# Strongly Connected Components

**Description** A strongly connected component (SCC) of a directed graph $G = (V, E)$ is defined as a maximal set of vertices $C \subseteq V$ such that for every pair of vertices $u$ and $v$ in $C$, the two vertices are reachable from each other. In this lab assignment, you are asked to decompose a given directed graph $G = (V, E)$ into a collection of SCCs. The input will have the following format. The first integer refers to the number of vertices, i.e. $|V|$. The second integer is the number of edges, i.e. $|E|$. Vertices are indexed by 0, 1, ..., $|V| - 1$. Then, two numbers $u$ $v$ appearing in each line means an edge $(u, v)$. See an example below for more details.

In the following, the first problem is easier. If you solve the second problem, you don't have to do the first. If you only solve the first problem, you will get half of the full points.

1. Output the number of SCCs of $G$. So your answer should be just one integer.
2. Output every SCC. A SCC's ID must be the smallest index of any vertex in the SCC. You must label each vertex $v$ with the ID of the unique SCC the vertex $v$ belongs to. You must output each vertex's label, in the order of 0, 1, ..., $|V| - 1$.

For the first problem, your execution file name must be 'main1'. Likewise, for the second problem, your execution file name must be 'main2'. Use GradeMe081 and GradeMe082 for the first and second problems, respectively. Since the answer to the first problem is simple, GradeMe081 just runs your code for the test files. So you won't see messages like " ... correct for ..." when running GradeMe081. In contrast, GradeMe082 will work similar to the previous grading tools – for instructions on how to use second grading tool, see the previous lab assignments.

* In this lab, you are allowed to complete the previous Lab07.

### Examples of input and output

*Input*

```
8
13
0 1
1 2
1 4
1 5
2 3
2 6
3 2
3 7
4 0
4 5
5 6
6 5
6 7
```

*Output for problem 1*

```
4
```

This means that the number of SCCs is 4.

*Output for problem 2*

```
0
0
2
2
0
5
5
7
```

What this answer implies that the graph is decomposed into four SCCs, $\{0, 1, 4\}, \{2, 3\}, \{5, 6\}, \{7\}$. Note that all vertices in the same SCC have the same label, which is equal to the smallest index of all vertices in the same component. For example, vertices 0,1 and 4 are labeled with 0.

**Your solutions** Before leaving the lab, submit a zipped tar archive of your program through the assignments page of CatCourse. Please use your UCMNetID as the filename for the zipped tar archive.