Problem E
Enjoying Elderberries

One day, a flock of hungry birds find a huge tree of elderberries. They want to eat all berries of this tree. These birds quickly alight on some leaves of the tree and eat all berries at where they stand. Now they are thinking of who will eat other berries ...

Since the flock has some *giant* birds and some *tiny* birds, and they observe that the tree has some *big* branches and some *small* branches, fairly distributing these berries among all birds turns out to be a tough problem.

Formally, the tree of elderberries can be presented as a tree with the following properties:

- The tree has n vertices numbered from 1 to n. The root of the tree is vertex 1.
- Each non-leaf vertex (vertex having at least one child) is called a *branch*. A branch is classified as either *big* or *small*. The root is always a **big** branch.
- On each leaf of the tree, there is either one *giant* bird, one *tiny* bird or one elderberry.

The process of determining which bird eats which berry is as below:

- First, every bird and every berry has a *label*. A label is a non-empty string of **at most five** lowercase English characters.
- Second, every bird has a *controlled area*. Consider the bird at vertex v:
  - If it is a **tiny** bird, its *controlled area* is the subtree rooted at vertex p_v, where p_v is the parent of v.
  - If it is a **giant** bird, its *controlled area* is the subtree rooted at vertex b_v, where b_v is the **closest** vertex to v among all **ancestors** of v which are **big** branches.
- Finally, for each berry, the bird who eats it is determined using the following rules:
  - A bird can only eat berries having the same label with it.
  - A bird can only eat berries inside its *controlled area*.
  - If there is more than one bird satisfying the two above conditions, only one bird with **smallest** *controlled area* eats it.

All birds also set some rules for labeling birds and berries:

- A bird or a berry can have same label with other birds and berries. However, no groups of **eight or more** birds have the same label.
- Each berry is inside the *controlled area* of at least one bird with same label.
- No two birds with same label have the same *controlled area*.

- From all of the above, it can be proven that the bird eating every berry can be uniquely determined.

Sadly, *tiny* birds think that these rules give advantages to *giant* birds over them. They claim that, by the rules of setting *controlled areas*, *giant* birds usually control larger areas, which means having more berries. (Although their thought is not always true.) They want their *controlled areas* to be determined using the rules of giant birds. (In other words, they want all tiny birds become giant birds).

Giant birds accept the *tiny* birds' claim. However, they try to change the labels of some birds and berries, so that if we assume **all tiny birds become giant**, the new set of labels still satisfy all the above conditions. Moreover, after changing labels, **no berries have changed owner** (i.e, every berry is still eaten by the same bird).

They want to change as few labels as possible. Please help them!

Input

The first line contains one integer n $(3 \le n \le 150\,000)$ — the number of vertices in the elderberry tree. The i-th of the next n lines describes the i-th vertex in either of the following formats:

- 'p_i t_i', where t_i is either 'B' or 'S': meaning that i is a **branch**. $t_i = B$ and $t_i = S$ mean that i is a *big* or *small* branch, respectively.
- 'p_i T_i L', where T_i is either 'G', 'T' or 'E' and L is a non-empty string of **at most five** English characters: meaning that i is a **leaf**. $t_i = G$, $t_i = T$ and $t_i = E$ mean that in vertex i there is either a *giant* bird, a *tiny* bird or an *elderberry*. L is the label of this bird or berry.

In both formats, p_i satisfies $1 \le p_i < i$ and denotes the parent of vertex i. We assume that $p_1 = 0$.

It is guaranteed that the input describes a valid tree, there is at least one bird and one berry, and all labels satisfy the rules presented above. Remember that **no eight birds** have the same label.

Output

- The first line contains an integer k — the minimum number of labels need changing.
- Each of the next k lines contains an integer x $(1 \le x \le n)$ and a label S — meaning that the label of the bird or berry at vertex x is assigned to S. x should be a leaf of the tree. S should be a non-empty string of at most five lowercase English characters.

If there are multiple optimal solutions, you can output any one of them.

Explanation for examples

Below are figures depicting these three examples. Red vertices are big branches, green vertices are small branches, violet vertices have giant birds, yellow vertices have tiny birds and white vertices have berries.

- In the first example:
  - Initially:
    - There are 3 birds with label 'a' at vertices 6, 7 and 13. Their *controlled areas* are the subtrees rooted at vertices 2, 5 and 1, respectively.
    - There is 1 bird with label 'b' at vertex 12. Its *controlled area* is the subtree rooted at vertex 1.
    - There are 3 elderberries with label 'a' at vertices 3, 8 and 11. They are eaten by the birds at vertices 6, 7 and 13, respectively.
    - There are 2 elderberries with label 'b' at vertices 4 and 9. They are both eaten by the bird at vertex 12.
  - If all tiny birds become giant birds, both the *controlled area* of the birds at vertices 6 and 7 become the subtree rooted at vertex 2, violating the rules (No two birds with same label having same *controlled area*). Hence, at least one bird's label needs changing. We can change the label of the bird at vertex 6 to 'c'. As the bird at vertex 6 eats the berry at vertex 3, we need to change the label of the bird at vertex 3 as well. The solution in which the bird/berry at vertices 7 and 8 get changed is also accepted.
- In the second example:
  - Initially:
    - The *controlled areas* of the birds at vertices 3 and 6 are subtrees rooted at vertices 1 and 5, respectively.
    - The bird at vertex 3 eats the berry at vertex 4.
  - If all tiny birds become giant birds, their *controlled areas* are subtrees rooted at vertices 1 and 2, respectively. As a result, the bird at vertex 6 eats the berry at vertex 4, which is invalid, (The owner of every berry must not change). Hence the label of the bird at vertex 6 must be changed.
- In the third example, no changes are necessary.

Sample Input 1

```
13
0 B
1 B
2 E a
2 E b
2 S
5 G a
5 T a
5 E a
5 E b
1 S
10 E a
10 G b
1 T a
```

Sample Output 1

```
2
3 c
6 c
```

Sample Input 2

```
6
0 B
1 B
1 T a
2 E a
2 S
5 T a
```

Sample Output 2

```
1
6 b
```

Sample Input 3

```
6
0 B
1 G y
1 E y
1 E z
1 T z
1 E z
```

Sample Output 3

```
0
```