Day 7

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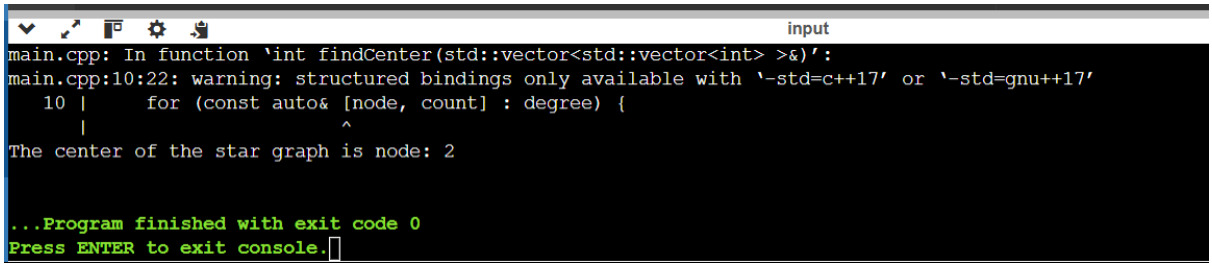
Section: 620-B

Ques1: Find Center of Star Graph

```
#include <iostream>
#include <vector>
#include <unordered_map>
int findCenter(std::vector<std::vector<int>>& edges) {
    std::unordered_map<int, int> degree;
    for (const auto& edge : edges) {
        degree[edge[0]]++;
        degree[edge[1]]++;
    }
    for (const auto& [node, count] : degree) {
        if (count == edges.size()) {
            return node;
        }
    }
    return -1;
}
int main() {
    std::vector<std::vector<int>> edges = {{1, 2}, {2, 3}, {4, 2}};
    int center = findCenter(edges);
    std::cout << "The center of the star graph is node: " << center << std::endl;
    return 0;
}
```

Output:



Ques 2: Find the Town Judge

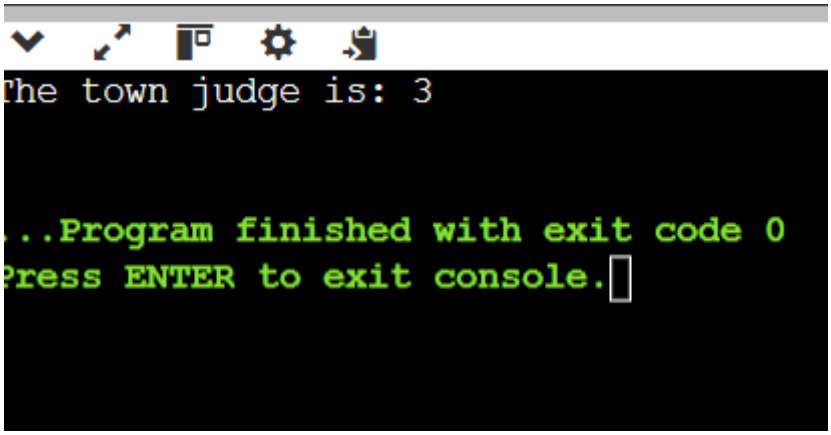
```
#include <iostream>
```

```
#include <vector>
int findJudge(int n, std::vector<std::vector<int>>& trust) {
    std::vector<int> trustCount(n + 1, 0);
    for (const auto& t : trust) {
        trustCount[t[0]]--;
        trustCount[t[1]]++;
    }
    for (int i = 1; i <= n; ++i) {
        if (trustCount[i] == n - 1) {
            return i;
        }
    }
    return -1;
}
int main() {
    int n = 3;
    std::vector<std::vector<int>> trust = {{1, 3}, {2, 3}};
    int judge = findJudge(n, trust);

    if (judge == -1) {
        std::cout << "No town judge found." << std::endl;
    } else {
        std::cout << "The town judge is: " << judge << std::endl;
    }

    return 0;
}
```

Output:

