Aim:-

There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight takes to reach city B from A, or the amount of fuel used for the journey. Represent this as a graph. The node can be represented by airport name or name of the city. Use adjacency list representation of the graph or use adjacency matrix representation of the graph. Justify the storage representations used.

Objective:-

To Use adjacency list representation of the graph or use adjacency matrix representation of the graph. Justify the storage representations used.

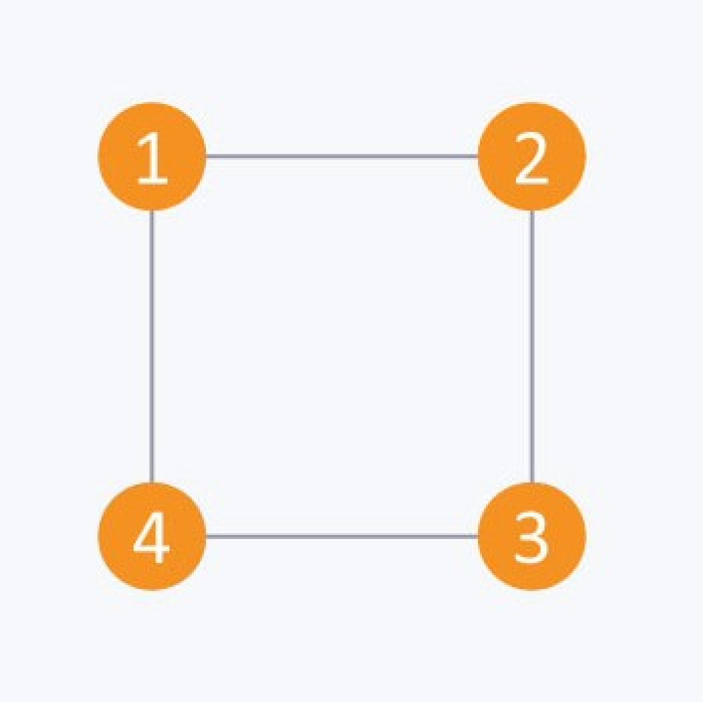
Theory:-

The other way to represent a graph is by using an adjacency list. An adjacency list is an array A of separate lists. Each element of the array **A**$_i$is a list, which contains all the vertices that are adjacent to vertex i.

For a weighted graph, the weight or cost of the edge is stored along with the vertex in the list using pairs. In an undirected graph, if vertex j is in list Ai then vertex i will be in list Aj.

The space complexity of adjacency list is **O(V + E)** because in an adjacency list information is stored only for those edges that actually exist in the graph. In a lot of cases, where a matrix is sparse using an adjacency matrix may not be very useful. This is because using an adjacency matrix will take up a lot of space where most of the elements will be 0, anyway. In such cases, using an adjacency list is better.

Note: A sparse matrix is a matrix in which most of the elements are zero, whereas a dense matrix is a matrix in which most of the elements are non-zero.



Algorithm:-

1. Create an array A of size N and type of array must be list of vertices. Intially each list is empty so each array element is initialise with empty list.

