LAB-10

From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

Algorithm:-

```
dijkstras(c[1….n,1….n],src)
//To compute shortest distance from given source node to all nodes of a weighted undirected graph
//Input: An nXn cost matrix c[1…n,1….n] with source node src
//Output: The length dist[j] of a shortest path from src to j
for j□1 to n do
dist[j]□c[src,[j]
end for
for j□1 to n do
vis[j]□0
end for
dist[src]□0
vis[src]□1
count□1
while count!=n do
min□9999
for j□1 to n do
if dist[j]&lt;min and vis[j]!=1
min□dist[j]
u□j
end if
end for
vis[u]□1
count□count+1
for j□1 to n do
if min+c[u,j]&lt;dist[j] and vis[j]!=1
dist[j]□min+c[u,j]
```

end if

end for

end while

write ‘shortest distance is’

for j?1 to n do

write src,j,dist[j]

end for

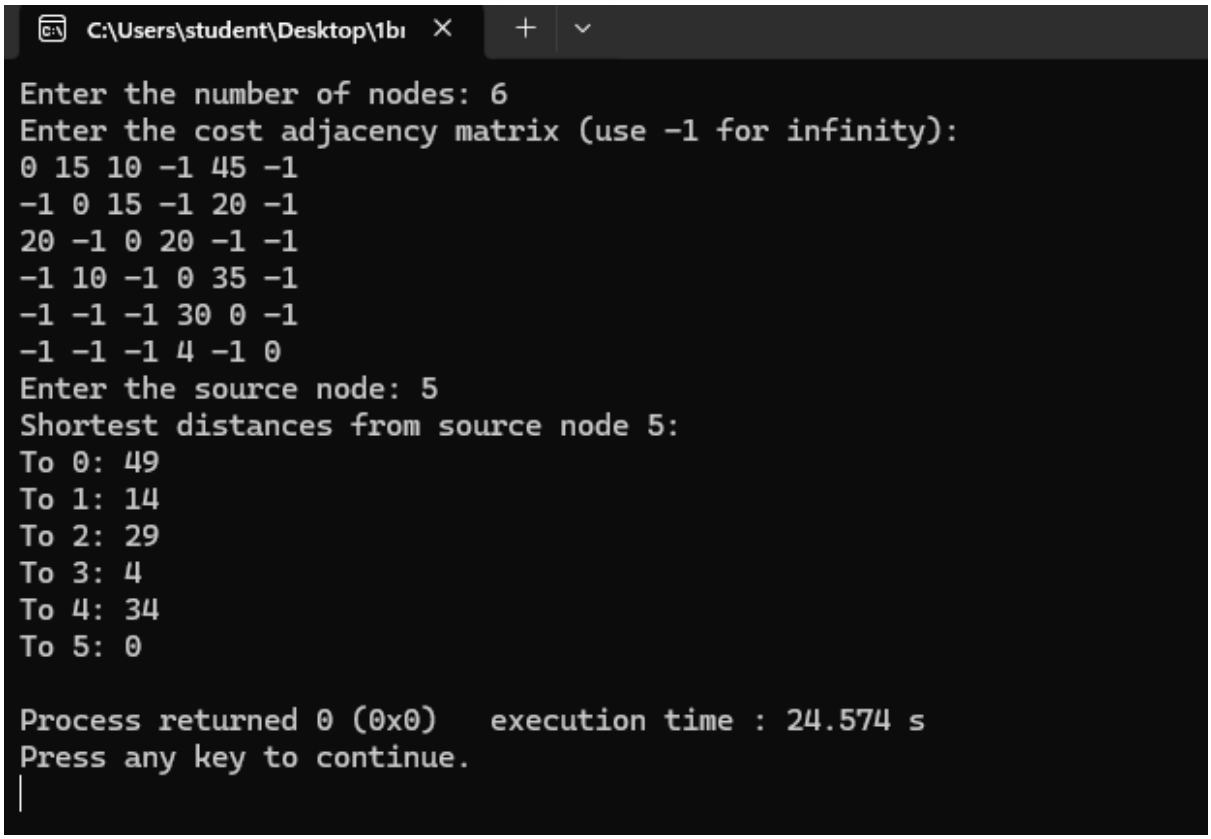
code:-

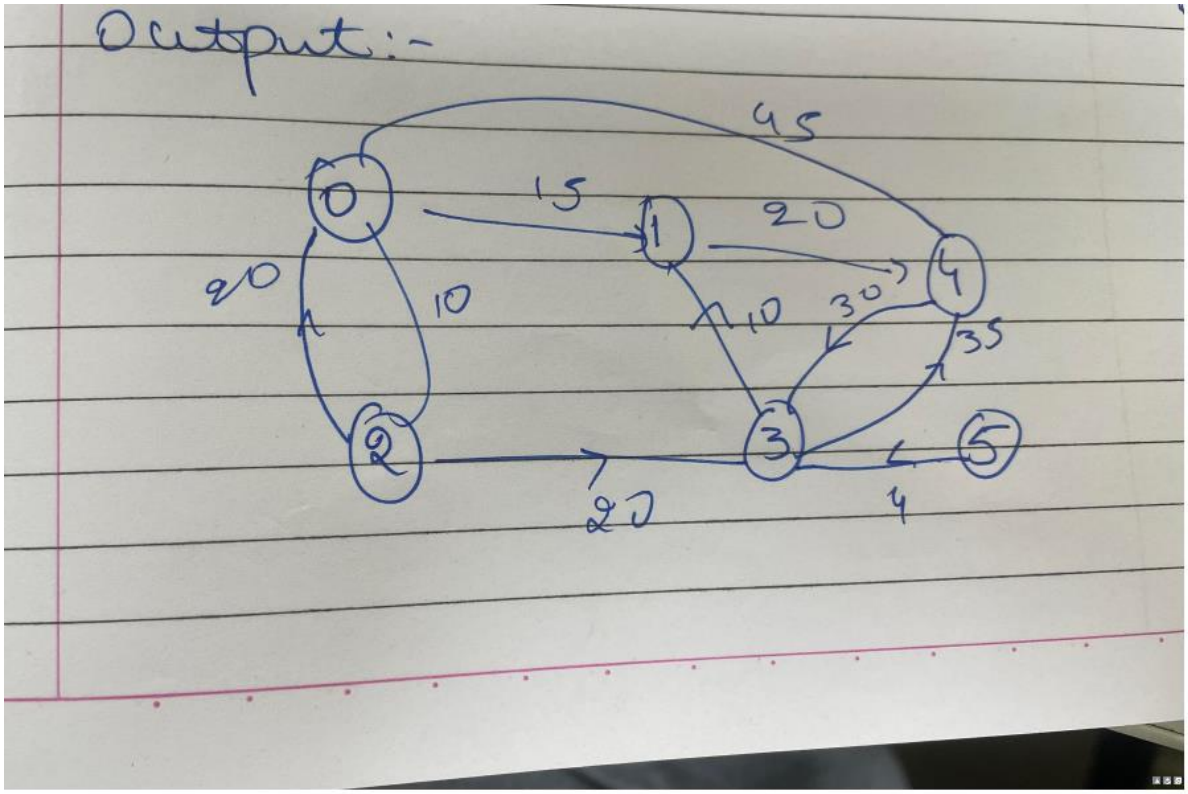
```
#include <stdio.h>
#include <stdlib.h>
#define MAX_NODES 100
#define INF 9999
void dijkstra(int n, int src, int cost[MAX_NODES][MAX_NODES]);
int main() {
   int n;
   int cost[MAX_NODES][MAX_NODES];
   int src;
   printf("Enter the number of nodes: ");
   scanf("%d", &n);
   printf("Enter the cost adjacency matrix (use -1 for infinity):\n");
   for (int i = 0; i < n; i++) {
      for (int j = 0; j < n; j++) {
