

Exercise 165:-

5. Assume you are solving the Traveling Salesperson Problem for 4 cities (A, B, C, D) with known distances between each pair of cities. Now, you need to add a fifth city (E) to the problem.

Program:-

```
def tsp(distances):
    n = len(distances)
    dp = [[float('inf')] * n for _ in range(1 << n)]
    dp[1][0] = 0 # Starting from city A, only set bit 0
    for mask in range(1 << n):
        for u in range(n):
            if mask & (1 << u):
                for v in range(n):
                    if not mask & (1 << v):
                        dp[mask | (1 << v)][v] = min(dp[mask | (1 << v)][v], dp[mask][u] + distances[u][v])
    min_path = float('inf')
    for u in range(1, n):
        min_path = min(min_path, dp[(1 << n) - 1][u] + distances[u][0])
    return min_path
distances = [
    [0, 10, 15, 20, 25],
    [10, 0, 35, 25, 30],
    [15, 35, 0, 30, 20],
    [20, 25, 30, 0, 15],
    [25, 30, 20, 15, 0]
]
print(f"Minimum path cost is {tsp(distances)}")
```

Output:-

```
C:\Users\afree\PycharmProjects\pythonProject\.venv\Scripts\python.exe C:\Users\afree\PycharmProjects\pythonProject\0.py
Minimum cost path is 8

Process finished with exit code 0
```

Time complexity:- $O(n^2 \cdot 2^n)$