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Git repository link - https://github.com/ANUSHREE-2021/Data-Structure/tree/main/EXTERNAL%20LAB%20EXAM

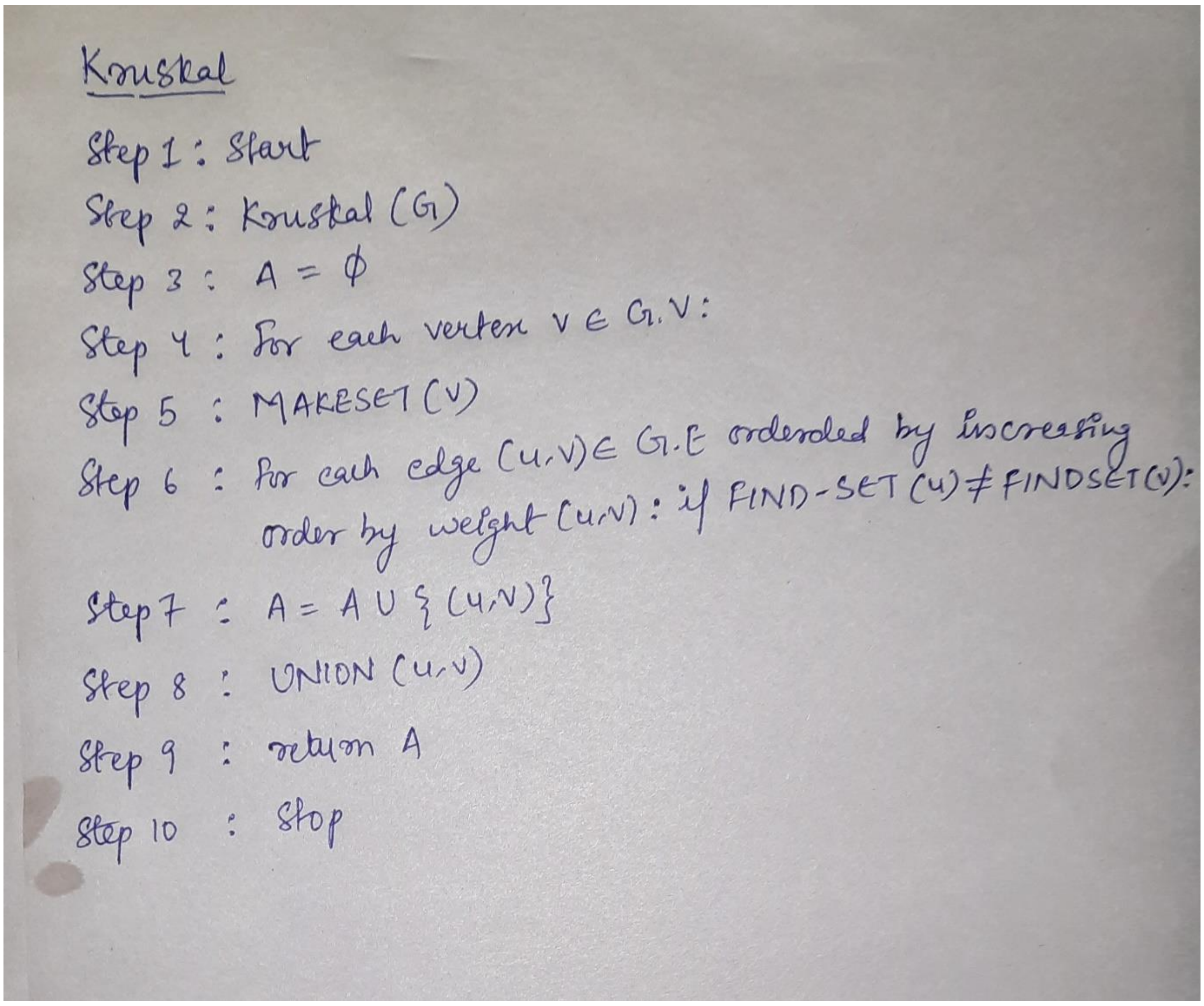
EXTERNAL LAB EXAM (1ST SEMESTER)