         scanf("%d", &cost[i][j]);
         if (cost[i][j] == -1 && i != j) {
            cost[i][j] = INF;
         }
      }
   }
   printf("Enter the source node: ");
   scanf("%d", &src);
```

```
    dijkstra(n, src, cost);
    return 0;
}
void dijkstra(int n, int src, int cost[MAX_NODES][MAX_NODES]) {
    int dist[MAX_NODES];
    int vis[MAX_NODES];
    for (int j = 0; j < n; j++) {
        dist[j] = cost[src][j];
        vis[j] = 0;
    }
    dist[src] = 0;
    vis[src] = 1;
    int count = 1;
    while (count != n) {
        int min = INF;
        int u = -1;
        for (int j = 0; j < n; j++) {
            if (!vis[j] && dist[j] < min) {
                min = dist[j];
                u = j;
            }
        }
        if (u == -1) break;
        vis[u] = 1;
        count++;
        for (int j = 0; j < n; j++) {
            if (!vis[j] && cost[u][j] != INF && dist[u] + cost[u][j] < dist[j]) {
                dist[j] = dist[u] + cost[u][j];
            }
        }
    }
```

```
    printf("Shortest distances from source node %d:\n", src);
    for (int j = 0; j < n; j++) {
        if (dist[j] == INF) {
            printf("To %d: Infinity\n", j);
        } else {
            printf("To %d: %d\n", j, dist[j]);
        }
    }
}
```

