NAME : MANNE EVANCY

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HTNO : 2503B05116

OSCN LAB 2

Question 1:

Write a C++ program to implement **Dijkstra’s Single Source Shortest Path Algorithm** for a given weighted, undirected graph using an **adjacency matrix representation**.

1. **Problem Setup**

* We have **9 vertices** (0 to 8).

// A C++ program for Dijkstra's single source shortest path

// algorithm. The program is for adjacency matrix

// representation of the graph

#include <limits.h>

#include <stdio.h>

#include <stdbool.h>

// Number of vertices in the graph

#define V 9

// A utility function to find the vertex with minimum

// distance value, from the set of vertices not yet included

// in shortest path tree

int minDistance(int dist[], bool sptSet[])

{

// Initialize min value

int min = INT\_MAX, min\_index;

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

if (sptSet[v] == false &&dist[v] <= min)

min = dist[v], min\_index = v;

return min\_index;

}

// A utility function to print the constructed distance

// array

void printSolution(int dist[], int n)

{

printf("Vertex Distance from Source\n");

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

printf("\t%d \t\t\t\t %d\n", i, dist[i]);

}

// Function that implements Dijkstra's single source

// shortest path algorithm for a graph represented using

// adjacency matrix representation

void dijkstra(int graph[V][V], int src)

{

int dist[V]; // The output array. dist[i] will hold the

// shortest

// distance from src to i

bool sptSet[V]; // sptSet[i] will be true if vertex i is

// included in shortest

// path tree or shortest distance from src to i is

// finalized

// Initialize all distances as INFINITE and stpSet[] as

// false

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

dist[i] = INT\_MAX, sptSet[i] = false;

// Distance of source vertex from itself is always 0

dist[src] = 0;

// Find shortest path for all vertices

for (int count = 0; count < V - 1; count++) {

// Pick the minimum distance vertex from the set of

// vertices not yet processed. u is always equal to

// src in the first iteration.

int u = minDistance(dist, sptSet);

// Mark the picked vertex as processed

sptSet[u] = true;

// Update dist value of the adjacent vertices of the

// picked vertex.

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

// Update dist[v] only if is not in sptSet,

// there is an edge from u to v, and total

// weight of path from srcto v through u is

// smaller than current value of dist[v]

if (!sptSet[v] && graph[u][v]

&&dist[u] != INT\_MAX

&&dist[u] + graph[u][v] <dist[v])

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

}

// print the constructed distance array

printSolution(dist, V);

}

// driver program to test above function

int main()

{

/\* Let us create the example graph discussed above \*/

int graph[V][V] = { { 0, 4, 0, 0, 0, 0, 0, 8, 0 },

{ 4, 0, 8, 0, 0, 0, 0, 11, 0 },

{ 0, 8, 0, 7, 0, 4, 0, 0, 2 },

{ 0, 0, 7, 0, 9, 14, 0, 0, 0 },

{ 0, 0, 0, 9, 0, 10, 0, 0, 0 },

{ 0, 0, 4, 14, 10, 0, 2, 0, 0 },

{ 0, 0, 0, 0, 0, 2, 0, 1, 6 },

{ 8, 11, 0, 0, 0, 0, 1, 0, 7 },

{ 0, 0, 2, 0, 0, 0, 6, 7, 0 } };

dijkstra(graph, 0);

return 0;

}  
  
**Output :**

Vertex Distance from Source

0 0

1 4

2 12

3 19

4 21

5 11

6 9

7 8

8 14

=== Code Execution Successful ===