DATA STRUCTURE LAB

QUESTION 1

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

ALGORITHM



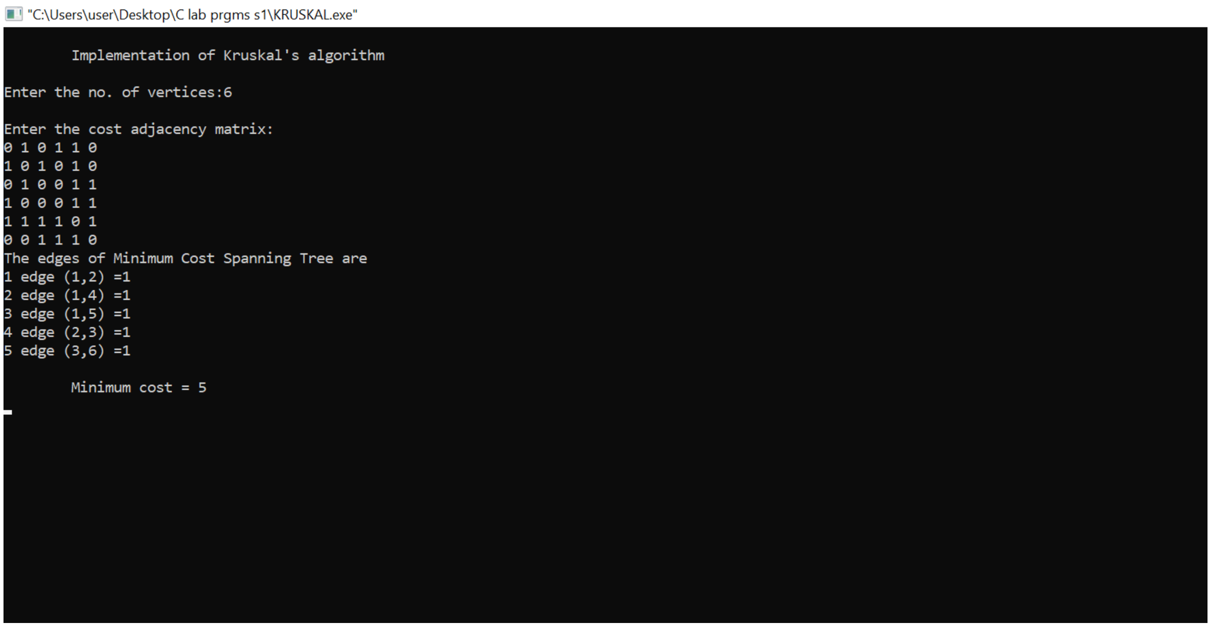
Kruskal

```
Step 1 : Start
Step 2 : Kruskal (G)
Step 3 : A = ϕ
Step 4 : For each vertex v ∈ G.V:
Step 5 : MAKESET (v)
Step 6 : For each edge (u,v)∈ G.E orderded by increasing
         order by weight (u,v) : if FIND-SET (u) ≠ FINDSET(v):
Step 7 : A = A U {(u,v)}
Step 8 : UNION (u,v)
Step 9 : return A
Step 10 : Stop
```

PROGRAM CODE

```
#include<stdio.h>
#include<conio.h>
#include<stdlib.h>
int i,j,k,a,b,u,v,n,ne=1;
int min,mincost=0,cost[9][9],parent[9];
int find(int);
int uni(int,int);
void main()
{

        printf("\n\tImplementation of Kruskal's algorithm\n");
        printf("\nEnter the no. of vertices:");
        scanf("%d",&n);
        printf("\nEnter the cost adjacency matrix:\n");
        for(i=1;i<=n;i++)
        {
                for(j=1;j<=n;j++)
                {
                        scanf("%d",&cost[i][j]);
                        if(cost[i][j]==0)
                                cost[i][j]=999;
                }
        }
        printf("The edges of Minimum Cost Spanning Tree are\n");
        while(ne < n)
        {
                for(i=1,min=999;i<=n;i++)
                {
                        for(j=1;j <= n;j++)
                        {
                                if(cost[i][j] < min)
                                {
                                        min=cost[i][j];
                                        a=u=i;
                                        b=v=j;
                                }
                        }
                }
                u=find(u);
                v=find(v);
                if(uni(u,v))
                {
                        printf("%d edge (%d,%d) =%d\n",ne++,a,b,min);
                        mincost +=min;
                }
                cost[a][b]=cost[b][a]=999;
        }
        printf("\n\tMinimum cost = %d\n",mincost);
        getch();
}
int find(int i)
{
        while(parent[i])
        i=parent[i];
        return i;
}
int uni(int i,int j)
{
        if(i!=j)
        {
                parent[j]=i;
                return 1;
        }
        return 0;
}
```

