

## ACM Programming Challenges Lab

### Exercise 1 – Count the Faces

**Description** A planar graph is a graph that can be drawn in the plane in such a way that no two edges cross at any point except at common vertices.

As you recall from your graph theory lectures there are many different ways of drawing such a graph in the plane. The figure below for example shows two different ways of drawing the bow-tie graph.



The remarkable thing is that the number of faces is the same in every such drawing. In fact you seem to recall that there is a formula for that...

Your task in this exercise is to count the number of faces in planar graphs.

**Input** The first line of input contains an integer  $n$  denoting the number of graphs you have to analyze. Afterwards there are  $n$  blocks encoding a planar graph as follows. The first line of each block contains two non-negative integers  $v, e$  denoting the number of vertices and edges in the graph. Then  $e$  lines follow, each containing two integers  $a, b$  between 0 and  $v - 1$ , which indicate that the graph contains an edge between the vertices  $a$  and  $b$ . The vertex set of the graph is  $\{0, \dots, v - 1\}$ .

**Output** For each graph in the input you must output one line containing the number of faces that it has in a planar embedding.

#### Sample input

```
3
1 0
3 3
0 1
0 2
1 2
4 5
0 1
0 2
0 3
1 2
2 3
```

#### Sample output

```
1
2
3
```