CSE221
Lab Assignment 07
Spring2023

Submission Guidelines

1. You can code all of them either in Python, CPP, or Java. But you should choose a specific language for all tasks.
2. For each task write separate python files like task2.py, task3.py, and so on. For problems that have subproblems, name those like task1A.py, task1B.py, and so on.
3. For each problem, take input from files called **"inputX_Y.txt"** and output at **"outputX_Y.txt"**, where X is the task number and Y is the sample i/o number. For example, for problem 2 sample 1, the input file is this, "input2_1.txt". For problems that have subproblems, name the files like "input1a_1.txt", "output1a_1.txt" and so on. Same for output.
4. For each task include at least one input file (if any) in the submission folder.
5. Finally zip all the files and rename this zip file as per this format:**LabSectionNo_ID_CSE221LabAssignmentNo_Spring2023.zip** [Example:**LabSection01_21101XXX_CSE221LabAssignment05_Spring2023.zip**]
6. Don't copy from your friends.
7. You MUST follow all the guidelines, naming/file/zipping convention stated above.
   Failure to follow instructions will result in a straight 50% mark deduction.

Task 1 [10 Marks]

You are a busy person with lots of tasks to do. You have a schedule of tasks represented by intervals of time, where each interval represents a task that you need to complete. However, you can only work on one task at a time, and you want to complete as many tasks as possible.

Given a list of N intervals of time, your task is to determine the maximum number of tasks you can complete and which tasks they are.

Input

The input consists of a single integer N ($1 \leq N \leq 10^5$), the number of tasks, followed by N lines representing the tasks. Each task is represented by two integers S_i and E_i ($0 \leq S_i \leq E_i \leq 10^9$), the start and end times of the task, respectively.

Output

Output a single integer k, the maximum number of tasks you can complete, followed by a line with k intervals of the tasks you can complete.

If there are multiple solutions with the same maximum number of tasks, print any one of them.

Sample Input/Output:

Sample Input 1	Sample Output 1
6 1 3 2 5 3 7 4 6 6 8 7 9	3 1 3 4 6 6 8
Sample Input 2	Sample Output 2
5 1 10 2 5 6 7 4 8 3 6	2 2 5 6 7

Sample Input 3	Sample Output 3
7 0 4 3 4 1 5 9 10 6 9 2 3 1 2	5 1 2 2 3 3 4 6 9 9 10

Task 2 [10 Marks]

Study material: http://www.shafaetsplanet.com/?p=763

There is a group of N people living in a small village. They live in their own house. Although they are all neighbors, they don't all know each other very well.

Each person in that village has their own unique identity - labeled with an integer value between 1 to N. Initially, the villagers don't have any friends. As time passes by, they begin to make friendship between themselves.

In this problem, you will be given a description of K friendships. You have to print an integer value which denotes the size of their friend circle.

Suppose, there are five people living in the village labeled with 1,2,3,4 and 5. Initially, the size of each friend circle is one, since no friendship has been created yet.
One day, person 1 and person 2 become friends. So the size of their friend circle becomes two. Next day, person 3 and person 4 become friends and the size of their friendship becomes two as well. After a few days, person 1 and person 4 become friends. Now the size of their friend circle becomes four consisting of persons 1,2,3 and 4.

Input Format:

The input consists of two integers, separated by a space, denoting the number of people in the village, N ($1 \leq N \leq 10^5$) and the number of queries that will follow, K ($1 \leq K \leq 10^5$).

The next K lines contain two integers A_i and B_i each ($1 \leq A_i, B_i \leq N$ and $A_i != B_i$), separated by a space, representing two people who have become friends as a result of the query.

Output Format:

For each query, output a single integer on a new line representing the size of the friend circle that the two people belong to after becoming friends.

Sample Input/Output:

Sample Input 1	Sample Output 1
5 3 1 2 3 4 1 4	2 2 4
Sample Input 2	Sample Output 2
8 7 2 4 4 5 3 6 4 7 3 1 2 7 6 2	2 3 2 4 3 4 7

Sample Input Explanation:

In sample input 2,

Query 0: Initially, there are 8 people in the village who do not know each other.

{1} {2} {3} {4} {5} {6} {7} {8}

Query 1: After person 2 and person 4 becoming friends:

{1} {2,4} {3} {5} {6} {7} {8}

The output is 2, since the size of the friends circle {2,4} is 2.

Query 2: After person 4 and person 5 becoming friends:

{1} {2,4,5} {3} {6} {7} {8}

The output is 3, since the size of the friends circle {2,4,5} is 3.

Query 3: After person 3 and person 6 becoming friends:

{1} {2,4,5} {3,6} {7} {8}

The output is 2, since the size of the friends circle {3,6} is 2.

Query 4: After person 4 and person 7 becoming friends:

{1} {2,4,5,7} {3,6} {8}

The output is 4, since the size of the friends circle {2,4,5,7} is 4.