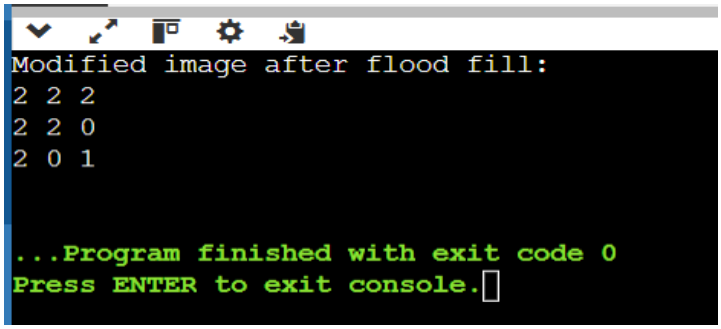


Ques 3: Flood Fill - link

```
#include <iostream>
#include <vector>
using namespace std;
void floodFillHelper(vector<vector<int>>& image, int sr, int sc, int color, int originalColor) {
    if (sr < 0 || sr >= image.size() || sc < 0 || sc >= image[0].size() || image[sr][sc] != originalColor) {
        return;
    }
    image[sr][sc] = color;
    floodFillHelper(image, sr - 1, sc, color, originalColor);
    floodFillHelper(image, sr + 1, sc, color, originalColor);
    floodFillHelper(image, sr, sc - 1, color, originalColor);
    floodFillHelper(image, sr, sc + 1, color, originalColor);
}
vector<vector<int>> floodFill(vector<vector<int>>& image, int sr, int sc, int color) {
    int originalColor = image[sr][sc];
    if (originalColor != color) {
        floodFillHelper(image, sr, sc, color, originalColor);
    }
    return image;
}
int main() {
    vector<vector<int>> image = {{1,1,1},{1,1,0},{1,0,1}};
    int sr = 1, sc = 1, color = 2;
    vector<vector<int>> result = floodFill(image, sr, sc, color);
    cout << "Modified image after flood fill:" << endl;
    for (const auto& row : result) {
```

```
        for (const auto& pixel : row) {
            cout << pixel << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Output:



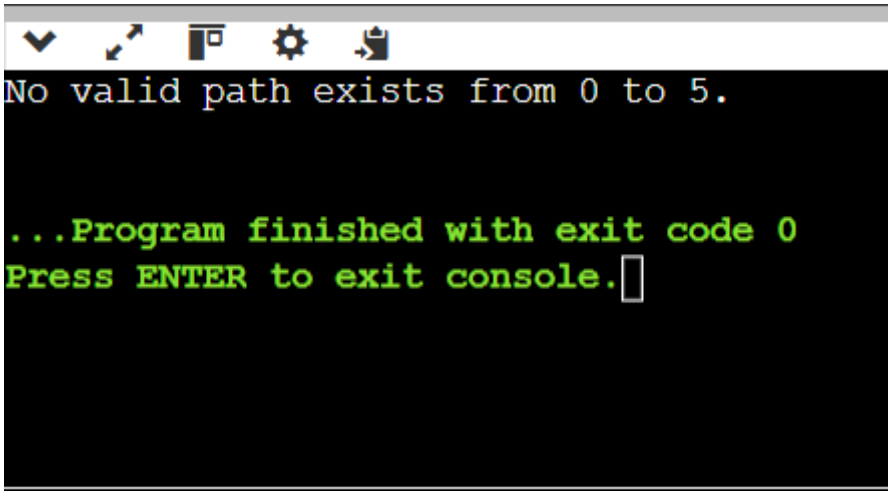
Ques 4: Find if Path Exists in Graph

```
#include <iostream>
#include <vector>
#include <queue>
using namespace std;
bool validPath(int n, vector<vector<int>>& edges, int source, int destination) {
    vector<vector<int>> graph(n);
    for (const auto& edge : edges) {
        graph[edge[0]].push_back(edge[1]);
        graph[edge[1]].push_back(edge[0]);
    }
    vector<bool> visited(n, false);
    queue<int> q;
    q.push(source);
    visited[source] = true;
    while (!q.empty()) {
        int node = q.front();
        q.pop();
        if (node == destination) {
            return true;
        }
```

