

## Assignment Week 7

### Connected Component

1.

```
1 public class Main {
2     public static void main(String[] args) {
3         // Matrix A
4         int[][] A = {
5             {0, 0, 1, 1, 0},
6             {0, 0, 1, 0, 0},
7             {1, 1, 0, 1, 0},
8             {1, 0, 1, 0, 1},
9             {0, 0, 0, 1, 0}
10        };
11
12        int result = Graph.Connected(A);
13        System.out.println(result == 1 ? "The graph is connected." :
14                               "The graph is not connected.");
15    }
16 }
```

Run Main

```
/opt/homebrew/Cellar/openjdk/21.0.1/libexec/openjdk.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/idea_rt.jar=
The graph is not connected.

Process finished with exit code 0
```

2. No, this algorithm doesn't work correctly for every undirected graph with  $n > 0$  vertices. There are two problems with the algorithm:
- Subgraph Connectivity check:** The algorithm checks if subgraph of first  $n-1$  vertices is connected. However, this does not ensure that the entire graph is connected, because it doesn't consider whether the last vertex  $n-1$  is connected to any of the vertices in the remaining subgraph.
  - Incorrect Termination Condition:** After the recursive check, the algorithm only verifies if there is a connection from the last vertex  $n-1$  to one of the other vertices in the subgraph. If no such connection exists, the graph is incorrectly considered disconnected. However, the graph could still be connected if there is a connection between vertices in the subgraph and the last vertex.

In summary, it only checks if each vertex is connected to a previous vertex in a recursive manner, but it doesn't account for all possible connections within the graph. The algorithm may fail for disconnected graphs because it only verifies edges between the current vertex and those in the subgraph, rather than ensuring that all vertices are reachable from any starting vertex.

## Warshall's Algorithm

The screenshot shows an IDE window for a project named "Assignment-Week7". The left sidebar displays the project structure, including a "src" directory with files "FloydWarshall", "Graph", "Main", and "MainPart2". The main editor area shows the "MainPart2.java" file with the following code:

```
1 import java.util.Arrays;
2 public class MainPart2 {
3     public static void main(String[] args) {
4         boolean[][] A = {{false, true, false, false},{false,false,true,false},
5                           {false,false,false,true},{false,false,false,false}};
6         boolean[][] T = FloydWarshall.WarshallsAlgorithm(A);
7         for(int i=0; i<T.length; i++)
8             System.out.println(Arrays.toString(T[i]));
9     }
10 }
11
```

The "Run" tab at the bottom shows the output of the program:

```
[false, true, true, true]
[false, false, true, true]
[false, false, false, true]
[false, false, false, false]
```

Below the output, it states "Process finished with exit code 0". The status bar at the bottom indicates the file encoding is UTF-8 and the line length is 4 spaces.