Query 5: After person 3 and person 1 becoming friends:

{2,4,5,7} {1,3,6} {8}

The output is 3, since the size of the friends circle {1,3,6} is 3.

Query 6: Since the person 2 and person 7 are already in the same friend circle, nothing changes:

{2,4,5,7} {1,3,6} {8}

The output is 4, since the size of the friends circle {2,4,5,7} is 4.

Query 7: After person 6 and person 2 becoming friends:

{1,2,3,4,5,6} {7} {8}

The output is 7, since the size of the friends circle {1,2,3,4,5,6} is 7.

Task 3 [10 Marks]

In the kingdom of Beluga, there are N cities connected by M roads, each with a maintenance cost associated with it. There is at least one path between any two cities. The king is concerned about the increasing maintenance cost and decides to take action.

He calls upon his council, and they suggest that they find a minimum-cost set of roads that connects all cities while minimizing the maintenance cost. Then the king decides to reduce the total maintenance cost by destroying some of the existing roads, instead of building new ones.

Since you are a very good programmer the king calls you. He asks you to find out what the lowest maintenance cost can be achieved after destroying a few roads while ensuring there still exists a path from each city to another.

Input

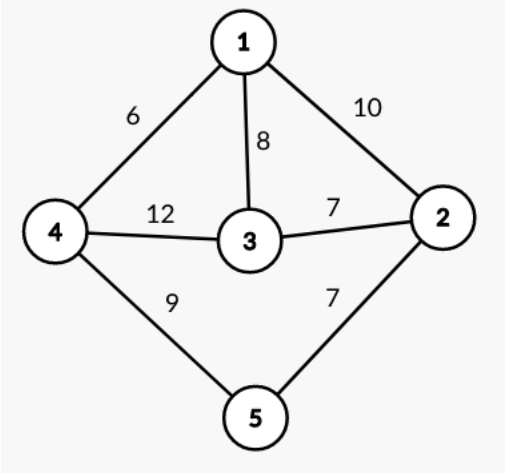
The first line of the input contains two space-separated integers, N and M ($1 \leq N \leq 10^5$, $1 \leq M \leq 10^6$), representing the number of cities and roads in the kingdom of Beluga, respectively.

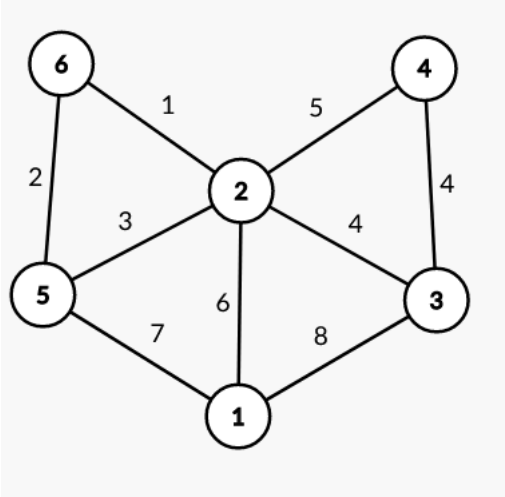
The next M lines each contain three space-separated integers, u, v, and w (1 ≤ u, v ≤ N, 1 ≤ w ≤ 10^9), where u and v denote the endpoints of a road and w represents its maintenance cost.

Output

The output should contain a single integer, the minimum total maintenance cost achievable.

Sample Input/Output:

Sample Input 1	Sample Output 1	Sample Graph 1
5 7 1 2 10 1 3 8 1 4 6 2 3 7 2 5 7 3 4 12 4 5 9	28	
Sample Input 2	Sample Output 2	Sample Graph 2

6 9 1 2 6 2 4 5 2 3 4 1 3 8 4 3 4 2 6 1 2 5 3 5 6 2 5 1 7	17	

Task 4 [10 Marks]

Once upon a time, there was a small frog named Freddy. Freddy was always fascinated by the stairs that led up to the top of the nearby hill. The stairs had N steps and Freddy dreamed of climbing all the way to the top.

Initially, Freddy is standing at the 0th stair. The only way to reach there is by climbing one or two steps at a time.

Can you write a code to determine the number of distinct ways in which the frog can climb from the 0th step to the Nth step?

Input

An integer N representing the total number of stairs (1 <= N <= 50).

Output

An integer representing the number of distinct ways in which the frog can climb from the 0th step to the Nth step.

Sample Input/Output:

Sample Input 1	Sample Output 1
3	3
Sample Input 2	Sample Output 2
4	5
Sample Input 3	Sample Output 3
5	8
Sample Input 4	Sample Output 4
50	20365011074

Sample Input Explanation:

In the first test case, there are three ways to climb the stairs i.e. {1,1,1} , {1,2} and {2,1}.

In the second test case, there are five ways to climb the stairs i.e. {1,1,1,1} , {1,1,2} , {2,1,1} , {1,2,1} , {2,2}.

Hint:

Can you relate the recurrence relation of this problem to Fibonacci Numbers?