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TRAVELLING SALESMAN PROBLEM

- The problem asks to find the shortest tour through a given set of n cities that visits each city exactly one before returning to the city where it is

- TSP is a weighted graph with vertices as cities & edges representing the distance.

- The problem can be stated as the problem of finding the shortest Hamiltonian circuit of the graph.

- Hamiltonian circuit can be defined as a sequence of n+1 adjacent vertices $V_{i0}, V_{i1}, \ldots V_{in-1} V_{in}$ where the first vertex of the sequence is the same as the last one while all the other n-1 vertices are distinct.

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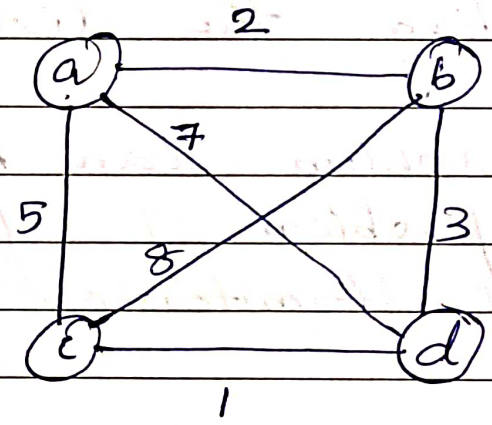
Brute force Procedure

- Get all the tours by generating all the permutations of n-1 intermediate cities
- Compute the tour lengths
- Find the shortest among them

Example



$a \to b \to c \to d \to a = 2+8+1+7 = 18$

$a \to b \to d \to c \to a = 2+3+1+5 = 11$ optional

$a \to c \to b \to d \to a = 5+8+3+7 = 23$

$a \to c \to d \to b \to a = 5+1+3+2 = 11$ optional

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$a \to d \to b \to c \to a = 7+3+8+5 = 23$

$a \to d \to c \to b \to a = 7+1+8+2 = 18$

The total no. of permutations needed will be $(n-1)!$

It makes the exhaustive search approach impractical for all but very small value of n.