Experiment Title- 3.1

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SECTION :-607-B

SEMESTER :- 5TH

SUBJECT:- DESIGN OF ANALYSIS AND ALGORITHM

AIM :- 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.

Program Code :-

a) Code and analyze to do a depth-first search (DFS) on an undirected graph

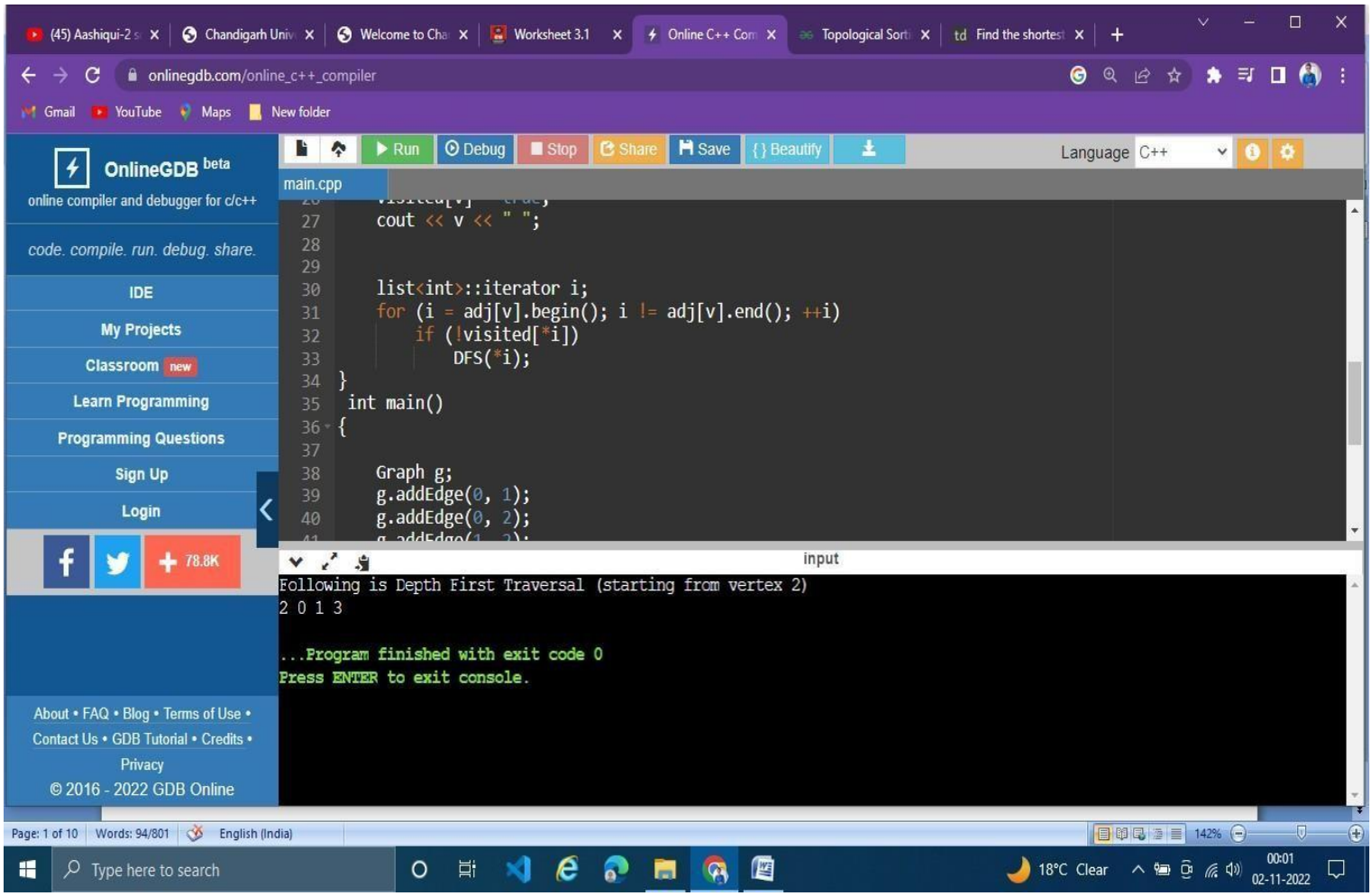
```
#include
<bits/stdc++.h>          using
namespace std;
class Graph {
public:
  map<int, bool> visited;
map<int, list<int> > adj;
void addEdge(int v, int
w);
  void DFS(int v);
};
```

void Graph::addEdge(int v, int w)

```
{
   adj[v].push_back(w);
}

void Graph::DFS(int v)
{

   visited[v] = true;
   cout << v << " ";

  list<int>::iterator i;
   for (i = adj[v].begin(); i != adj[v].end();
       ++i) if (!visited[*i])
           DFS(*i);
}
 int main()
{

   Graph g;
   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;
}
```

