Experiment Title- 3.1

STUDENT NAME :- YASH KUMAR

UID :- 20BCS9256

SECTION :- 616 '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 :-

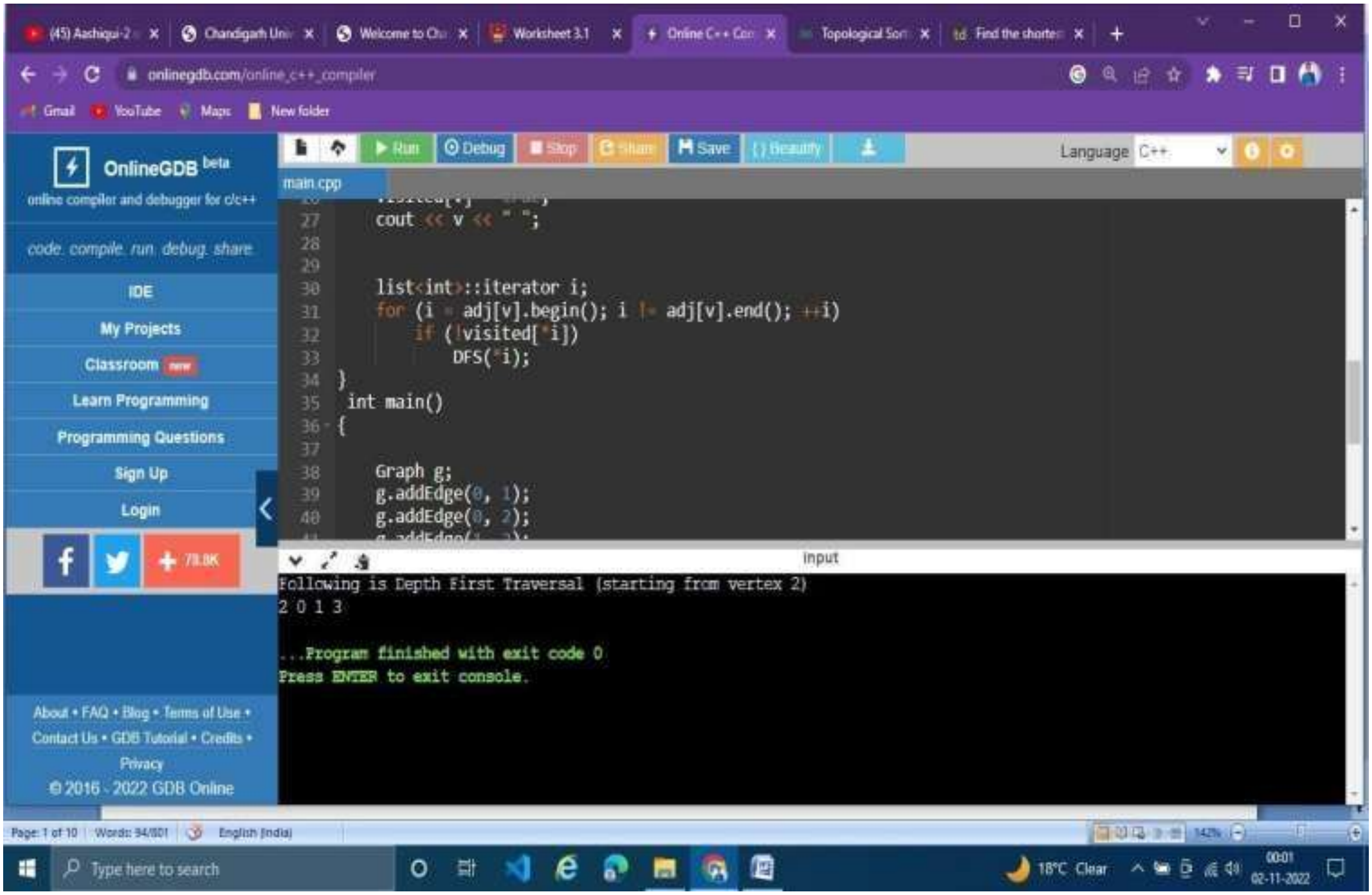
a) Code and analyze to do a depth-first search (DFS) on an undirected graph

```
  #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 :-



