EXHAUSTIVE SEARCH

Many problems require identifying an element with a special property.

This problem arises in combinatorial, permutation and subset problems.

Exhaustive search

It is the brute force search to combinatorial problem. It checks each and every element of the problem domain, selecting those of them to satisfy all the constraints.

Traveling salesman problem

Prim statement:-

A traveler needs to visit all cities from a list. where the distance b/w all the cities are known and each city should be visited just once.

Brute force attack is used for identifying every possible tour and select the best one.

If there are 'n' vertices, then there are (n-1)! no of of possibilities.

G(V, E) - G - graph. V - vertices e - edges
↓ ↓
cities distance.

e(u, v) - edge from u to v.

d(u, v) - distance between u and v.

S - subset of cities to identify which cities are most convinient to use, which cities are far away.

→ S ⊆ {1, 2, 3 ... n} c(s, j) - length of shortest path in S set.

Algo:-

$C(\{1\},1) = 0$

for $s = 2$ to n do

for all subsets $S \subseteq \{1,2,3,\ldots,n\}$ of size s and containing 1

$C(S,1) = \infty$

for all $j \in S$ and $j \neq 1$

$C(S,j) = \min \{C(S-\{j\},i) + d(i,j)$ for $i \in S, i \neq j\}$

Return $\min_j C(\{1,2,3,\ldots,n\},j) + d(j,i)$.

Analysis:

$O(2^n \cdot n)$

Naive solution:

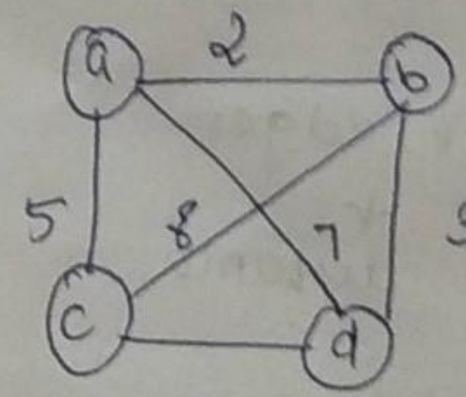
→ consider 'n' cities

→ Generate all permutations $(n-1)!$

→ Calculate the cost of every permutation and keep track of minimum cost permutation

→ Return permutation with minimum cost.

Time complexity :- $\theta(n!)$.



} Hamiltonian circuit.

Tour	length
a→b→c→d→a	2+8+1+7=18
a→b→d→c→a	2+3+1+5=11
a→c→b→d→a	5+8+3+7=23
a→c→d→b→a	5+1+3+2=11

a→c→d→b→a = 11

a→d→b→c→a = 7+3+8+5=23

a→d→c→b→a = 7+1+8+2=18

Here mere are 2 pairs of tour.