

# Analysis and Design of Algorithms Lab

## Assignment -7

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Sub Code: CSE-228

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# Dijkstra's shortest path algorithm

## Code

```
// Keep Changing....@Vi

// Dijkstra's single source shortest path algorithm.

#include <bits/stdc++.h>
using namespace std;

#define V 9

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;
}

void printSolution(int dist[], int parent[])
{
    cout<<"Vertex \t Dist. from Source \t Parent\n";
    for (int i = 0; i < V; i++)
        cout << i << "\t\t" << dist[i] << "\t\t" << parent[i] << endl;
}

void dijkstra(int graph[V][V], int src)
{
    // dist[i] will hold the parent of i
    int parent[V];

    // dist[i] will hold the shortest distance from src to i
    int dist[V];

    // sptSet[i] will be true if vertex i is included in shortest path tree
    bool sptSet[V];

    // Initialize all distances as INT_MAX (infinite) and sptSet[] as false
    for (int i = 0; i < V; i++)
    {
        dist[i] = INT_MAX, sptSet[i] = false;
    }
}
```

```
}

dist[src] = 0;
parent[src] = -1;

for (int count = 0; count < V - 1; count++)
{
    // Pick the minimum distance vertex
    int u = minDistance(dist, sptSet);

    sptSet[u] = true;

    // Update dist value of the adjacent vertices
    for (int v = 0; v < V; v++)

        // Update dist[v] only if is not in sptSet
        if (!sptSet[v] && graph[u][v] && dist[u] != INT_MAX
            && dist[u] + graph[u][v] < dist[v])
        {
            dist[v] = dist[u] + graph[u][v];
            parent[v] = u;
        }
}

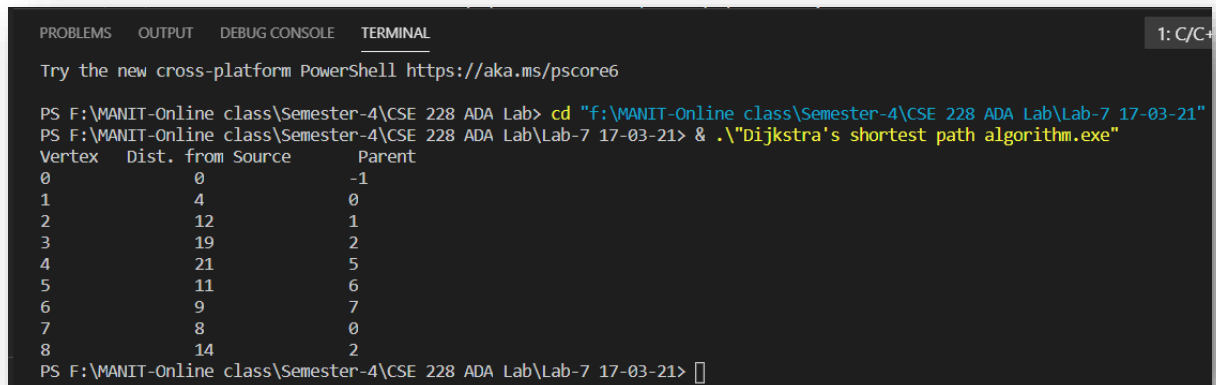
printSolution(dist, parent);
}

int main()
{
    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



```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
Try the new cross-platform PowerShell https://aka.ms/pscore6

PS F:\MANIT-Online class\Semester-4\CSE 228 ADA Lab> cd "f:\MANIT-Online class\Semester-4\CSE 228 ADA Lab\Lab-7 17-03-21"
PS F:\MANIT-Online class\Semester-4\CSE 228 ADA Lab\Lab-7 17-03-21> & .\"Dijkstra's shortest path algorithm.exe"
Vertex  Dist. from Source  Parent
0         0             -1
1         4              0
2        12             1
3        19             2
4        21             5
5        11             6
6         9             7
7         8             0
8        14             2
PS F:\MANIT-Online class\Semester-4\CSE 228 ADA Lab\Lab-7 17-03-21> 
```

## Analysis

- Time Complexity of the implementation is  $O(V^2)$ .
- If the input graph is represented using adjacency list, it can be reduced to  $O(E \log V)$  with the help of binary heap.
- Dijkstra's algorithm doesn't work for graphs with negative weight cycles, it may give correct results for a graph with negative edges. For graphs with negative weight edges and cycles, *Bellman–Ford algorithm* can be used.