OUTPUT



"C:\Users\user\Desktop\C lab prgms s1\KRUSKAL.exe"

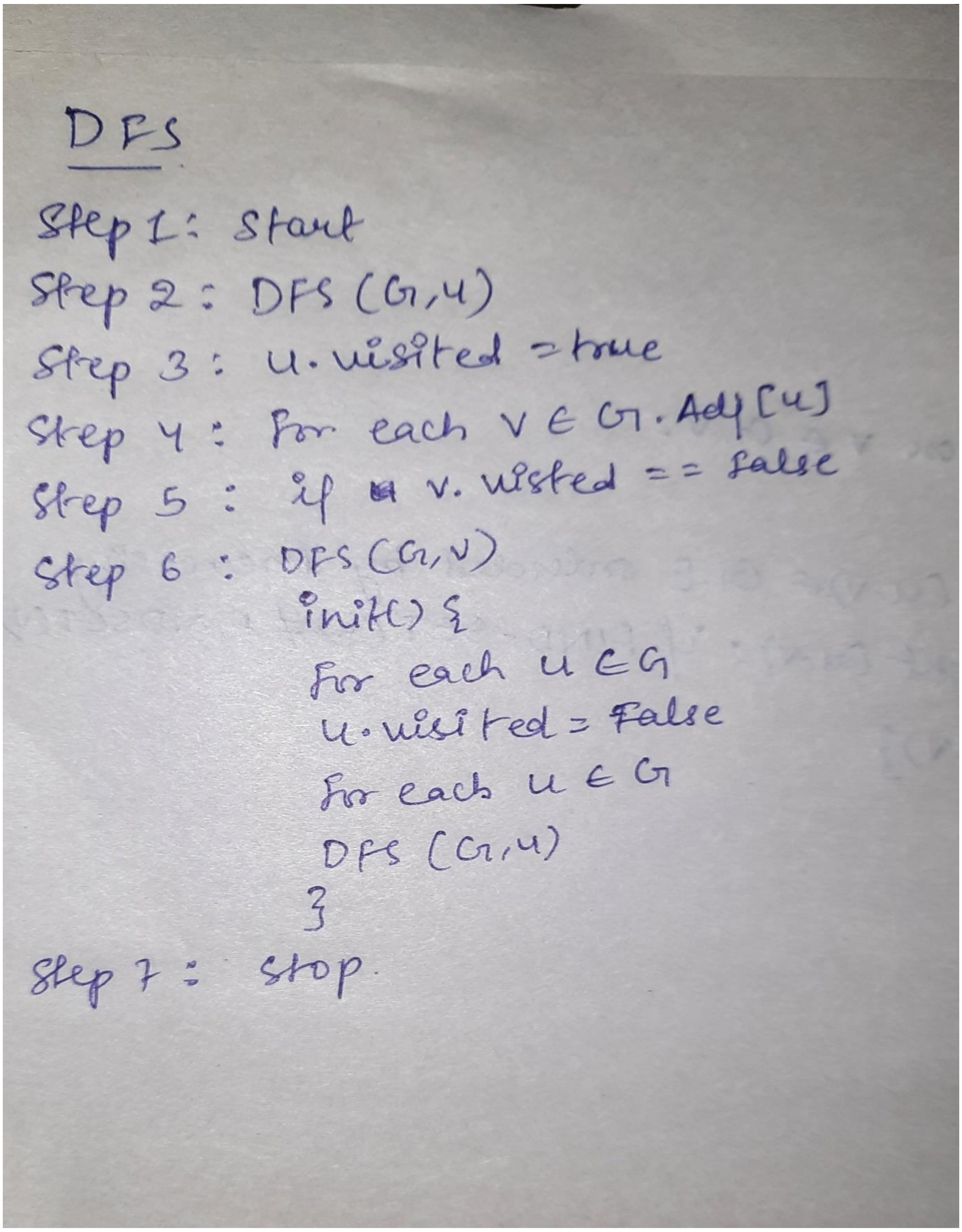
```
        Implementation of Kruskal's algorithm

Enter the no. of vertices:6

Enter the cost adjacency matrix:
0 1 0 1 1 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
The edges of Minimum Cost Spanning Tree are
1 edge (1,2) =1
2 edge (1,4) =1
3 edge (1,5) =1
4 edge (2,3) =1
5 edge (3,6) =1

        Minimum cost = 5
```

QUESTION 2

Develop a program to implement DFS and BFS.

