Competitive Programming

Saarland University — Summer Semester 2020

Julian Baldus, Markus Bläser, Karl Bringmann, Marian Dietz, Simon Schwarz,
Christoph Weidenbach, Dominic Zimmer

Assignments Week 7

Deadline: **June 23, 2020 at 16:00 sharp**

Please submit solutions to the problems in our judge system, available at
`https://compro.mpi-inf.mpg.de/`.
You can find your credentials on your personal status page in our CMS.

Problem	`marriage`	`reelection`
Points	3	3
Difficulty	🌶🌶	🌶🌶🌶
Time Limit	5s	1s
Memory Limit	2 GB	2 GB

Please note:

- Later, we will reopen the judge for the problems of the last weeks. However, you won't get any points for submissions of these problems.
- In the judge you can switch between the exercises of different weeks in the top-right corner.
- Your solution will be judged immediately after submitting. This may take some time, depending on the current server load.
- You can submit as many times as you want. However, don't abuse the server or try to extract the secret test cases.
- If your solution is **accepted**, you will receive the points specified in the table above.
- If you get **another verdict**, you will receive 0 points.

Marriage
Problem ID: marriage

Finally, Dieter made it back to Saarbrücken. However, the money he earned from his criminal carreer still does not suffice to satisfy the Mafia. Therefore, Dieter needs another way to get some easy money. He decides that marrying a wealthy woman should be the way to go. However, since he has returned to the Saarland, he has the uneasy feeling that he should better watch out who to marry - otherwise, he might marry one of his cousins.

Dieter has already compiled a list of the women that want to get married. Furthermore, he has obtained the family tree of those women. Conveniently, it is actually a tree, and in particular all people in his list descend from the first person on his list and everyone has only one direct ancestor. We say that a person A descends from person B if $B = A$ or if B is either mother, grandmother, grand-grandmother, ... of A.

To avoid getting in trouble with the law again, Dieter wants to find the degree of the relationship between two arbitrary persons q_1 and q_2. Dieter is interested in two properties:

- The *lowest common ancestor*, e.g. the person p lowest in the tree such that q_1 descends from p and q_2 descends from p. Furthermore, there should be no person $p' \neq p$ which descends from p with q_1 and q_2 descending from p'.
- The *distance* of the persons q_1 and q_2. The distance is the length of the shortest link between the two persons. For example, a person A and her mother B have distance 1. A person has distance 2 to her grandmother and, furthermore, distance 2 to her cousins. A person has distance 0 to itself.

Input

The first line of the input contains an integer n and q ($1 \leq n, q \leq 2 \cdot 10^5$).

The second line contains n space-separated strings l_i representing the names of the persons. All of them consist of lower- and uppercase letters and are less than 20 characters long. It is guaranteed that all names are distinct.

The third line contains $n - 1$ names $s_2, s_3, \ldots, s_n$, meaning that s_i is the mother of l_i. It is guaranteed that all names are contained in the first line and that there are no inconsistencies in the input (e.g. everyone is a descendant of the first person and there are no cycles).

The following q lines each contain two names q_i^1, q_i^2, representing a pair of persons Dieter is interested in.

Output

Print q lines. In the i-th line, print the name of the lowest common ancestor and the distance between q_i^1 and q_i^2.

Sample Input 1

```
6 4
Gertrude Annegret Elisabeth Lea Jule Dieter
Gertrude Gertrude Elisabeth Annegret Annegret
Dieter Jule
Dieter Annegret
Dieter Lea
Jule Gertrude
```

Sample Output 1

```
Annegret 2
Annegret 1
Gertrude 4
Gertrude 2
```

Sample Input 2

```
6 3
Sissi Liesbeth Gertrude Annegret Dieter Cecilia
Cecilia Liesbeth Gertrude Annegret Sissi
Liesbeth Liesbeth
Dieter Sissi
Annegret Cecilia
```

Sample Output 2

```
Liesbeth 0
Sissi 5
Cecilia 3
```

Reelection
Problem ID: reelection

You are the president of a great country. Getting into the office the first time was not that difficult – you just invested a whole lot of money into promoting yourself. However, contrary to your expectations you have nothing to do the whole day, giving you more time to fly to your golf courses every day. That's why you want to candidate for the next election this fall as well. Unfortunately, the candidate of another political party wants to replace you in the office.

You have one advantage: Currently, you are the president and he is not. Therefore you could make the citizens happy by doing what is written in your job description for the first time in your political career. Hopefully this will convince the people that you should stay president.

Your country consists of n cities connected by m bidirectional streets. The citizens like some of the streets (e.g. those which have bicycle lanes and have many trees), while they hate others (e.g. streets passing directly through their home[1]). Therefore every street has a corresponding quality between -10^9 and 10^9, indicating whether it is being liked by the citizens (positive value), or not (negative value).

You have a lot of money remaining (because you don't have to pay for the presidential aircraft yourself) and can decide which streets to keep and which streets to remove. The goal is to maximize the total quality (sum of qualities of all streets which are being kept), with the constraint that every city stays reachable from every other city after the removal.

Input

The first line contains two integers n and m ($1 \leq n \leq 10^5$, $1 \leq m \leq 2 \cdot 10^5$), the number of cities and the number of streets.

The following m lines each contain three integers s_i, d_i, v_i ($1 \leq s_i, d_i \leq n$, $-10^9 \leq v_i \leq 10^9$), indicating that there is a bidirectional street between s_i and d_i of quality v_i.

It is guaranteed that it is possible to reach each city from each other city using only streets given in the input.

Output

Output a single integer: The maximum total quality.

Sample Input 1

```
4 6
1 2 15
1 3 3
2 3 1
2 4 -1
3 4 -2
1 1 5
```

Sample Output 1

```
23
```

Sample Input 2

```
4 6
1 2 -4
1 3 -2
1 4 -3
2 4 -2
3 4 -5
2 4 -3
```

Sample Output 2

```
-7
```

[1] https://www.youtube.com/watch?v=tvS75z7gl-s