```
    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);
```

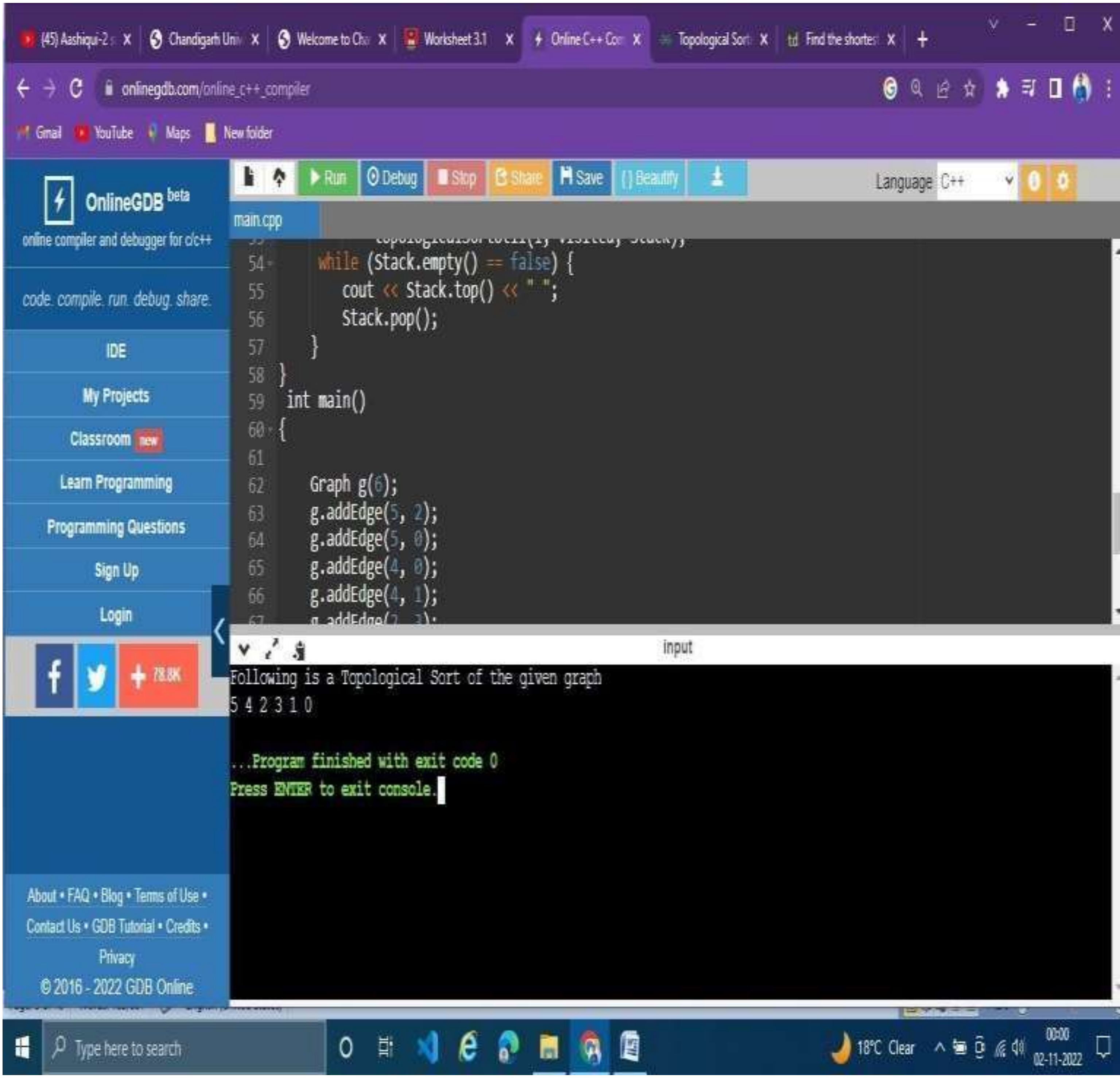
```
Following is Depth First Traversal (starting from vertex 2)
2 0 1 3