ALGORITHM

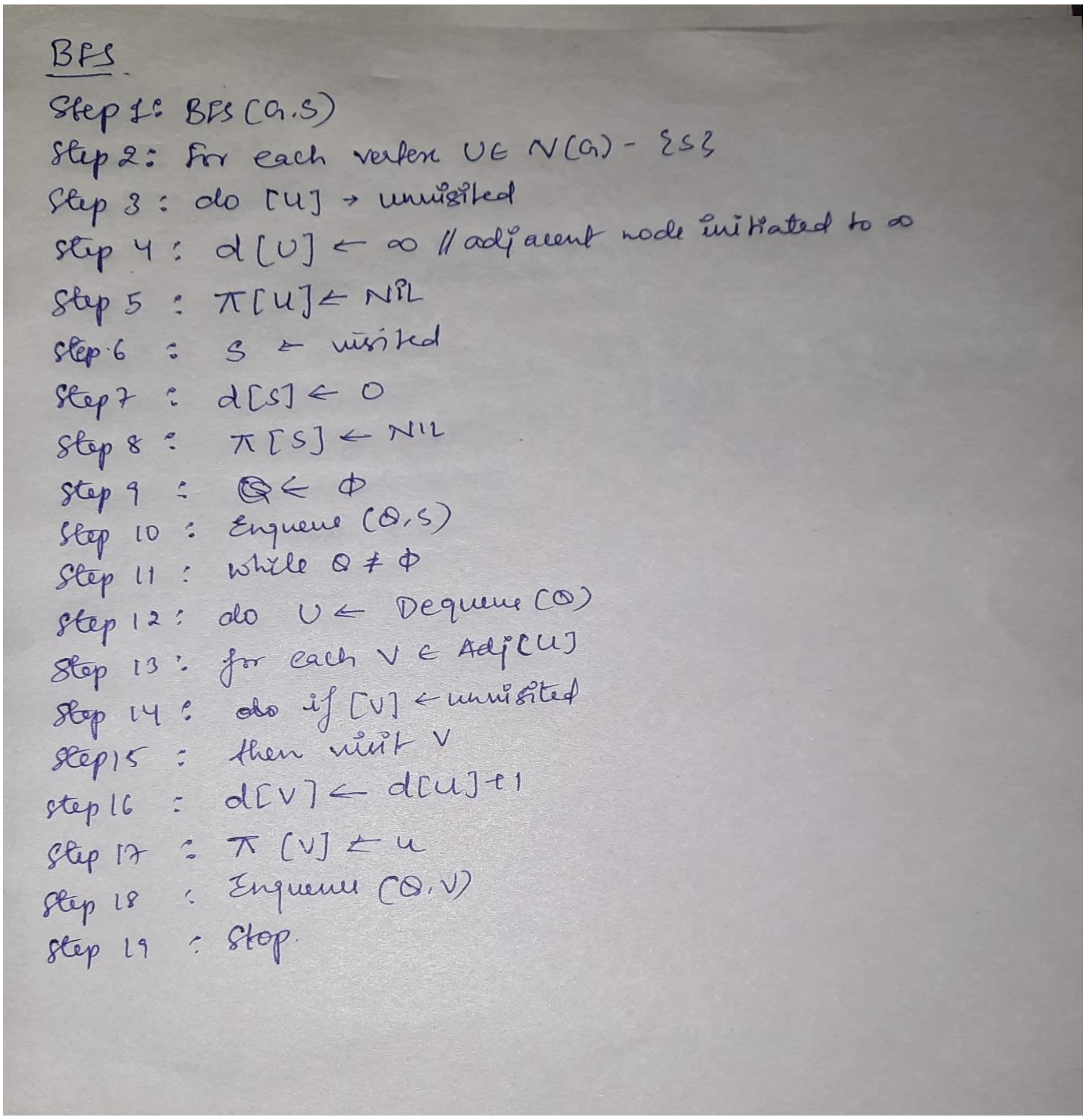
//DFS



DFS

```
Step 1: Start
Step 2: DFS (G,u)
Step 3: u.visited = true
Step 4: for each v ∈ G.Adj[u]
Step 5:  if v. wisted == false
Step 6: DFS (G,v)
         init() {
          for each u ∈ G
          u.visited = False
          for each u ∈ G
          DFS (G,u)
         }
Step 7: stop.
```

