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**Assignment No: 2**

**Problem Statement:**

Write a program to implement Bellman-Ford Algorithm using Dynamic

Programming and verify the time complexity

**Program:**

#include <iostream>

#include <climits>

using namespace std;

// Structure for directed edge

struct DirectedEdge

{

int source, destination, weight;

};

// Bellman-Ford function for directed graph

void BellmanFord(DirectedEdge edges[], int V, int E, int source)

{

int dist[V];

// Initialize distances to maximum value for all vertices except the source

for (int i = 0; i < V; i++)

{

dist[i] = INT\_MAX;

}

dist[source] = 0; // Distance from the source to itself is 0

// Relax edges repeatedly (V - 1 times)

for (int i = 1; i <= V - 1; i++)

{

for (int j = 0; j < E; j++)

{

int u = edges[j].source;

int v = edges[j].destination;

int w = edges[j].weight;

// If relaxation condition is met, update the distance

if (dist[u] != INT\_MAX && dist[u] + w < dist[v])

{

dist[v] = dist[u] + w;

}

}

}

// Check for negative weight cycles

for (int i = 0; i < E; i++)

{

int u = edges[i].source;

int v = edges[i].destination;

int w = edges[i].weight;

// If relaxation condition is met after V - 1 iterations, a negative cycle exists

if (dist[u] != INT\_MAX && dist[u] + w < dist[v])

{

cout << "Graph contains a negative weight cycle." << endl;

return;

}

}

// Print the result

cout << "Vertex:\t\tDistance from Source:" << endl;

for (int i = 0; i < V; i++)

{

cout << i << "\t\t" << (dist[i] == INT\_MAX ? "INF" : to\_string(dist[i])) << endl;

}

}

int main()

{

int V = 7;

int E = 10;

DirectedEdge edges[] = {

// Start, Destination, Distance

{0, 1, 6},

{0, 2, 5},

{0, 3, 5},

{2, 1, -2},

{3, 2, -2},

{3, 4, -1},

{1, 5, -1},

{2, 5, -1},

{4, 6, 3},

{5, 6, 3}};

int start;

cout << "Enter the starting source: ";

cin >> start;

BellmanFord(edges, V, E, start);

return 0;

}

**Output:**

Enter the starting source: 0

Vertex: Distance from Source:

0 0

1 1

2 3

3 5

4 4

5 0

6 3

Enter the starting source: 3

Vertex: Distance from Source:

0 INF

1 -4

2 -2

3 0

4 -1

5 -5

6 -2