Experiment: 3.2

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Subject Name: DAA Lab **Date of Performance:** 31/10/2022

1. Aim:

Code and analyze to find the shortest paths in a graph with positive edge weights using Dijkstra’s algorithm.

2. Task:

To find the shortest paths in a graph with positive edge weights using Dijkstra’s algorithm.

3. Software Used:

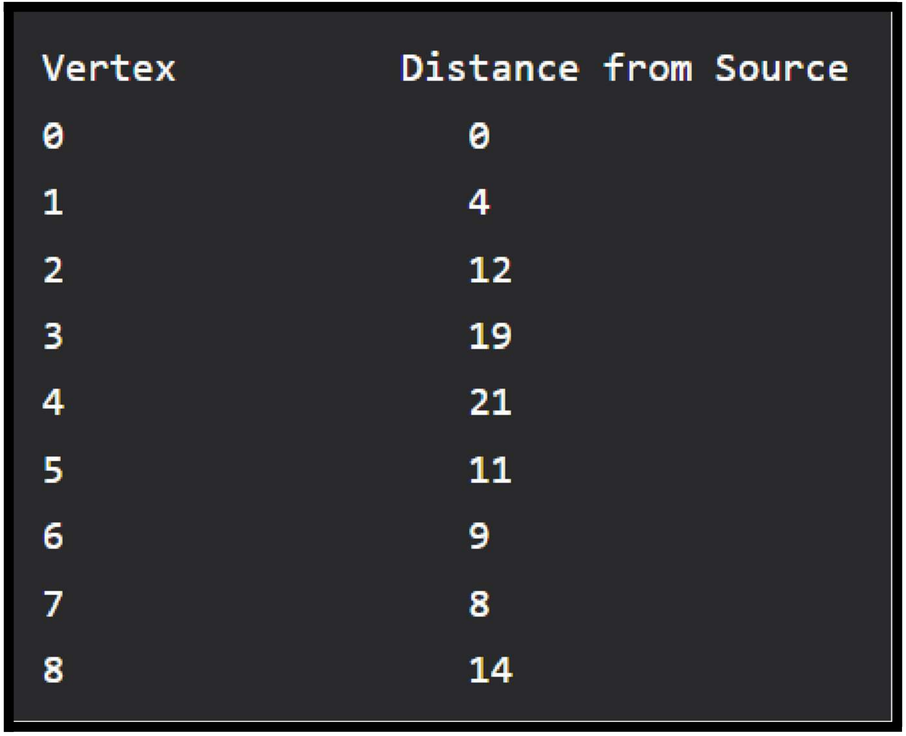
1. Visual Studio Code
2. MinGW
3. C++ compiler

4. Code:

```
#include <bits/stdc++.h>
using namespace std;
#include <limits.h>
#define V 9

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

```
{ cout << "Vertex \t Distance from Source" << endl; for
        (int i = 0; i < V; i++) cout << i << " \t\t\t\t" <<
        dist[i] << endl;
}
void dijkstra(int graph[V][V], int src)
{
        int dist[V]; bool sptSet[V]; for (int i = 0; i <
        V; i++) dist[i] = INT_MAX, sptSet[i] =
        false;
        dist[src] = 0; for (int count = 0; count < V -
        1; count++) { int u = minDistance(dist,
        sptSet); sptSet[u] = true; for (int v = 0; v <
        V; 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];
        }
        printSolution(dist);
}
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;
}
```

5. Output:



```
Vertex              Distance from Source
0                     0
1                     4
2                     12
3                     19
4                     21
5                     11
6                     9
7                     8
8                     14
```

6. Time Complexity:-

The time complexity of this algorithm will be $O(V^2)$

Learning outcomes:

1. Learned about Dynamic programming
2. Learned about optimization techniques
3. Learned about the knapsack problem
4. Learned about different ways of solving knapsack problem