4\}), c14 + g(4,\{2,3\})\}$

$= \min\{35, 40, 43\}$
$= 35$

$J(1,\{2,3,4\}) = 2$
$J(2,\{3,4\}) = 4$
$J(4,\{3\}) = 3$

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Final optimal tour : 1-2-4-3-1 &
Coast of tour : 35

Conclusion :-
The Dynamic programming Stategy For TSP is studied & implemented