**TITLE 33**

Write a program to find All-to-all Shortest paths in a Graph

**OBJECTIVE:**

By the end of this program we will be able to find All-to-all Shortest paths in a graph.

**PROBLEM STATEMENT:**

In this problem we find All-to-all Shortest paths in a graph. Input from the user:

Enter number of vertices:

Once the input is collected and stored the output is printed.

**ALGORITHM:**

START

Define variables: u,v,w

INPUT: Read from the keyboard

COMPUTATION: Computing the All-to-all Shortest paths in a graph

DISPLAY: Displaying the output

STOP

**PROGRAM:**

#include<stdio.h>

#define MAX 30

typedef struct edge

{

int u,v,w;

}edge;

typedef struct edgelist

{

edge data[MAX];

int n;

}edgelist;

edgelist elist;

int G[MAX][MAX],n;

edgelist spanlist;

void kruskal();

int find(int belongs[],int vertexno);

void union1(int belongs[],int c1,int c2);

void sort();

void print();

void main()

{

int i,j,total\_cost;

printf("\nEnter number of vertices:");

scanf("%d",&n);

printf("\nEnter the adjacency matrix:\n");

for(i=0;i<n;i++)

for(j=0;j<n;j++)

scanf("%d",&G[i][j]);

kruskal();

print();

}

void kruskal()

{

int belongs[MAX],i,j,cno1,cno2;

elist.n=0;

for(i=1;i<n;i++)

for(j=0;j<i;j++)

{

if(G[i][j]!=0)

{

elist.data[elist.n].u=i;

elist.data[elist.n].v=j;

elist.data[elist.n].w=G[i][j];

elist.n++;

}

}

sort();

for(i=0;i<n;i++)

belongs[i]=i;

spanlist.n=0;

for(i=0;i<elist.n;i++)

{

cno1=find(belongs,elist.data[i].u);

cno2=find(belongs,elist.data[i].v);

if(cno1!=cno2)

{

spanlist.data[spanlist.n]=elist.data[i];

spanlist.n=spanlist.n+1;

union1(belongs,cno1,cno2);

}

}

}

int find(int belongs[],int vertexno)

{

return(belongs[vertexno]);

}

void union1(int belongs[],int c1,int c2)

{

int i;

for(i=0;i<n;i++)

if(belongs[i]==c2)

belongs[i]=c1;

}

void sort()

{

int i,j;

edge temp;

for(i=1;i<elist.n;i++)

for(j=0;j<elist.n-1;j++)

if(elist.data[j].w>elist.data[j+1].w)

{

temp=elist.data[j];

elist.data[j]=elist.data[j+1];

elist.data[j+1]=temp;

}

}

void print()

{

int i,cost=0;

for(i=0;i<spanlist.n;i++)

{

printf("\n%d\t%d\t%d",spanlist.data[i].u,spanlist.data[i].v,spanlist.data[i].w);

cost=cost+spanlist.data[i].w;

}

printf("\n\nCost of the spanning tree=%d",cost);

}

**CONCLUSION:**

The simulation of the above C program enhanced my knowledge on graphs.

**OUTPUT:**

Enter number of vertices:5

Enter the adjacency matrix:

1 2 3 4 5

6 7 8 9 10

11 12 13 1 4

14 15 14 3 2

9 4 8 2 1

4 3 2

4 1 4

1 0 6

4 2 8

Cost of the spanning tree=20