

## 111. Warshalls algorithm

### Code:

```
def warshall_algorithm(graph):
    n = len(graph)
    reach = [[0] * n for _ in range(n)]
    for i in range(n):
        for j in range(n):
            reach[i][j] = graph[i][j]
    for k in range(n):
        for i in range(n):
            for j in range(n):
                reach[i][j] = reach[i][j] or (reach[i][k] and reach[k][j])

    return reach

if __name__ == "__main__":
    graph = [[1, 1, 0, 1],
              [0, 1, 1, 0],
              [0, 0, 1, 1],
              [0, 0, 0, 1]]

    reach = warshall_algorithm(graph)
    print("Transitive closure of the given graph:")
    for row in reach:
        print(row)
```

### Output:

```
Transitive closure of the given graph:
[1, 1, 1, 1]
[0, 1, 1, 1]
[0, 0, 1, 1]
[0, 0, 0, 1]
```

### Time Complexity:

- $T(n) = O(n^3)$