//BFS



BFS.

```
Step 1: BFS (G,S)
Step 2: For each vertex $U \in V(G) - \{S\}$
Step 3: do [U] → unvisited
Step 4: $d[U] \leftarrow \infty$ // adjacent node initiated to $\infty$
Step 5: $\pi[U] \leftarrow$ NIL
Step 6: $S \leftarrow$ visited
Step 7: $d[S] \leftarrow 0$
Step 8: $\pi[S] \leftarrow$ NIL
Step 9: $Q \leftarrow \Phi$
Step 10: Enqueue (Q,S)
Step 11: while $Q \neq \Phi$
Step 12: do $U \leftarrow$ Dequeue (Q)
Step 13: for each $V \in Adj[U]$
Step 14: do if [V] ← unvisited
Step15: then visit V
step 16: $d[V] \leftarrow d[U]+1$
Step 17: $\pi[V] \leftarrow u$
Step 18: Enqueue (Q,V)
Step 19: Stop.
```

PROGRAM CODE

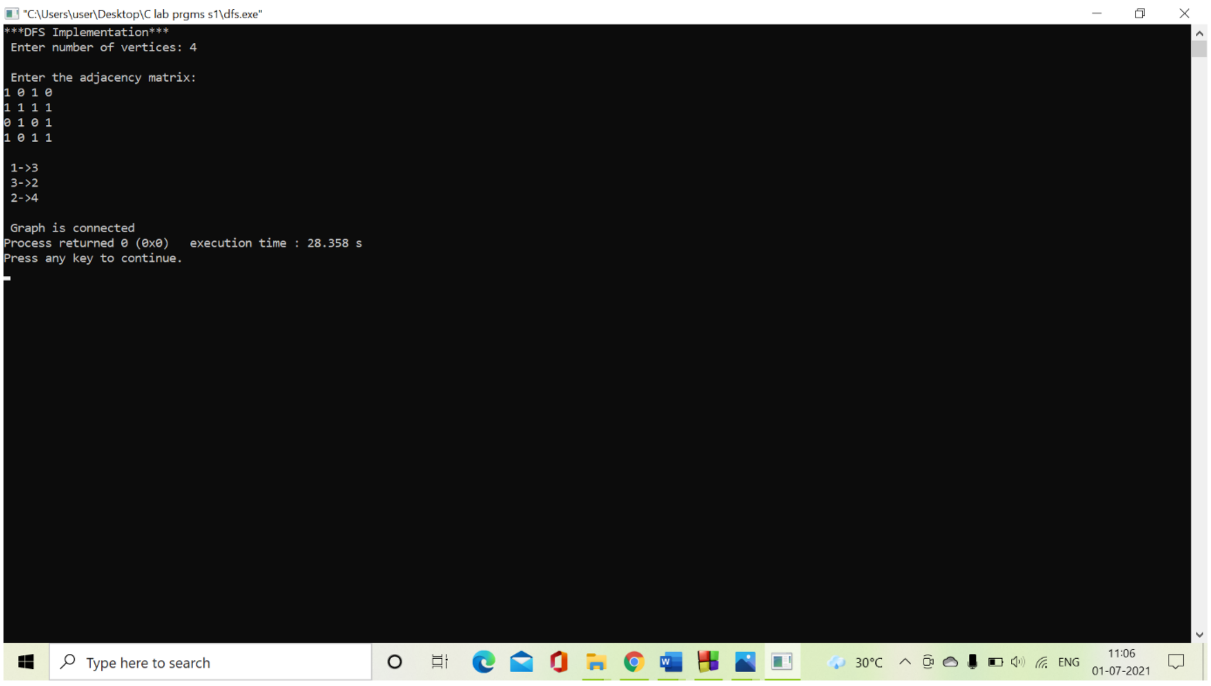
//DFS

```
#include<stdio.h>

int a[20][20],reach[20],n; int 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 i,j,count=0;
    printf("***DFS Implementation***");
    printf("\n Enter number of vertices:"); scanf("%d",&n);
    for (i=1;i<=n;i++)
    {
        reach[i]=0;
    for (j=1;j<=n;j++)
        a[i][j]=0;
    }
    printf("\n Enter the adjacency matrix:\n");
for (i=1;i<=n;i++)
    for (j=1;j<=n;j++)
        scanf("%d",&a[i][j]);
        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");
return 0;
}
```

