Warshall's Algorithm

- Warshall's algorithm computes the transitive closure.
- Transitive closure is a matrix that gives information about the existence of path between every pair of vertices.

Pseudocode

- *Input*:   **The adjacency matrix A of a digraph with n vertices**
- *Output*:   **The transitive closure of the digraph**
  1. $R^{(0)} \leftarrow A$
  2. *for $k \leftarrow 1$ to n do*
  3. *for $i \leftarrow 1$ to n do*
  4. *for $j \leftarrow 1$ to n do*
  5. $R^{(k)}[i, j] \leftarrow R^{(k-1)}[i, j]$ *or ($R^{(k-1)}[i, k]$ and $R^{(k-1)}[k, j]$)*
  6. *return $R^{(n)}$*

Time Complexity of Warshall's Algorithm

- The basic operation is in the inner most for loop. It executes for every iteration.
- There are three for loops in this algorithm.
- Each for loop executes n times for every iteration of its outer for loop.
- Number of times the basic operation executes is given by the expression

$$C(n) = n \times n \times n$$
$$= n^3$$

- **Time complexity of Warshall's algorithm is $\Theta(n^3)$.**
- It is same for best case, worst case and average case scenarios.