University of Dhaka
Department of Computer Science and Engineering
CSE 2212: Design and Analysis of Algorithms – I
Evaluation Lab 1

Problem 1

Sylhet is one of the most beautiful cities in Bangladesh during the monsoon season and Sharara has decided to explore Sylhet in the monsoon season. But it is difficult for her to see as she navigates Sylhet in her car on a cloudy day. She has K units of petrol left in her car, and she can go one unit farther with each unit of fuel.

Given Sylhet's layout, which is made up of several interconnected cities, and her current location, your goal is to calculate and print the maximum number of cities she can visit until she runs out of fuel.

Input

- The input starts with four integers:
  - C: The number of cities in Sylhet.
  - R: The number of roads connecting different cities in Sylhet
  - K: The remaining fuel units in Sharara's car.
  - L : Sharara's current city
- The following R lines describe the road connections between cities as pairs of integers u,v, indicating a bidirectional road between cities u and v

Output

Output a single integer representing the total possible number of cities Sharara can reach if she uses up all K units of her fuel.

Constraints:

$2 \le C \le 10^3$

$0 \le R \le (C*(C-1))/2$

$1 \le K \le 10^6$

$1 \le L \le C$

Sample Input	Sample Output
5 5 2 1 5 3 2 4 3 4 1 5 2 5	4

Explanation:

1. Sharara starts in city 1 with 2 units of fuel.
2. She can move to city 5 using 1 unit of fuel (remaining fuel = 1).
    - From city 5, she can reach city 3 using 1 unit of fuel (remaining fuel = 0).
3. Alternatively, from city 5, she can reach city 2 using 1 unit of fuel (remaining fuel = 0).

At this point, Sharara has 0 units of fuel and has reached cities 3 and 2. There are no further cities she can reach with her remaining fuel.

The total number of cities she can reach is {1, 5, 3, 2} through all possible paths.

So, the answer for the sample input, considering all possible paths, is 4.

Problem 2

In order to enhance the safety of traveling and alleviate traffic congestion, one-way traffic is now implemented worldwide. The interim government of Bangladesh decided to remain updated with emerging trends. In the past, the ring-shaped network of R two-way roads connected all R cities of Bangladesh. This meant that each city was directly connected to exactly two other cities, and it was possible to travel to any other city from any of the R cities. Despite the introduction of one-way traffic on all R roads by the Government of Bangladesh, it was soon obvious that it was impossible to travel from certain cities to others. Now for each road, it is known in which direction the traffic is directed at it, and the cost of redirecting the traffic. What is the minimum amount of money that the government should allocate to the redirection of roads to ensure that it is possible to travel from every city to another?

Input

The first line contains integer R $(3 \le R \le 100)$ — amount of cities (and roads) in Bangladesh. Next R lines contain descriptions of roads. Each road is described by three integers ai, bi, ci $(1 \le ai, bi \le n, ai \ne bi, 1 \le ci \le 100)$ — road is directed from city ai to city bi, redirecting the traffic costs ci.

Output

Output single integer — the smallest amount of money the government should spend on the redirecting of roads so that from every city you can get to any other.

Sample Input	Sample Output
3 1 3 1 1 2 1 3 2 1	1
3 1 3 1 1 2 5 3 2 1	2
6 1 5 4 5 3 8 2 4 15 1 6 16 2 3 23 4 6 42	39
4 1 2 9 2 3 8 3 4 7 4 1 5	0

Problem 3

In this monsoon season, you are visiting Lalakhal in Sylhet and there is an island in Lalakhal. You are currently staying at the Nazimgarh Wilderness Resort and decided to go around that island by kayaking. You found a map of that island on facebook and the map is given as a row x col grid, with grid[i][j] = 0 denoting water and grid[i][j] = 1 denoting land. Grid cells are joined vertically or horizontally, not diagonally. There is just one island—that is, one or more connected land cells—and the grid is entirely encircled by water. There are no "lakes" on the island, which means that the water inside is not connected to the water around it. A square with a side length of one makes up one cell. The rectangular grid's width and height cannot exceed 100. You want to calculate the island's perimeter.

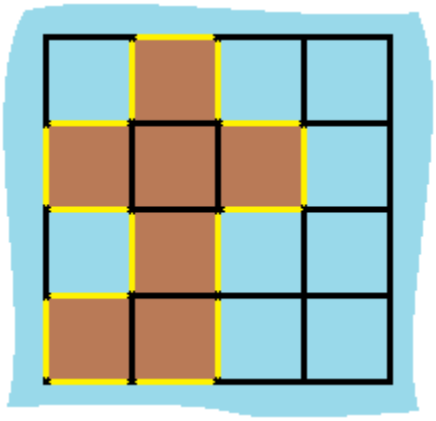
The first line of input is r and c. The next r lines each have c **comma separated** 0/1 values.

Sample Input	Sample Output
4 4 0,1,0,0 1,1,1,0 0,1,0,0 1,1,0,0	16
1 1 1	4
1 2 1,0	4

Constraints:

- row == grid.length
- col == grid[i].length
- 1 <= row, col <= 100
- grid[i][j] is 0 or 1.
- There is exactly one island in the grid.

Example 1 Explanation: The perimeter is the 16 yellow stripes in the image above.



Problem 4

There are m teleporters connecting the n planets in a game. When there is a path from a to b and from b to a, two planets, a and b, are in the same kingdom. You have to identify the kingdom of each planet.

Input

The number of planets and teleporters is indicated by the two integers n and m on the first input line. Numbers 1,2,…,n are the planets' numbers.

The teleporters are then described in m lines. There are two integers on each line, a and b. You can use a teleporter to go from planet a to planet b.

Output

The number of kingdoms, k, should be printed first. Next, print a kingdom label between 1 and k for every planet. Any valid answer can be printed.

Constraints

- $1 \le n \le 10^5$
- $1 \le m \le 2 * 10^5$
- $1 \le a,b \le n$

Sample Input	Sample Output
5 6 1 2 2 3 3 1 3 4 4 5 5 4	2 1 1 1 2 2