
BFS AND DFS TRAVERSAL TECHNIQUES

```java
package com.muthadevs;

import java.util.*;

// A class to store a graph edge
class Edge{
    int source, dest;

    public Edge(int source, int dest)
    {
        this.source = source;
        this.dest = dest;
    }
    int getSource(){
        return this.source;
    }
    int getDest(){
        return this.dest;
    }
}

// A class to represent a graph object
class Graph{
    // A list of lists to represent an adjacency list
    List<List<Integer>> adjList = null;

    // Constructor
    Graph(List<Edge> edges, int n)
    {
        adjList = new ArrayList<>();

        for (int i = 0; i < n; i++) {
            adjList.add(new ArrayList<>());
        }

        // add edges to the undirected graph
        for (Edge edge: edges)
        {
            int src = edge.source;
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            int dest = edge.dest;

            adjList.get(src).add(dest);
            adjList.get(dest).add(src);
        }
    }
}

class Main
{
    public static void BFS(Graph graphBFS, Queue<Integer> q, boolean[] discovered_bfs){
        if (q.isEmpty()) {
            return;
        }

        int v = q.poll();
        System.out.print((v+1) + " ");

        // do for every edge (v, u)
        for (int u: graphBFS.adjList.get(v))
        {
            if (!discovered_bfs[u])
            {
                // mark it as discovered and enqueue it
                discovered_bfs[u] = true;
                q.add(u);
            }
        }
        BFS(graphBFS, q, discovered_bfs);
    }

    public static void DFS(Graph graph, int v, boolean[] discovered_dfs){
        // mark the current node as discovered
        discovered_dfs[v] = true;

        // print the current node
        System.out.print((v+1) + " ");

        // do for every edge (v, u)
        for (int u: graph.adjList.get(v))
        {
            // if `u` is not yet discovered
            if (!discovered_dfs[u]) {
                DFS(graph, u, discovered_dfs);
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            }
        }
    }

    public static void main(String[] args)
    {
        int sc;
        Scanner s = new Scanner(System.in);
        System.out.print("BFS and DFS Traversal Techniques :-");
        while(true){
            System.out.print("" +
                    "\n|--|--------------------|" +
                    "\n|1 | Bread First Search  |" +
                    "\n|2 | Depth First Search  |" +
                    "\n|3 | Exit                |" +