//BFS

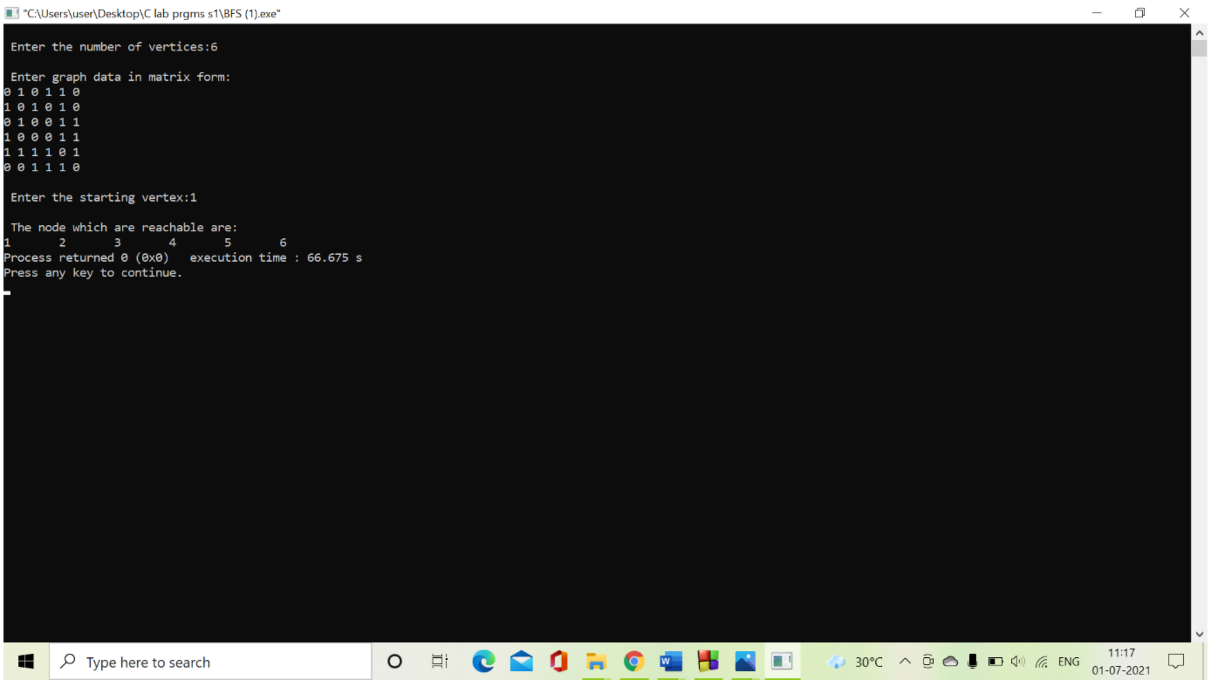
```
#include<stdio.h>
int a[20][20], q[20], visited[20], n, i, j, f = 0, r = -1;
void bfs(int v)
 {
            for(i = 1; i <= n; i++)
            if(a[v][i] && !visited[i])
            q[++r] = i;
 if(f <= r)
{
             visited[q[f]] = 1;
            bfs(q[f++]);
 }
}
int main()
{
             int v;
            printf("\n Enter the number of vertices:");
            scanf("%d", &n);
 for(i=1; i <= n; i++)
 {
            q[i] = 0;
            visited[i] = 0;
 }
 printf("\n Enter graph data in matrix form:\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);
 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;
 }
 }
}
```

Output (DFS)



```
"C:\Users\user\Desktop\C lab prgms s1\dfs.exe"
***DFS Implementation***
 Enter number of vertices: 4

 Enter the adjacency matrix:
1 0 1 0
1 1 1 1
0 1 0 1
1 0 1 1

 1->3
 3->2
 2->4

 Graph is connected
Process returned 0 (0x0)   execution time : 28.358 s
Press any key to continue.
```

Output (BFS)



```
"C:\Users\user\Desktop\C lab prgms s1\BFS (1).exe"

 Enter the number of vertices:6

 Enter graph data in matrix form:
0 1 0 1 1 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

 The node which are reachable are:
1       2       3       4       5       6
Process returned 0 (0x0)   execution time : 66.675 s
Press any key to continue.
```