```
        for (const auto& neighbor : graph[node]) {
            if (!visited[neighbor]) {
                visited[neighbor] = true;
                q.push(neighbor);
            }
        }
    }
    return false;
}
int main() {
    int n = 6;
    vector<vector<int>> edges = {{0, 1}, {0, 2}, {3, 5}, {5, 4}, {4, 3}};
    int source = 0, destination = 5;

    if (validPath(n, edges, source, destination)) {
        cout << "A valid path exists from " << source << " to " << destination << "." << endl;
    } else {
        cout << "No valid path exists from " << source << " to " << destination << "." << endl;
    }
    return 0;
}
```

Output:



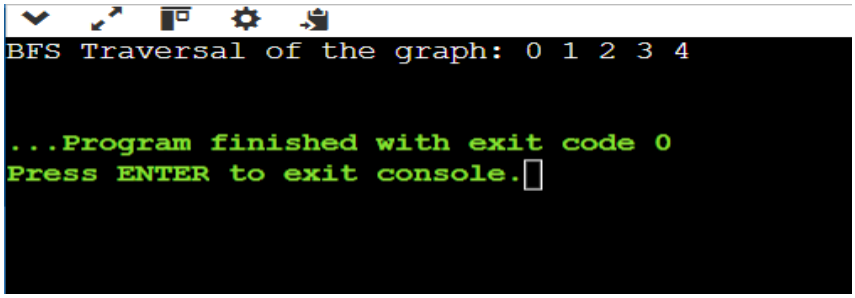
Ques 5: BFS of graph link

```
#include <iostream>
#include <vector>
#include <queue>
```

```
using namespace std;
vector<int> bfsOfGraph(int V, vector<vector<int>>& adj) {
    vector<int> bfsResult;
    vector<bool> visited(V, false);
    queue<int> q;
    q.push(0);
    visited[0] = true;
    while (!q.empty()) {
        int node = q.front();
        q.pop();
        bfsResult.push_back(node);
        for (int neighbor : adj[node]) {
            if (!visited[neighbor]) {
                visited[neighbor] = true;
                q.push(neighbor);
            }
        }
    }
    return bfsResult;
}
int main() {
    int V = 5;
    vector<vector<int>> adj = {
        {1, 2, 3},
        {0, 4},
        {0, 4},
        {0},
        {1, 2}
    };
    vector<int> bfsResult = bfsOfGraph(V, adj);
    cout << "BFS Traversal of the graph: ";
    for (int vertex : bfsResult) {
        cout << vertex << " ";
    }
    cout << endl;
    return 0;
```

}

Output:



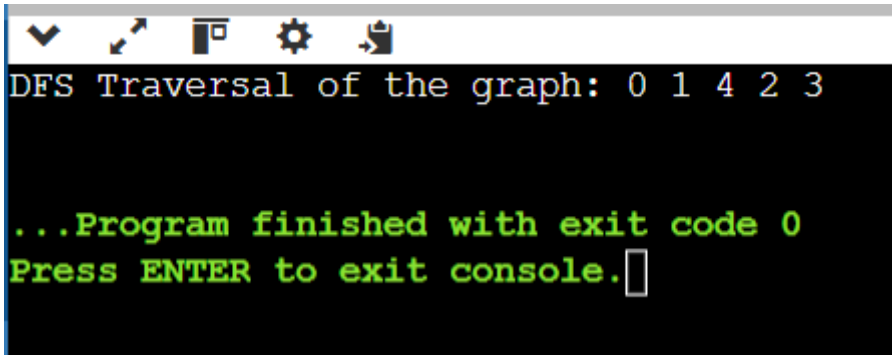
Ques 6: DFS of Graph