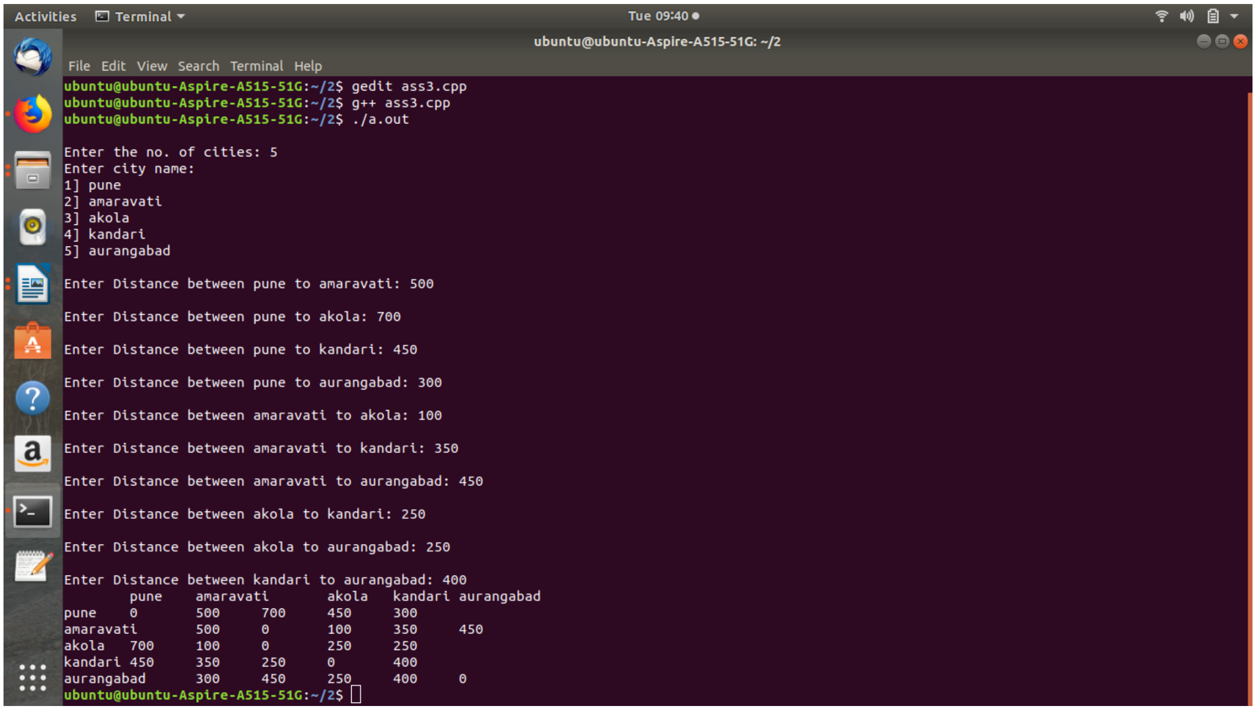
2. Iterate each given edge of the form (u,v) and append v to the uth list of array A. Also, If graph is undirected append u to the vth list of array A

Code:-

```
        #include<iostream>
#define MAX 10
using namespace std;
class airport
{
        string city[MAX];
        int distance[10][10];
public :
    int n;
    airport();
    void read_city();
    void show_graph();
};
airport::airport()
{
        n=0;
        for(int i=0;i<MAX;i++)
        {
                for(int j=0;j<MAX;j++)
                        distance[i][j]=0;
        }
}
void airport::read_city()
{
        int k;
        cout<<"\nEnter the no. of cities: " ;
        cin>>n;
        cout<<"Enter city name:\n";
        for(int k=0;k<n;k++)
        {
            cout<<k+1<<"] ";
                cin>>city[k];
        }
        for(int i=0;i<n;i++)
        {
                for(int j=i+1 ; j<n ; j++)
                {
                        cout<<"\nEnter Distance between "<<city[i]<<" to
"<<city[j]<<": ";
                        cin>>distance[i][j];
                        distance[j][i]=distance[i][j];
                }
        }
}
void airport::show_graph()
{
    cout<<"\t";
    for(int k=0;k<n;k++)
    {
        cout<<city[k]<<"\t";
    }
    cout<<endl;
    for(int i=0;i<n;i++)
    {
        cout<<city[i]<<"\t";
        for(int j=0;j<n;j++)
        {
            cout<<distance[i][j]<<"\t";
        }
        cout<<endl;
    }
}
int main()
```

```
{
        airport obj;
        obj.read_city();
        obj.show_graph();
}
```

Output Screenshot:-


Activities
Terminal
Tue 09:40
ubuntu@ubuntu-Aspire-A515-51G: ~/2
File Edit View Search Terminal Help

```
ubuntu@ubuntu-Aspire-A515-51G:~/2$ gedit ass3.cpp
ubuntu@ubuntu-Aspire-A515-51G:~/2$ g++ ass3.cpp
ubuntu@ubuntu-Aspire-A515-51G:~/2$ ./a.out

Enter the no. of cities: 5
Enter city name:
1] pune
2] amaravati
3] akola
4] kandari
5] aurangabad

Enter Distance between pune to amaravati: 500

Enter Distance between pune to akola: 700

Enter Distance between pune to kandari: 450

Enter Distance between pune to aurangabad: 300

Enter Distance between amaravati to akola: 100

Enter Distance between amaravati to kandari: 350

Enter Distance between amaravati to aurangabad: 450

Enter Distance between akola to kandari: 250

Enter Distance between akola to aurangabad: 250

Enter Distance between kandari to aurangabad: 400
        pune    amaravati       akola   kandari aurangabad
pune    0       500     700     450     300
amaravati       500     0       100     350     450
akola   700     100     0       250     250
kandari 450     350     250     0       400
aurangabad      300     450     250     400     0
ubuntu@ubuntu-Aspire-A515-51G:~/2$ 
```

Conclusion:-

We Conclude That We Can Use Adjajency List To Show If Route Exists Between Any Particular Cities Or Not.