output:-





Find Minimum Cost Spanning Tree of a given undirected graph using Kruskals algorithm.
Algorithm:

kruskals(c[1…n,1…n])

//To compute the minimum spanning tree of a given weighted undirected graph using Kruskal's

// algorithm

//Input: An nXn cost matrix c[1…n,1….n]

//Output: minimum cost of spanning tree of given undirected graph

ne□0

mincost□0

for i□1 to n do

parent[i]□0

end for

while ne!=n-1 do

min□9999

for i□1 to n do

for j□1 to n do

if c[i,j]<min

min□c[i,j]

u□i

a□i

v□j

b□j

end if

end for

end for

while parent[u]!=0 do

u□parent[u]

end while

while parent[v]!=0 do

v□parent[v]

end while

if u!= v

write a,b,min

parent[v]□u

ne□ne+1

mincost□mincost+min

end if

c[a,b]□9999

c[b,a]□9999

end while

write mincost

return

Code:-

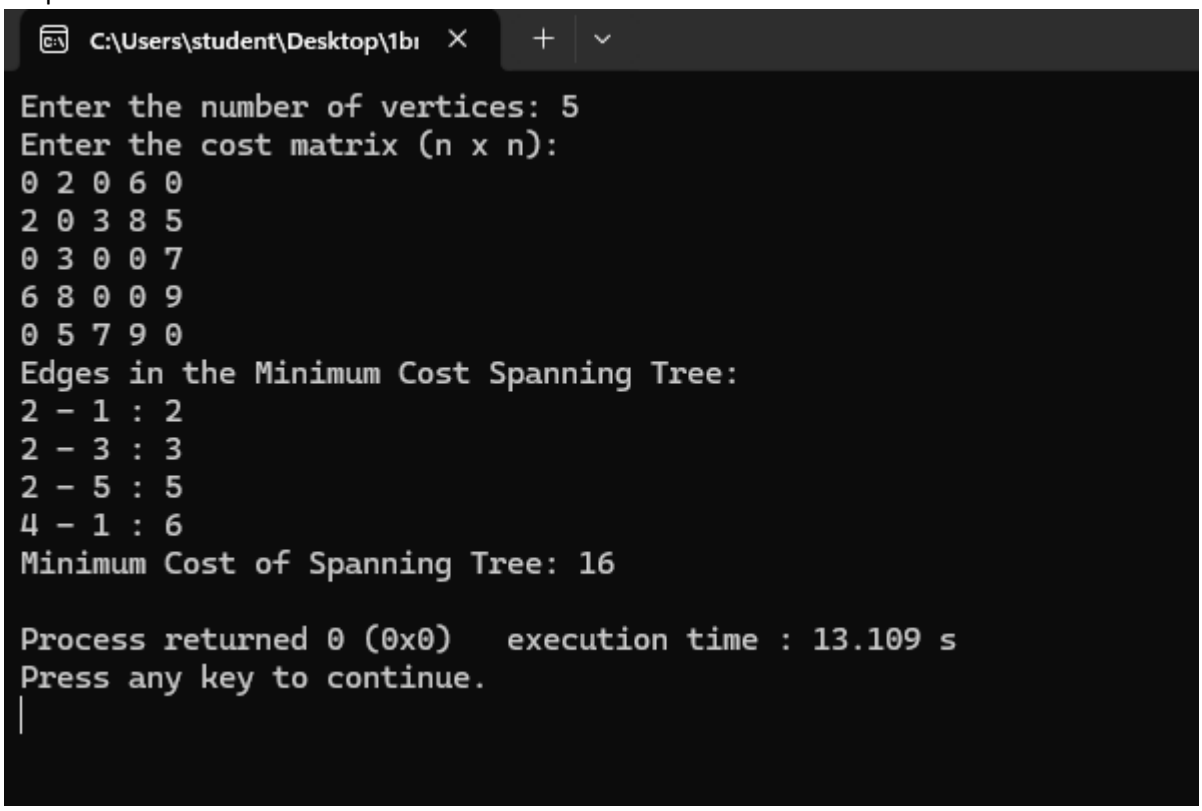
```
#include <stdio.h>
#include <stdbool.h>
```

```
#define MAX 100
struct Edge {
   int u, v, weight;
};
int compare(const void *a, const void *b) {
   struct Edge *a1 = (struct Edge *)a;
   struct Edge *b1 = (struct Edge *)b;
   return a1->weight - b1->weight;
}
int find(int parent[], int i) {
   if (parent[i] == 0)
      return i;
   return find(parent, parent[i]);
}
void unionSets(int parent[], int u, int v) {
   parent[v] = u;
}
void kruskals(int cost_matrix[][MAX], int n) {
   struct Edge edges[MAX * MAX];
   int edge_count = 0;
   int parent[MAX] = {0};
   for (int i = 1; i <= n; i++) {
      for (int j = 1; j <= n; j++) {