```
#include <iostream>
#include <vector>
using namespace std;
void dfsHelper(int node, vector<vector<int>>& adj, vector<bool>& visited, vector<int>& dfsResult) {
    visited[node] = true;
    dfsResult.push_back(node);
    for (int neighbor : adj[node]) {
        if (!visited[neighbor]) {
            dfsHelper(neighbor, adj, visited, dfsResult);
        }
    }
}
vector<int> dfsOfGraph(int V, vector<vector<int>>& adj) {
    vector<int> dfsResult;
    vector<bool> visited(V, false);

    dfsHelper(0, adj, visited, dfsResult);
    return dfsResult;
}
int main() {
    int V = 5;
    vector<vector<int>> adj = {
        {1, 2, 3},
        {0, 4},
        {0, 4},
        {0},
```

```
        {1, 2}
    };
    vector<int> dfsResult = dfsOfGraph(V, adj);
    cout << "DFS Traversal of the graph: ";
    for (int vertex : dfsResult) {
        cout << vertex << " ";
    }
    cout << endl;
    return 0;
}
```

Output:

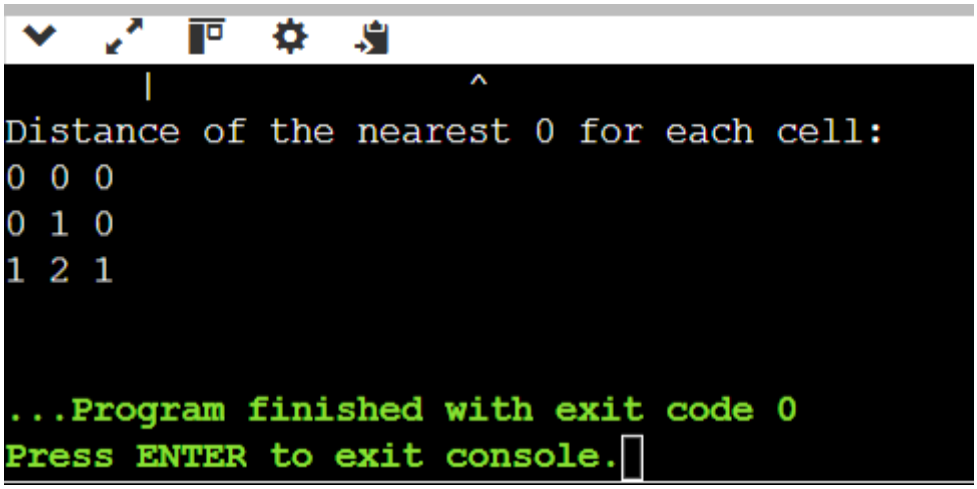


Ques 7: 01 Matrix

```
#include <iostream>
#include <queue>
#include <climits>
using namespace std;
const int MAX = 1000;
void updateMatrix(int mat[MAX][MAX], int m, int n) {
    int dist[MAX][MAX];
    queue<pair<int, int>> q;
    for (int i = 0; i < m; ++i) {
        for (int j = 0; j < n; ++j) {
            if (mat[i][j] == 0) {
                dist[i][j] = 0;
                q.push({i, j});
            } else {
                dist[i][j] = INT_MAX;
            }
        }
```