                    "\n|--|--------------------|" +
                    "\nEnter Your Choice : ");
            sc = s.nextInt();
            switch(sc){
                case 1:
                    //Recursive BFS Algorithm

                    // List of graph edges as per the above diagram
                    List<Edge> edges_BFS = Arrays.asList(
                            new Edge(1, 2), new Edge(1, 3), new Edge(1, 4),
                            new Edge(2, 5), new Edge(2, 6),
                            new Edge(5, 9), new Edge(5, 10),
                            new Edge(4, 7), new Edge(4, 8),
                            new Edge(7, 11), new Edge(7, 12)
                            // vertex 0, 13, and 14 are single nodes
                    );
                    System.out.println("\nAdjacency List for BFS: ");
                    for(int i = 0; i < edges_BFS.size(); i++) {
                            System.out.println(edges_BFS.get(i).getSource()+" ->
"+edges_BFS.get(i).getDest());
                    }
                    System.out.println("");

                    // total number of nodes in the graph (labelled from 1 to 15)
                    int n = 15;

                    // build a graph from the given edges
                    Graph graphBFS = new Graph(edges_BFS, n);
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                    // to keep track of whether a vertex is discovered or not
                    boolean[] discovered = new boolean[n];

                    // create a queue for doing BFS
                    Queue<Integer> q = new ArrayDeque<>();

                    // Perform BFS traversal from all undiscovered nodes to cover all connected components
of a graph
                    for (int i = 0; i < n; i++)
                    {
                        if(i==0){
                            System.out.println("BFS Starting from vertex "+(i+1)+" :");
                        }
                        if (!discovered[i])
                        {
                            // mark the source vertex as discovered
                            discovered[i] = true;

                            // enqueue source vertex
                            q.add(i);

                            // start BFS traversal from vertex `i`
                            BFS(graphBFS, q, discovered);
                        }
                    }

                    break;
                case 2:
                    //Recursive DFS Algorithm

                    List<Edge> edges_dfs = Arrays.asList(

                            new Edge(1, 2), new Edge(1, 7), new Edge(1, 8),