         if (cost_matrix[i][j] != 9999) {
            edges[edge_count].u = i;
            edges[edge_count].v = j;
            edges[edge_count].weight = cost_matrix[i][j];
            edge_count++;
         }
      }
   }
```

```
    qsort(edges, edge_count, sizeof(edges[0]), compare);

    int mincost = 0;
    int ne = 0;

    printf("Edges in the Minimum Cost Spanning Tree:\n");
    for (int i = 0; i < edge_count; i++) {
        int u = find(parent, edges[i].u);
        int v = find(parent, edges[i].v);
        if (u != v) {
            printf("%d - %d : %d\n", edges[i].u, edges[i].v, edges[i].weight);
            unionSets(parent, u, v);
            mincost += edges[i].weight;
            ne++;
        }
        if (ne == n - 1)
            break;
    }

    printf("Minimum Cost of Spanning Tree: %d\n", mincost);
}

int main() {
    int n;
    printf("Enter the number of vertices: ");
    scanf("%d", &n);

    int cost_matrix[MAX][MAX];

    printf("Enter the cost matrix (n x n):\n");
    for (int i = 1; i <= n; i++) {
```

```
        for (int j = 1; j <= n; j++) {
            scanf("%d", &cost_matrix[i][j]);
            if (cost_matrix[i][j] == 0)
                cost_matrix[i][j] = 9999;
        }
    }

    kruskals(cost_matrix, n);

    return 0;
}
```

output:-



return 0;}

Output:-

Enter no of vertices: 5

Enter the cost matrix

	0	1	2	3	4
0	0	2	0	6	0
1	2	0	3	8	5
2	0	3	0	0	7
3	6	8	0	0	9
4	0	5	7	9	0

Edges in MST

2 - 1 = 2

2 - 3 = 3