```
    }
    int directions[4][2] = {{-1, 0}, {1, 0}, {0, -1}, {0, 1}};
    while (!q.empty()) {
        auto [x, y] = q.front();
        q.pop();
        for (auto dir : directions) {
            int newX = x + dir[0];
            int newY = y + dir[1];
            if (newX >= 0 && newX < m && newY >= 0 && newY < n && dist[newX][newY] >
dist[x][y] + 1) {
                dist[newX][newY] = dist[x][y] + 1;
                q.push({newX, newY});
            }
        }
    }
    cout << "Distance of the nearest 0 for each cell: " << endl;
    for (int i = 0; i < m; ++i) {
        for (int j = 0; j < n; ++j) {
            cout << dist[i][j] << " ";
        }
        cout << endl;
    }
}
int main() {
    int mat[MAX][MAX] = {
        {0, 0, 0},
        {0, 1, 0},
        {1, 1, 1}
    };
    int m = 3, n = 3;
    updateMatrix(mat, m, n);
    return 0;
}
```

Output:



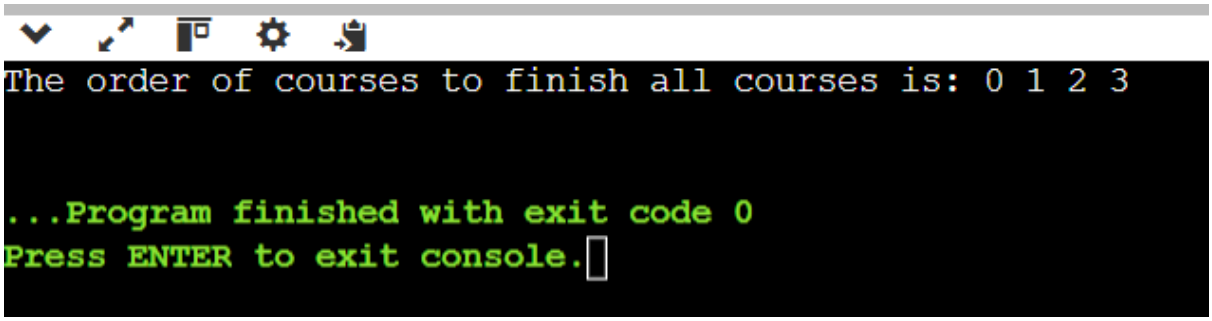
Ques 8: Course Schedule II

```
#include <iostream>
#include <vector>
#include <queue>
using namespace std;
vector<int> findOrder(int numCourses, vector<vector<int>>& prerequisites) {
    vector<int> inDegree(numCourses, 0);
    vector<vector<int>> adj(numCourses);
    for (const auto& pre : prerequisites) {
        adj[pre[1]].push_back(pre[0]);
        inDegree[pre[0]]++;
    }
    queue<int> q;
    for (int i = 0; i < numCourses; ++i) {
        if (inDegree[i] == 0) {
            q.push(i);
        }
    }
    vector<int> courseOrder;
    while (!q.empty()) {
        int course = q.front();
        q.pop();
        courseOrder.push_back(course);
        for (int nextCourse : adj[course]) {
            inDegree[nextCourse]--;
            if (inDegree[nextCourse] == 0) {
```

```
            q.push(nextCourse);
          }
        }
    }
    if (courseOrder.size() == numCourses) {
        return courseOrder;
    } else {
        return {};
    }
}
int main() {
    int numCourses = 4;
    vector<vector<int>> prerequisites = {{1, 0}, {2, 0}, {3, 1}, {3, 2}};
    vector<int> order = findOrder(numCourses, prerequisites);

    if (order.empty()) {
        cout << "It is impossible to finish all courses." << endl;
    } else {
        cout << "The order of courses to finish all courses is: ";
        for (int course : order) {
            cout << course << " ";
        }
        cout << endl;
    }
    return 0;
}
```

Output:



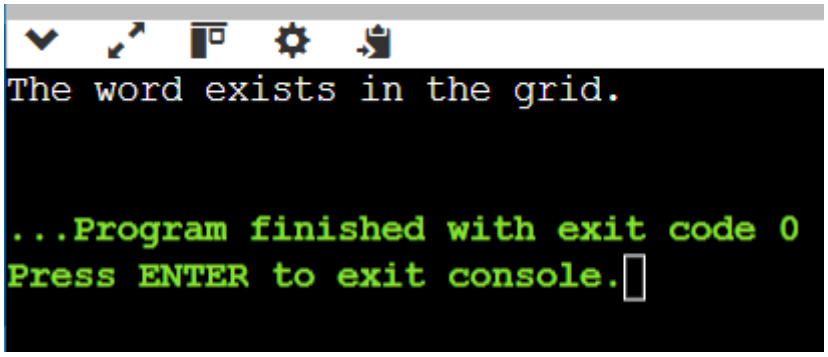
Ques 9: Word Search