Output :-



b) to find the topological sort of a directed acyclic graph

Program Code :- #include <bits/stdc++.h>

```
using namespace std;
class Graph {
    int V;

    list<int>* adj;
    void topologicalSortUtil(int v, bool visited[],
                             stack<int>& Stack);

public:

    Graph(int V);

    void addEdge(int v, int w);
    void topologicalSort();
};
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::topologicalSortUtil(int v, bool visited[],
```

```
                    stack<int>& Stack)
{
  visited[v] = true;

  list<int>::iterator i;
  for (i = adj[v].begin(); i != adj[v].end();
    ++i) if (!visited[*i])
      topologicalSortUtil(*i, visited, Stack);

  Stack.push(v);
}
void Graph::topologicalSort()
{
  stack<int> Stack;
  bool* visited = new
  bool[V]; for (int i = 0; i < V;
  i++)
    visited[i] = false;
  for (int i = 0; i < V; i++)
    if (visited[i] == false)
      topologicalSortUtil(i, visited,
  Stack); while (Stack.empty() == false) {
    cout << Stack.top() << " ";
    Stack.pop();
  }
}
int main()
{
```

Graph g(6);

```
    g.addEdge(5, 2);
    g.addEdge(5, 0);
    g.addEdge(4, 0);
    g.addEdge(4, 1);
    g.addEdge(2, 3);
    g.addEdge(3, 1);

    cout << "Following is a Topological Sort of the given "
         "graph \n";
    g.topologicalSort();

    return 0;
}
```

Output :-

```
54      while (Stack.empty() == false) {
55          cout << Stack.top() << " ";
56          Stack.pop();
57      }
58  }
59   int main()
60  {
61
62      Graph g(6);
63      g.addEdge(5, 2);
64      g.addEdge(5, 0);
65      g.addEdge(4, 0);
66      g.addEdge(4, 1);
```

input

```
Following is a Topological Sort of the given graph
5 4 2 3 1 0

...Program finished with exit code 0
Press ENTER to exit console.
```

