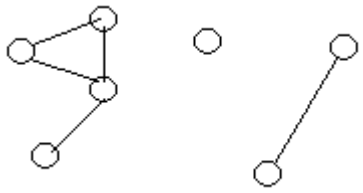
UCF Local Contest (Final Round) — September 19, 2020

Making Connections

filename: `connect`
Difficulty Level: `Medium`
Time Limit: `5 seconds`

Given that everything is online these days, connectivity is a must. A computer network can be modeled as a graph, where each computer is a vertex and each direct network connection between pairs of computers is an undirected edge.

Consider the process of building a computer network. At the very beginning there will be n computers, with no connections between any of them. Then, as time goes on, pairs of computers are chosen, one pair at a time, and a direct network connection between them is added. In the middle of such a process, we might get the following graph modeling the current connections:



This network currently has three groups: the first group has 4 computers that can communicate with each other directly or indirectly, the second group consists of 1 computer by itself, and the third group has 2 computers that can communicate with each other. So, a group is each of the separate components of the graph.

We can define the average connectivity of a network as the sum of the group sizes squared, divided by the number of components. For the example graph shown above, the current connectivity equals $(4^2 + 1^2 + 2^2)/3 = 21/3 = 7$.

As a network is being built, the project manager would like to know the average connectivity of the network at that given snapshot of time. Write a program to handle the queries as the network is being constructed.

The Problem:

Given a network of n initially separate computers, along with a sequence of steps, where each step is either a pair of computers being connected or a query about the average connectivity as of that moment, process each step (i.e., connect the two computers or answer the query).

The Input:

The first input line contains two space separated integers: n ($1 \le n \le 10^5$), representing the number of computers, and m ($1 \le m \le 3 \times 10^5$), representing the total number of steps (each step being either

connect two computers or a query on the average connectivity as of that moment). Assume that the computers are numbered 1 through *n*, inclusive.

Each of the following *m* input lines contains information about one operation, in the order that they occur. Each of these lines will start with a single integer, either 1 or 2, providing the step type. If the step type is 1, it means that a pair of computers is being connected with a direct connection. The value of 1 will be followed by *u* and *v* ($1 \leq u, v \leq n, u \neq v$), representing the pair of computers being connected with a direct connection. If the step type is 2, this is a query and no other information will be on that input line.

Note: It's possible that the input contains multiple direct connections for the same pair of computers; the extra direct connections between the same two computers do not have any effects. It's also possible that, at the end of the process, not all *n* computers are connected in the same component, i.e., there may be more than one component even at the end of the process.

The Output:

For each query, output the average connectivity of the network at that point in time as a fraction in lowest terms on a line by itself. Specifically, output two integers, *x* and *y*, with the character '/' in between, indicating that the average connectivity of the network at the time is *x* divided by *y* such that *x* and *y* share no common factors, e.g., 21/12 is not correct (should be 7/4).

Sample Input **Sample Output**

7 9 2 1 1 2 1 1 3 2 1 3 4 1 2 3 2 1 6 7 2	1/1 13/5 19/4 7/1
4 9 1 1 2 2 1 3 4 2 1 2 3 2 1 1 4 1 2 4 2	2/1 4/1 16/1 16/1