```
#include <iostream>
#include <vector>
```

```
#include <string>
using namespace std;
bool dfs(vector<vector<char>>& board, int i, int j, string& word, int index) {
   if (index == word.size()) return true;
   if (i < 0 || i >= board.size() || j < 0 || j >= board[0].size() || board[i][j] != word[index])
return false;
   char temp = board[i][j];
   board[i][j] = '*';
   bool found = dfs(board, i+1, j, word, index+1) ||
            dfs(board, i-1, j, word, index+1) ||
            dfs(board, i, j+1, word, index+1) ||
            dfs(board, i, j-1, word, index+1);
   board[i][j] = temp;
   return found;
}
bool exist(vector<vector<char>>& board, string word) {
   for (int i = 0; i < board.size(); ++i) {
      for (int j = 0; j < board[0].size(); ++j) {
         if (board[i][j] == word[0] && dfs(board, i, j, word, 0)) {
            return true;
         }
      }
   }
   return false;
}
int main() {
   vector<vector<char>> board = {
      {'A', 'B', 'C', 'E'},
      {'S', 'F', 'C', 'S'},
      {'A', 'D', 'E', 'E'}
   };
   string word = "ABCCED";
   if (exist(board, word)) {
      cout << "The word exists in the grid." << endl;
   } else {
      cout << "The word does not exist in the grid." << endl;
```

```
    }
    return 0;
}
```

Output:



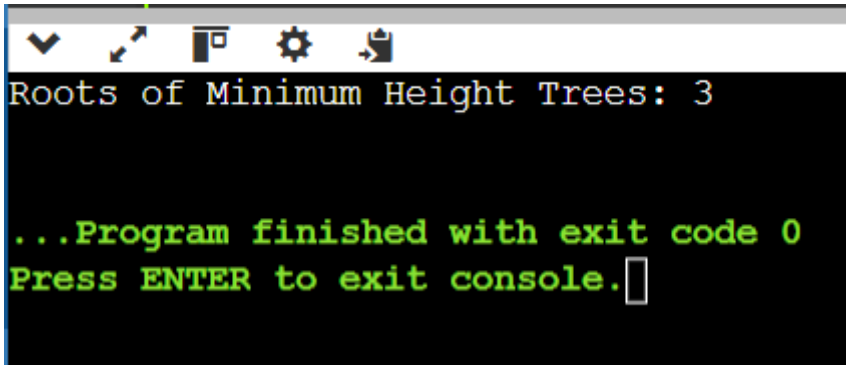
Ques 10: Minimum Height Trees

```
#include <iostream>
#include <vector>
#include <queue>
using namespace std;
vector<int> findMinHeightTrees(int n, vector<vector<int>>& edges) {
    if (n == 1) return {0};
    vector<vector<int>> adj(n);
    vector<int> degree(n, 0);
    for (const auto& edge : edges) {
        adj[edge[0]].push_back(edge[1]);
        adj[edge[1]].push_back(edge[0]);
        degree[edge[0]]++;
        degree[edge[1]]++;
    }
    queue<int> q;
    for (int i = 0; i < n; ++i) {
        if (degree[i] == 1) {
            q.push(i);
        }
    }
    while (n > 2) {
        int size = q.size();
        n -= size;
        for (int i = 0; i < size; ++i) {
```

```
            int node = q.front();
            q.pop();

            for (int neighbor : adj[node]) {
                degree[neighbor]--;
                if (degree[neighbor] == 1) {
                    q.push(neighbor);
                }
            }
        }
    }
    vector<int> mhts;
    while (!q.empty()) {
        mhts.push_back(q.front());
        q.pop();
    }
    return mhts;
}
int main() {
    int n = 6;
    vector<vector<int>> edges = {{0, 1}, {0, 2}, {0, 3}, {3, 4}, {4, 5}};
    vector<int> mhts = findMinHeightTrees(n, edges);
    cout << "Roots of Minimum Height Trees: ";
    for (int root : mhts) {
        cout << root << " ";
    }
    cout << endl;
    return 0;
}
```

Output:


Roots of Minimum Height Trees: 3
...Program finished with exit code 0
Press ENTER to exit console.