Computer Science 220 S2C (2023)
Assignment 4 (Graph Algorithms)
Due date October 22, 2023

Goals

In this assignment we want you to write simple graph algorithms for undirected graphs. There are five algorithmic tasks. Each task should be coded up in a separate program.

1. Determine the size of the graph.

2. Determine the order of the largest component.

3. Convert to adjacency matrix representation.

4. Compute the diameter.

5. Compute the girth.

Input Format

Input for these problems consist of a sequence of one or more (undirected) graphs taken from the keyboard (e.g. `System.in`). Each graph is represented by an adjacency list. The first line is an integer n indicating the order of the graph. This is followed by n white space separated lists of adjacencies for nodes labeled 0 to $n - 1$. The input will be terminated by a line consisting of one zero (0). This line should not be processed. Two sample input graphs are listed below.

```
4
1
0 3

1
5
1 4
0 2
1 3
2 4
0 3
0
```
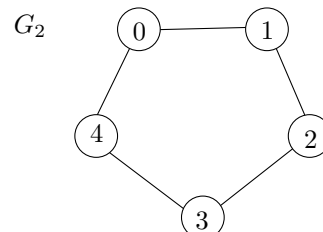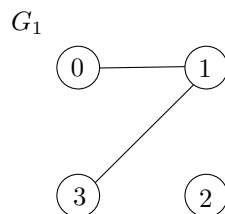
Output Format

Output will be like the model answers given below to the console (e.g. `System.out`). Your program will only be correct if there is no difference between your output and the model solution using an automated 'diff' checker (think `windiff`, `vim -d`, etc). That is, any other output besides a sequence of answers required is a **wrong** program!

Output for Task 1

```
Graph 1 has size 2.
Graph 2 has size 5.
```

Output for Task 2

```
Graph 1 has a component of order 3.
Graph 2 has a component of order 5.
```

Output for Task 3

```
4
0 1 0 0
1 0 0 1
0 0 0 0
0 1 0 0
5
0 1 0 0 1
1 0 1 0 0
0 1 0 1 0
0 0 1 0 1
1 0 0 1 0
0
```

Output for Task 4

```
Graph 1 is disconnected.
Graph 2 has diameter 2.
```

Output for Task 5

```
Graph 1 has girth infinity.
Graph 2 has girth 5.
```

Submission and Due Date

Submit your source code for your five programs to the CompSci 220 automarker before the end of October 22nd (automarker time). You can submit up to 10 times before getting a penalty of 20%. Each task is worth 2 marks.