                            new Edge(2, 3), new Edge(2, 6),
                            new Edge(3, 4), new Edge(3, 5),
                            new Edge(8, 9),
                            new Edge(8, 12), new Edge(9, 10), new Edge(9, 11)
                    );
                    System.out.println("\nAdjacency List for DFS: ");
                    for(int i = 0; i < edges_dfs.size(); i++) {
                        System.out.println(edges_dfs.get(i).getSource()+" -> "+edges_dfs.get(i).getDest());
                    }
                    System.out.println("");
```
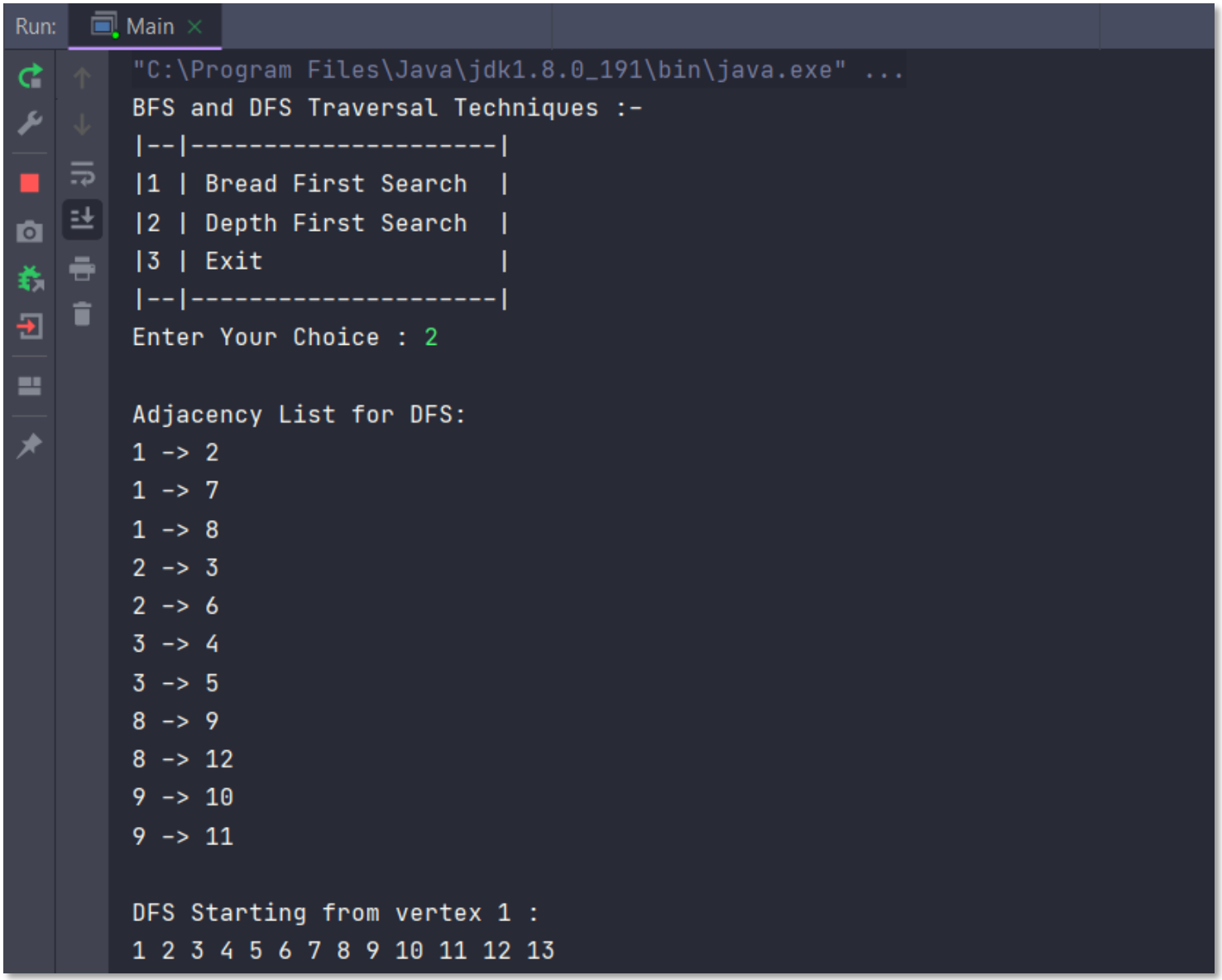
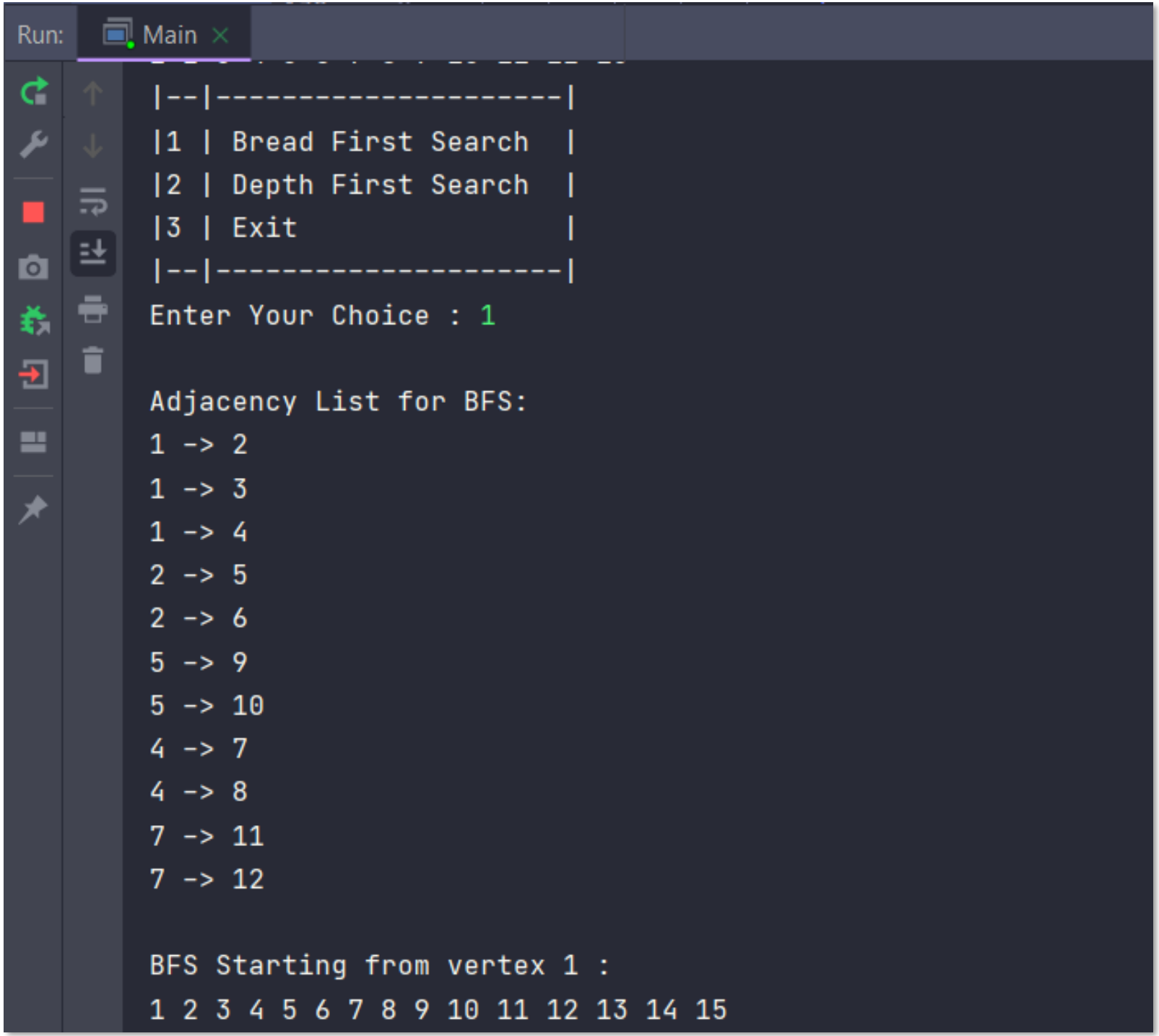

```
                    // total number of nodes in the graph (labelled from 1 to 13)
                    int n_dfs = 13;

                    // build a graph from the given edges
                    Graph graph = new Graph(edges_dfs, n_dfs);

                    // to keep track of whether a vertex is discovered or not
                    boolean[] discovered_dfs = new boolean[n_dfs];

                    // Perform DFS traversal from all undiscovered nodes to cover all connected components
of a graph
                    for (int i = 0; i < n_dfs; i++)
                    {
                        if(i==0){
                            System.out.println("DFS Starting from vertex "+(i+1)+" :");
                        }
                        if (!discovered_dfs[(i)]) {
                            DFS(graph, i, discovered_dfs);
                        }
                    }

                    break;
                case 3:
                    System.out.println("Terminated, Bye !");
                    System.exit(0);
                default:
                    System.out.println("Please Enter Valid Choice");
                    break;
            }
        }
    }
}
```

Output:


Run:
Main
"C:\Program Files\Java\jdk1.8.0_191\bin\java.exe" ...
BFS and DFS Traversal Techniques :-
|--|--------------------|
|1 | Bread First Search |
|2 | Depth First Search |
3	Exit
Enter Your Choice : 2
Adjacency List for DFS:
1 -> 2
1 -> 7
1 -> 8
2 -> 3
2 -> 6
3 -> 4
3 -> 5
8 -> 9
8 -> 12
9 -> 10
9 -> 11
DFS Starting from vertex 1 :
1 2 3 4 5 6 7 8 9 10 11 12 13


Run:
Main
|--|--------------------|
|1 | Bread First Search |
|2 | Depth First Search |
3	Exit
Enter Your Choice : 1
Adjacency List for BFS:
1 -> 2
1 -> 3
1 -> 4
2 -> 5
2 -> 6
5 -> 9
5 -> 10
4 -> 7
4 -> 8
7 -> 11
7 -> 12
BFS Starting from vertex 1 :
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15