

Check graph is bipartite using Breadth First Search in C++

```
#include<bits/stdc++.h>
using namespace std;

class Solution {
    // colors a component
private:
    bool check(int start, int V, vector<int>adj[], int
color[]) {
        queue<int> q;
        q.push(start);
        color[start] = 0;
        while(!q.empty()) {
            int node = q.front();
            q.pop();

            for(auto it : adj[node]) {
                // if the adjacent node is yet not colored
                // you will give the opposite color of the
node
                if(color[it] == -1) {

                    color[it] = !color[node];
                    q.push(it);
                }
                // is the adjacent guy having the same
color
                // someone did color it on some other path
                else if(color[it] == color[node]) {
                    return false;
                }
            }
        }
        return true;
    }
public:
    bool isBipartite(int V, vector<int>adj[]){
        int color[V];
        for(int i = 0;i<V;i++) color[i] = -1;

        for(int i = 0;i<V;i++) {
            // if not coloured
            if(color[i] == -1) {
                if(check(i, V, adj, color) == false) {
                    return false;
                }
            }
        }
        return true;
    }
};

void addEdge(vector <int> adj[], int u, int v) {
    adj[u].push_back(v);
    adj[v].push_back(u);
}

int main(){

    // V = 4, E = 4
    vector<int>adj[4];
```

Graph Structure

Vertices: V = 4

Edges:

- 0 ↔ 2
- 0 ↔ 3
- 2 ↔ 3
- 3 ↔ 1

Adjacency List:

0: [2, 3]


1: [3]

2: [0, 3]

3: [0, 2, 1]

Dry Run of check() Function (BFS for Coloring)

We want to color the graph with **2 colors (0 and 1)** such that no two adjacent nodes have the same color.

Step	Node	Queue	Color Status	Action
1	0	[0]	[-1, -1, -1, -1]	Start BFS with node 0 → color[0] = 0
2	0	[2, 3]	[0, -1, 1, 1]	2 & 3 uncolored → assign opposite color
3	2	[3]	[0, -1, 1, 1]	0 already colored & valid → continue
4	2	[3]	[0, -1, 1, 1]	3 already colored with same color → 
				Conflict found → graph is not bipartite

✖ Output:

0

```
addEdge(adj, 0, 2);
addEdge(adj, 0, 3);
    addEdge(adj, 2, 3);
    addEdge(adj, 3, 1);

Solution obj;
bool ans = obj.isBipartite(4, adj);
if(ans)cout << "1\n";
else cout << "0\n";

return 0;
}
```

Output:-
0