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Sub: Algorithm Analysis and Design
<u>Practical 12</u>

"Rocket Singh: Salesman of the Year" is a travelling salesman, who sales good in various cities. One day in the morning, he decided to visit all the cities to sales good and come back to the starting city (from where he has started). Travelling Salesman Problem (TSP) is a touring problem in which n cities and distance between each pair is given. We have to help him to find a shortest route to visit each city exactly once and come back to the starting point.

Sample Input:

[[∞, 20, 30, 10, 11],

[15, ∞, 16, 4, 2],

[3, 5, ∞, 2, 4],

[19, 6, 18, ∞, 3],

[16, 4, 7, 16, ∞]]

Sample Output:

Minimum Path

1 – 4 = 10

4 – 2 = 6

2 – 5 = 2

5 – 3 = 7

3 – 1 = 3

Minimum cost: 28

Path Taken: 1 – 4 – 2 – 5 – 3 – 1

Code :-

```
import math

def tsp(dp, dist, mask, pos,
    n): if mask == (1 << n) – 1:
        return dist[pos][0]

    if dp[mask][pos] != –1:
        return
        dp[mask][pos]

    ans = math.inf
```

```python
        for city in range(n):
            if (mask & (1 << city)) == 0:
                newAns = dist[pos][city] + tsp(dp, dist, mask | (1 << city), city, n)
                ans = min(ans, newAns)

    dp[mask][pos] =
    ansreturn ans

def
    find_minimum_cost(dist):
    n = len(dist)
    dp = [[-1 for _ in range(n)] for _ in range(1 << n)]
    return tsp(dp, dist, 1, 0, n)

dist = [
    [float('inf'), 20, 30, 10, 11],
    [15, float('inf'), 16, 4, 2],
    [3, 5, float('inf'), 2, 4],
    [19, 6, 18, float('inf'), 3],
    [16, 4, 7, 16, float('inf')]
]

min_cost =
find_minimum_cost(dist)
print(f"Minimum cost: {min_costK")
```

Output :-

```
PS D:\Sem 5\Algorithm Analysis and Design> & C:/Users/princ/AppData/Local/Programs/Python/Python312/python.exe "d:/Sem 5/Algorithm Analysis and Design/Pr
actical-7/Travelling_Salesman_Problem.py"
Minimum cost: 28
PS D:\Sem 5\Algorithm Analysis and Design> & C:/Users/princ/AppData/Local/Programs/Python/Python312/python.exe "d:/Sem 5/Algorithm Analysis and Design/Pr
actical-7/Travelling_Salesman_Problem.py"
Minimum cost: 28
PS D:\Sem 5\Algorithm Analysis and Design> []
```