Experiment 3.1

Aim: *Develop a program and analyze complexity to do a depth-first search (DFS) on an undirected graph. Implementing an application of DFS such as (i) to find the topological sort of a directed acyclic graph, OR (ii) to find a path from source to goal in a maze.*

Objectives: *Code and analyze to do a depth-first search (DFS) on an undirected graph.Implementing an application of DFS such as (i) to find the topological sort of a directed acyclic graph, OR (ii) to find a path from source to goal in a maze.*

Input/Apparatus Used: *VS CODE*

Procedure/Algorithm:

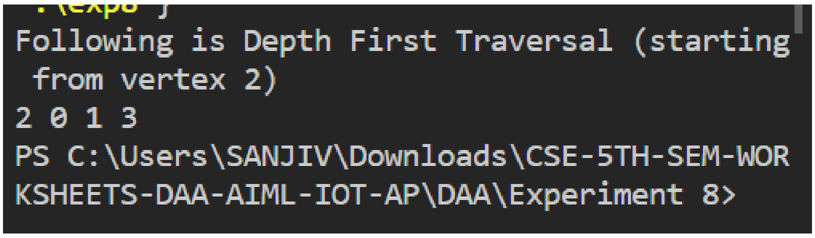
- *Create a class or data structure to represent a graph.*
- *Initialize the graph with the number of vertices (V) and an adjacency list to represent the edges.*
- *Create a method within the graph class for adding an edge between two vertices.*
- *Create a private helper method within the graph class for the DFS traversal:*
    - *Mark the current vertex as visited.*
    - *Print the current vertex.*
    - *For each unvisited neighbor of the current vertex, recursively call the DFS function on that neighbor.*
- *Create a public method in the graph class to start the DFS traversal:*
    - *Initialize a boolean array to keep track of visited vertices.*
    - *Call the private DFS helper method for the starting vertex.*
- *In the main function:*
    - *Create an instance of the graph with the desired number of vertices.*
    - *Add edges between vertices to represent the graph's structure.*
    - *Call the DFS method with the starting vertex to begin the traversal.*
    - *Print the visited vertices as they are traversed.*
- *Compile and run the program to observe the depth-first traversal of the graph starting from a specified vertex.*

Code:

```
#include <iostream>
#include <list>

using namespace std;

class Graph
{
   int V;
   list<int> *adj;

   void DFSUtil(int v, bool visited[]);
public:
   Graph(int V);
   void addEdge(int v, int w);
   void DFS(int v);
};

Graph::Graph(int V)
{
   this->V = V;
   adj = new list<int>[V];
}

void Graph::addEdge(int v, int w)
{
   adj[v].push_back(w);
}

void Graph::DFSUtil(int v, bool visited[])
{
   visited[v] = true;
```

```
    cout << v << " ";

    for (auto i = adj[v].begin(); i != adj[v].end(); ++i)
    {
        if (!visited[*i])
        {
            DFSUtil(*i, visited);
        }
    }
}

void Graph::DFS(int v)
{
    bool *visited = new bool[V];
    for (int i = 0; i < V; i++)
    {
        visited[i] = false;
    }

    DFSUtil(v, visited);
}

int main()
{
    Graph g(4);
    g.addEdge(0, 1);
    g.addEdge(0, 2);
    g.addEdge(1, 2);
    g.addEdge(2, 0);
    g.addEdge(2, 3);
    g.addEdge(3, 3);
    cout << "Following is Depth First Traversal (starting from vertex 2) \n";
    g.DFS(2);

    return 0;
}
```

Observations/Outcome :



```
 .\exp8 }
Following is Depth First Traversal (starting
 from vertex 2)
2 0 1 3
PS C:\Users\SANJIV\Downloads\CSE-5TH-SEM-WOR
KSHEETS-DAA-AIML-IOT-AP\DAA\Experiment 8>
```

Time Complexity:

- *Time Complexity: O(V + E), where V is the number of vertices and E is the number of edges in the graph.*