Animal Transport

Capeta is working part-time for an animal shipping company. He needs to pick up animals from various zoos and drop them to other zoos. The company ships four kinds of animals: elephants, dogs, cats, and mice.

There are m zoos, numbered 1 to m. Also, there are n animals. For each animal i, Capeta knows its type t_i (`E` for elephant, `D` for dog, `C` for cat and `M` for mouse), source zoo s_i where Capeta has to pick it up from, and destination zoo d_i where Capeta needs to deliver it to.

Capeta is given a truck with a huge capacity where n animals can easily fit. He is also given additional instructions:

1. He must visit the zoos in **increasing** order.
2. **Dogs** are scared of **elephants**, so he is not allowed to bring them together at the same time.
3. **Cats** are scared of **dogs**, so he is not allowed to bring them together at the same time.
4. **Mice** are scared of **cats**, so he is not allowed to bring them together at the same time.
5. **Elephants** are scared of **mice**, so he is not allowed to bring them together at the same time.

Also, loading and unloading animals are complicated, so once an animal is loaded onto the truck, that animal will only be unloaded at its destination.

Because of these reasons, Capeta might not be able to transport all animals. He will need to ignore some animals. Which ones? The company decided to leave that decision for Capeta. He is asked to prepare a report and present it at a board meeting of the company.

Capeta needs to report the minimum zoo number that must be reached in order to transport x animals, for each x from 1 to n.

He is good at racing and driving, but not in planning. So he asked for your help.

Input Format

The first line contains a single integer t, the number of test cases.

Each test case consists of four lines. The first line contains two space-separated integers m and n. The second line contains n space-separated characters $t_1, t_2, \ldots, t_n$. The third line contains n space-separated integers $s_1, s_2, \ldots, s_n$. The fourth line contains n space-separated integers $d_1, d_2, \ldots, d_n$.

t_i, s_i and d_i are the details for the ith animal, as described in the problem statement.

Constraints

- $1 \leq t \leq 10$
- $1 \leq m, n \leq 5 \cdot 10^4$
- $1 \leq s_i, d_i \leq m$
- $s_i \neq d_i$
- t_i is either `E`, `D`, `C` or `M`

Subtasks

- For 30% of the total score, $m, n \leq 10^3$

Output Format

For each case, print a single line containing n space-separated integers, where the x^{th} integer is the minimum zoo number that Capeta needs to reach in order to transport x animals. If it is not possible to transport x animals at all, then put -1 instead.

Sample Input 0

```
2
10 3
E D C
4 1 4
7 5 8
10 6
E D C M E D
1 1 1 2 9 7
2 2 2 4 10 10
```

Sample Output 0

```
5 8 -1
2 2 4 10 -1 -1
```

Explanation 0

First Test Case

Capeta can transport one animal by traveling up to zoo number 5. Just drop the dog there. Next, in order to transport 2 animals (elephant and cat), Capeta has to go up to zoo number 8.

Second Test Case

- 1 Animal: Drop the elephant to zoo 2.
- 2 Animal: Drop the elephant and cat to zoo 2.
- 3 Animal: Drop the elephant and cat to zoo 2. Then drop the mouse to zoo 4.
- 4 Animal: Drop the elephant and cat to zoo 2. Then drop the mouse to zoo 4. Finally, drop either the elephant or the dog to 10.
- It is impossible to transport 5 or 6 animals.