ASSIGNMENT 3

Aim: Represent a Graph using adjacency matrix

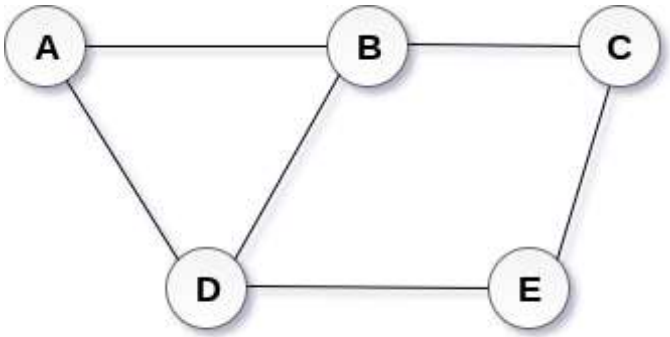
Objective: To understand advantages and disadvantages of using adjacency matrix to represent graphs

Theory:

Graph

A graph can be defined as group of vertices and edges that are used to connect these vertices. A graph can be seen as a cyclic tree, where the vertices (Nodes) maintain any complex relationship among them instead of having parent child relationship.

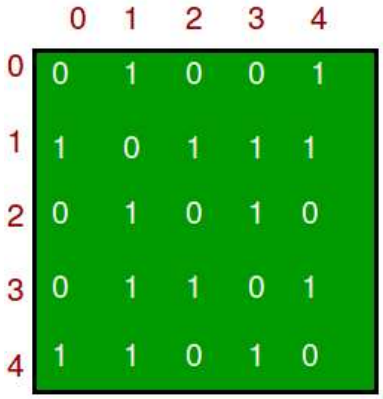
A graph G can be defined as an ordered set G(V, E) where V(G) represents the set of vertices and E(G) represents the set of edges which are used to connect these vertices.



Adjacency Matrix:

Adjacency Matrix is a 2D array of size V x V where V is the number of vertices in a graph. Let the 2D array be adj[][], a slot adj[i][j] = 1 indicates that there is an edge from vertex i to vertex j. Adjacency matrix for undirected graph is always symmetric. Adjacency Matrix is also used to represent weighted graphs. If adj[i][j] = w, then there is an edge from vertex i to vertex j with weight w.

The adjacency matrix for the above example graph is:



Algorithm:

- **Step 1:** Enter all vertices
- **Step 2:** If edge exists between v1 and v2

  Adjmat[v1][v2]= cost

  Else

  Adjmat[v1][v2]= 0

- **Step 3:** EXIT

Program:

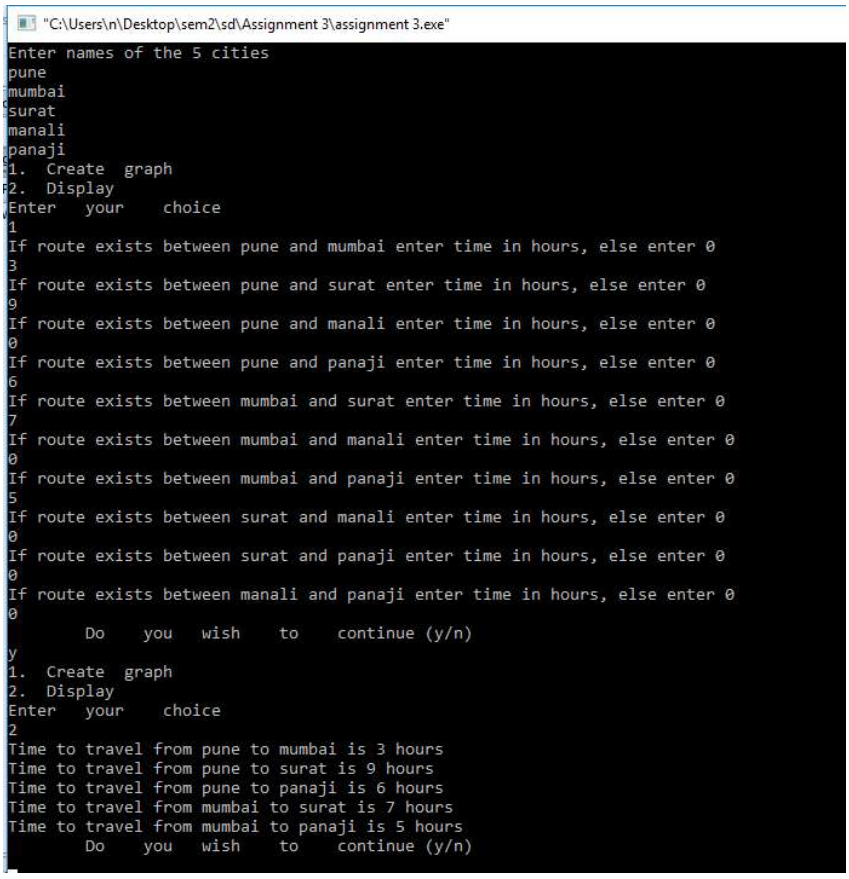
```
#include<iostream>
using namespace std;
class Graph{
int ver=5 ;
string city[5];
int adjmat[5][5];
int val;
public:
Graph(){
cout<<"Enter names of the 5 cities"<<endl;
for(int i=0; i<ver; i++)
cin>>city[i];
}
void create()
{
```

```
for(int i=0; i<ver; i++)

{

for(int j=0; j<ver; j++)

{

if(i!=j && i<=j)

{

cout<<"If route exists between "<<city[i]<<" and "<<city[j]<<" enter Time, else enter
0"<<endl;

cin>>val;

adjmat[i][j]=val;

}

}

}

}

void display(){

for(int i=0; i<ver; i++)

{

for(int j=0; j<ver; j++)

{

if(i!=j && i<=j)

{

if(adjmat[i][j]!=0){

cout<<"Time to travel from "<<city[i]<<" to "<<city[j]<<" is"<<adjmat[i][j]<<endl;

}

}

}
```

```
}
}
};
int main()
{
Graph g;
char choice ;
int ch ;
do
{
cout << "\tMENU" << endl;
cout << "\t1. Create graph" << endl;
cout << "\t2. display" << endl;
cout << "\tenter your choice " << endl;
cin >> ch ;
switch ( ch )
{
case 1:
g.create ();
break;
case 2 :
g.display();
break;
default :
cout << "\tINVALID CHOICE " << endl;
```

```
}
cout << "\tDo you wish to continue (y/n) " << endl;
cin >> choice ;
}
while ( choice == 'y');
}
```

Output:



Conclusion:

Graphs are nonlinear data structures that make operations on large data easier.

Pros: Representation is easier to implement and follow. Removing an edge takes O(1) time. Queries like whether there is an edge from vertex ‘u’ to vertex ‘v’ are efficient and can be done O(1).

Cons: Consumes more space O(V^2). Even if the graph is sparse(contains less number of edges), it consumes the same space. Adding a vertex is O(V^2) time.