C. to find a path from source to goal in a maze.

Program Code :-

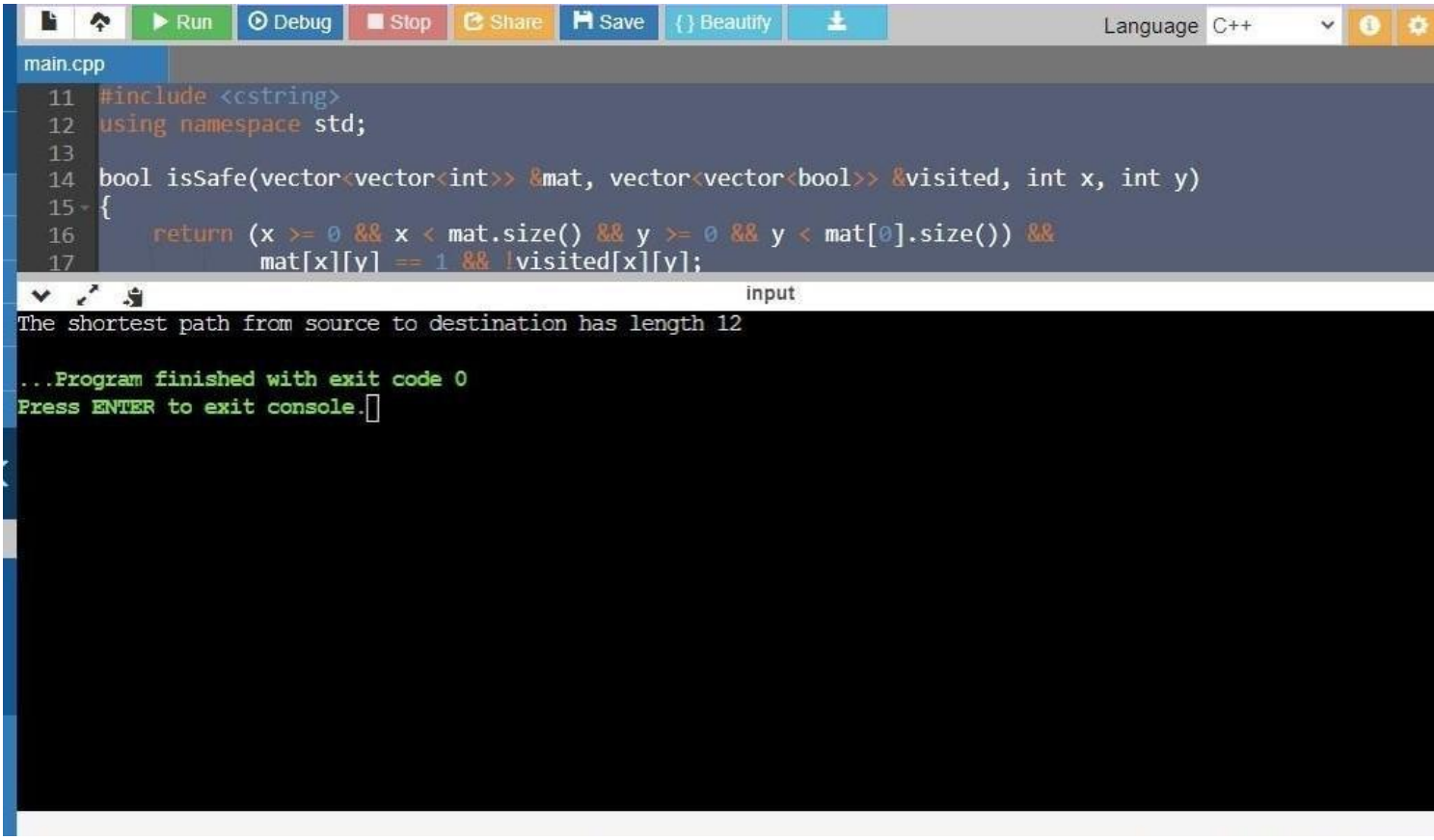
```
#include <iostream>
#include <vector>
#include <climits>
#include <cstring> using
namespace std;

    bool isSafe(vector<vector<int>> &mat, vector<vector<bool>> &visited, int x, int y)
    {
       return (x >= 0 && x < mat.size() && y >= 0 && y < mat[0].size())
              && mat[x][y] == 1 && !visited[x][y];
    }


    void findShortestPath(vector<vector<int>> &mat, vector<vector<bool>>
                  &visited, int i, int j, int x, int y, int &min_dist, int dist)
    {
       if (i == x && j == y)
       {
          min_dist = min(dist,
          min_dist); return;
       }

       visited[i][j] = true;

       if (isSafe(mat, visited, i + 1, j)) {
```

```
        findShortestPath(mat, visited, i + 1, j, x, y, min_dist, dist + 1);
    }

    if (isSafe(mat, visited, i, j + 1)) {
        findShortestPath(mat, visited, i, j + 1, x, y, min_dist, dist + 1);
    }

    if (isSafe(mat, visited, i - 1, j)) {
        findShortestPath(mat, visited, i - 1, j, x, y, min_dist, dist + 1);
    }

    if (isSafe(mat, visited, i, j - 1)) {
        findShortestPath(mat, visited, i, j - 1, x, y, min_dist, dist + 1);
    }

    visited[i][j] = false;
}

int findShortestPathLength(vector<vector<int>> &mat, pair<int, int> &src,
                           pair<int, int> &dest)
{

    if (mat.size() == 0 || mat[src.first][src.second] == 0 ||
            mat[dest.first][dest.second] == 0) {
        return -1;
    }
```

```
    int M = mat.size();
    int N =
    mat[0].size();
    vector<vector<bool>> visited;
    visited.resize(M, vector<bool>(N));
    int min_dist = INT_MAX;
    findShortestPath(mat, visited, src.first, src.second, dest.first, dest.second,
            min_dist, 0);

    if (min_dist != INT_MAX) {
        return min_dist;
    }

    return -1;
}

int main()
{
    vector<vector<int>> mat =
    {
        { 1, 1, 1, 1, 1, 0, 0, 1, 1, 1 },
        { 0, 1, 1, 1, 1, 1, 0, 1, 0, 1 },
        { 0, 0, 1, 0, 1, 1, 1, 0, 0, 1 },
        { 1, 0, 1, 1, 1, 0, 1, 1, 0, 1 },
        { 0, 0, 0, 1, 0, 0, 0, 1, 0, 1 },
        { 1, 0, 1, 1, 1, 0, 0, 1, 1, 0 },
        { 0, 0, 0, 0, 1, 0, 0, 1, 0, 1 },
        { 0, 1, 1, 1, 1, 1, 1, 1, 0, 0 },
```

```
        { 1, 1, 1, 1, 1, 0, 0, 1, 1, 1 },
        { 0, 0, 1, 0, 0, 1, 1, 0, 0, 1 },
    };

    pair<int, int> src = make_pair(0, 0);
    pair<int, int> dest = make_pair(7, 5);

    int min_dist = findShortestPathLength(mat, src, dest);

    if (min_dist != -1)
    {
        cout << "The shortest path from source to destination "
                "has length " << min_dist;
    }
    else {
        cout << "Destination cannot be reached from a given source";
    }

    return 0;
}
```

OUTPUT:


Run
Debug
Stop
Share
Save
{} Beautify
Language C++
main.cpp
#include <cstring>
using namespace std;
bool isSafe(vector<vector<int>> &mat, vector<vector<bool>> &visited, int x, int y)
{
return (x >= 0 && x < mat.size() && y >= 0 && y < mat[0].size()) &&
mat[x][y] == 1 && !visited[x][y];
input
The shortest path from source to destination has length 12
...Program finished with exit code 0
Press ENTER to exit console.