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

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 :-



```
            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);
```

```
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 amaze.

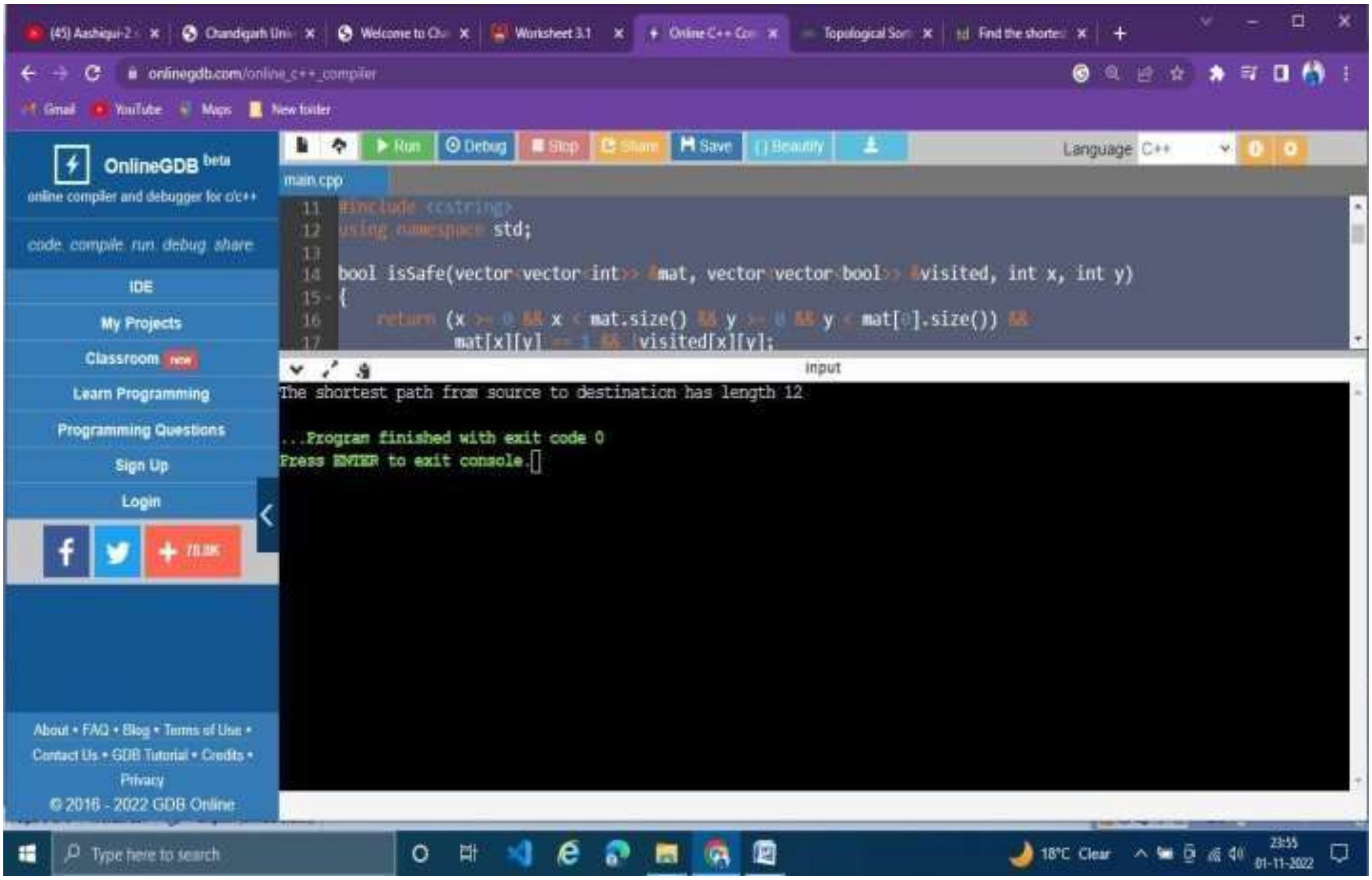
Program Code :-

#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 :-



onlinegdb.com/online_c++_compiler
OnlineGDB beta
online compiler and debugger for c/c++
code. compile. run. debug. share.
IDE
My Projects
Classroom new
Learn Programming
Programming Questions
Sign Up
Login
Run
Debug
Stop
Share
Save
{} Beautify
Language C++
main.cpp
input
About • FAQ • Blog • Terms of Use • Contact Us • GDB Tutorial • Credits • Privacy
© 2016 - 2022 GDB Online

```
#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];
```

```
The shortest path from source to destination has length 12

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

Evaluation Grid :

Sr. No.	Parameters	Marks Obtained	Maximum Marks
1.	Student Performance (Conduct of experiment) objectives/Outcomes.		12
2.	Viva Voce		10
3.	Submission of Work Sheet (Record)		8
	Total		30