

DATA STRUCTURE LAB EXAM

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REG NO : TKM20MCA-2038

S1 -136

GIT LINK : <https://github.com/sindoori-b/data-structures/tree/patch-1/EXAM>

QUESTION 1

Develop a program to generate a minimum spanning tree using Kruskal's Algorithm for the given graph and computes the total cost.

ALGORITHM

Step

- 1: Start
- 2: Create a graph
- 3: Make an adjacency matrix for that graph
- 4: Sort all the edges from low weight to high
- 5: Take the edge with the lowest weight and add it to the spanning tree. If adding the edge created a cycle, then reject this edge.
- 6: Add the weight to mincost.
- 7: Keep adding edges until we reach all vertices.
- 8: Stop

PROGRAM CODE

```
#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);

}

```

OUTPUT

```

File Edit View Search Terminal Help
Enter number of vertices:6
Enter the adjacency matrix:
0 3 0 0 1 0
3 0 3 0 5 0
0 3 0 0 0 0
0 0 0 0 5 2
1 5 0 5 0 4
0 0 6 2 4 0

4 0 1
5 3 2
1 0 3
2 1 3
5 4 4

Cost of the spanning tree=13
(program exited with code: 30)
Press return to continue

```

QUESTION 2

Develop a programs to implement DFS and BFS

ALGORITHM BFS**STEPS**

- 1: Start
- 2: Create a graph
- 3: Create adjacency matrix
- 4: Start by putting any one of the graph's vertices at the back of a queue.
- 5: Take the front item of the queue and add it to the visited list.
- 6: Create a list of that vertex's adjacent nodes.
- 7: Add the ones which aren't in the visited list to the back of the queue.
- 8: Keep repeating steps 5,6 and 7 until the queue is empty.
- 9: Stop

ALGORITHM DFS**STEPS**

- 1: Start
- 2: Create a graph
- 3: Create adjacency matrix
- 4: Start by putting any one of the graph's vertices on top of a stack.
- 5: Take the top item of the stack and add it to the visited list.
- 6: Create a list of that vertex's adjacent nodes.
- 7 Add the ones which aren't in the visited list to the top of the stack.
- 8: Keep repeating steps 5,6 and 7 until the stack is empty.

PROGRAM CODE

```
#include<stdio.h>

int a[20][20], q[20], visited[20], n, i, j, f = 0, r = -1, reach[20];

void bfs(int v)
{
    for(i = 1; i <= n; i++)
        if(a[v][i] && !visited[i])
            q[++r] = i;
    if(f <= r) {
        visited[q[f]] = 1;
        bfs(q[f++]);
    }
}

void dfs(int v)
{
    int i;
    reach[v]=1;
    for (i=1;i<=n;i++)
        if(a[v][i] && !reach[i])
        {
            printf("\n %d->%d",v,i);
            dfs(i);
        }
}
```



```
int main()
{
    int v,ch,count=0;
    printf("\n Enter the number of vertices:");
    scanf("%d", &n);
    for(i=1; i <= n; i++)
    {
        q[i] = 0;
        visited[i] = 0;
        reach[i]=0;
    }
    printf("\n Enter the adjecncy matrix \n");
    for(i=1; i<=n; i++)
    {
        for(j=1;j<=n;j++)
        {
            scanf("%d", &a[i][j]);
        }
    }
    printf("\n Enter the starting vertex:");
    scanf("%d", &v);

    printf("1: BFS \n2: DTS \nEnter your Choice\n");
    scanf("%d",&ch);
```

```
switch(ch)
{
    case 1:printf("BFS is :\n");
            bfs(v);
            printf("\n The node which are reachable are:\n");
            for(i=1; i <= n; i++)
            {
                if(visited[i])
                    printf("%d\t", i);
                else
                {
                    printf("\n BFS is not possible. Not all nodes are reachable");
                    break;
                }
            }
            break;

    case 2: printf("DFS is \n");
            dfs(1);
            printf("\n");
            for (i=1;i<=n;i++)
            {
                if(reach[i])
                    count++;
            }
}
```

```

        if(count==n)

        printf("\n Graph is connected"); else

        printf("\n Graph is not connected");

        break;

default :printf("inavlid entry");

}

}

```

OUTPUT

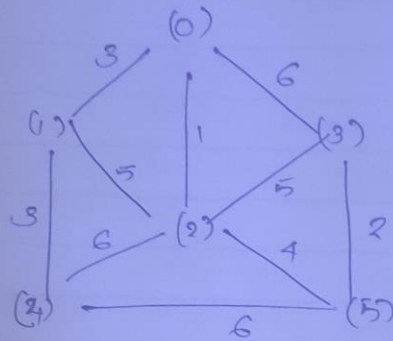
```

File Edit View Search Terminal Help
Enter the number of vertices:6
Enter the adjacency matrix
0 1 0 1 0 0
1 0 1 0 1 0
0 1 0 0 1 1
1 0 0 0 1 1
1 1 1 1 0 1
0 0 1 1 1 0
Enter the starting vertex:1
1: BFS
2: DFS
Enter your choice
1
DFS is :
The node which are reachable are:
1 2 3 4 5 6
(program exited with code: 0)
Press return to continue

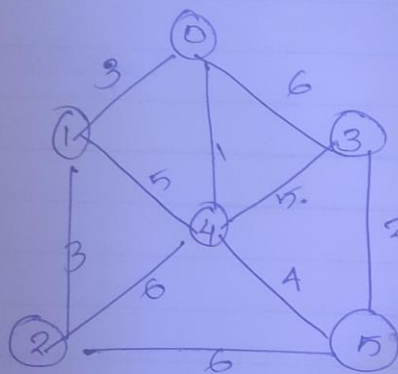
```

```
File Edit View Search Terminal Help
Enter the number of vertices:4
Enter the adjacency matrix
0 1 0 0
1 0 1 0
1 1 0 1
0 1 1 0
Enter the starting vertex:1
1: BFS
2: DFS
Enter your Choice
2
DFS is
1->2
2->3
3->4
Graph is connected
(program exited with code: 0)
Press return to continue
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```

1. Develop a program to generate a minimum spanning tree using Kruskal algorithm for the given graph and compute the total cost.



0	1	2	3	4
0	3	1	6	0
3	0	5	0	3
1				
6				
0				



	0	1	2	3
0	0	3	0	6
1	3	0	3	0
2	0	3	0	0
3	6	0	0	0
4	1	5	6	5
5	0	0	6	2

2. Develop a program to implement DFS and BFS.

Algorithm BFS

Step 1: Start

Step 2: Start create a graph

Step 3: create adjacency matrix

Step 4: Start by putting 1s to make each vertex at the back of a queue

Step 5: Take the front item of queue and add it to visited list

Step 6: create a list of adjacency nodes

Step 7: Add the ones which are in the visited list to back of queue

Step 8: Repeat Step 5, 6 & 7, until list is empty.

Step 9: stop

Algorithm DFS

1: start

2: create a graph & its appropriate adjacency matrix

3: Start by putting any one of graph's vertices on top

4: take the top item and add it to the visited list

5: create a list of that vertex's adjacent nodes.

6: Add the ones which are in the visited list to the back of queue.

7: Repeat step 4, 5 & 6 until list is empty.

8: stop

Algorithm Kruskal's

- Step 1: Create a graph
- Step 2: Make a adjacency matrix for that graph
- Step 3: Sort all the edge from low weight to high weight
- Step 4: Take the edge with lowest weight and add it to spanning graph, if the edge create a cycle, remove the edge.
- Step 5: Add the weight to mincost
- Step 6: keep adding the edge until visiting all edges

