S.No: 6	Exp. Name: ***kruskals Algorithm***	Date:2025-08-25

Aim:

Write a C program to implement Kruskal's algorithm for finding the Minimum Cost Spanning Tree (MCST) and the total minimum cost of travel for a given undirected graph. The graph will be represented by an adjacency matrix.

Input Format:

- The first input should be an integer, representing the number of vertices in the graph.
- The next input should be an adjacency matrix representing the weighted graph.
- If there is no edge between two vertices, the weight should be given as 9999 (representing infinity).

Output Format:

- The program should print the edges selected in the Minimum Spanning Tree (MST) along with their weights.

Note:

- Refer to the visible test cases to strictly match the input and output layout.

Source Code:

minCostFinding.c

```
#include <stdio.h>
#include <stdlib.h>
#include <limits.h>
#define INF 9999

typedef struct{
int u,v,cost;
}Edge;

int find(int parent[], int i) {
// Write your code here...
while(parent[i]!=i)
i=parent[i];
return i;
}


void union1(int parent[], int rank[], int i, int j) {
   int xset=find(parent, i);
   int yset=find(parent, j);
   // Write your code here...
   if(xset==yset)
      return;
   if(rank[xset]<rank[yset]){
      parent[xset]=yset;
   }
   else if(rank[xset]>rank[yset]){
      parent[yset]=xset;
   }
   else{
```

```
      parent[yset]=xset;
      rank[xset]++;
   }
}
int compare(const void *a,const void *b){
   Edge *e1=(Edge *)a;
   Edge *e2=(Edge *)b;
   if(e1->cost != e2->cost)
      return e1->cost - e2->cost;
   else if (e1->u != e2->u)
      return e1->u - e2->u;
   else
      return e1->v - e2->v;
}

void kruskalMST(int **cost, int V) {

   // Write your code here...
   Edge edges[V*V];
   int edgeCount=0;
   for(int i=0;i<V;i++){
      for(int j=i+1;j<V;j++){
         if(cost[i][j] != INF){
            edges[edgeCount].u=i;
            edges[edgeCount].v=j;
            edges[edgeCount].cost=cost[i][j];
            edgeCount++;
         }
      }
   }

   qsort(edges,edgeCount,sizeof(Edge),compare);
   int parent[V],rank[V];
   for(int i=0;i<V;i++){
      parent[i]=i;
      rank[i]=0;
   }

   int mstCost=0;
   int cnt=0;
   int edgeIndex=0;
   for(int i=0 ;i<edgeCount && cnt<V-1;i++){
      int u=edges[i].u;
      int v= edges[i].v;
      int setU=find(parent,u);
      int setV=find(parent,v);
      if(setU !=setV){
         printf("Edge %d:(%d, %d) cost:%d\n",edgeIndex,u,v,edges[i].cost);
         mstCost+=edges[i].cost;
         union1(parent,rank,setU,setV);
         cnt++;
         edgeIndex++;
      }
   }
   printf("Minimum cost= %d\n",mstCost);
}
```

```
int main() {
    int V;
    printf("No of vertices: ");
    scanf("%d", &V);

    int **cost = (int **)malloc(V * sizeof(int *));
    for (int i = 0; i < V; i++)
        cost[i] = (int *)malloc(V * sizeof(int));

    printf("Adjacency matrix:\n");
    for (int i = 0; i < V; i++)
        for (int j = 0; j < V; j++)
            scanf("%d", &cost[i][j]);

    kruskalMST(cost, V);

    for (int i = 0; i < V; i++)
        free(cost[i]);
    free(cost);

    return 0;
}
```

Execution Results - All test cases have succeeded!

Test Case - 1
User Output
No of vertices: 5
Adjacency matrix: 9999 2 9999 9999 5
2 9999 3 9999 9999
9999 3 9999 4 9999
9999 9999 4 9999 9999
5 9999 9999 9999 9999
Edge 0:(0, 1) cost:2
Edge 1:(1, 2) cost:3
Edge 2:(2, 3) cost:4
Edge 3:(0, 4) cost:5
Minimum cost= 14

Test Case - 2
User Output
No of vertices: 4
Adjacency matrix: 9999 3 6 3
3 9999 5 2
6 5 9999 4
3 2 4 9999
Edge 0:(1, 3) cost:2
Edge 1:(0, 1) cost:3
Edge 2:(2, 3) cost:4

```
Minimum cost= 9
```