

Pseudocode Outline: Topic 5

Graph Algorithms —

Reachability, Shortest Paths, and Performance Tracking

BEGIN

Initialize constants and counters:

- Set INF = 99999 to represent unreachable edges
- Initialize comparisons = 0
- Initialize dataExchanges = 0

Define 2D array W to represent the graph as a weight matrix

Print:

- “Original Graph (Weight Matrix)”
- Matrix W to console

Compute reachability matrix using Warshall’s Algorithm:

- FOR each vertex i:
 - FOR each vertex j:
 - IF $i == j$ OR $W[i][j] \neq \text{INF}$, then $R[i][j] = 1$
 - ELSE $R[i][j] = 0$
- FOR each intermediate vertex k:
 - FOR each source vertex i:
 - FOR each destination vertex j:
 - Increment comparisons
 - IF $R[i][j] == 0$ AND $R[i][k] == 1$ AND $R[k][j] == 1$:
 - Set $R[i][j] = 1$
 - Increment dataExchanges

Print:

- “Reachability Matrix using Warshall’s Algorithm”
- Matrix R to console

Compute shortest paths using Floyd-Warshall Algorithm:

- Copy matrix W to matrix D
- FOR each intermediate vertex k:
 - FOR each source vertex i:
 - FOR each destination vertex j:
 - IF $D[i][k] \neq \text{INF}$ AND $D[k][j] \neq \text{INF}$:
 - Increment comparisons
 - IF $D[i][k] + D[k][j] < D[i][j]$:
 - Update $D[i][j] = D[i][k] + D[k][j]$
 - Increment dataExchanges

Print:

- "Shortest Paths using Floyd-Warshall Algorithm"
- Matrix D to console

Check for negative weight cycles:

- FOR each vertex i:
 - IF $D[i][i] < 0$, return true (cycle detected)

Print:

- "Negative Cycle Present: true/false"

Print performance statistics:

- "Comparisons: " followed by the value of comparisons
- "Data Exchanges: " followed by the value of dataExchanges

END