

Tree Sales

Filename: treesales

The Problem

Several well-known companies use a pyramid sales scheme. Being both an entrepreneur AND a computer scientist, however, you prefer to model your new business as a tree sales scheme, where the hierarchical structure of the company can be modeled as a tree.

In particular, the company initiator, or CEO, is the root of the tree structure of the company. From there, any current member of the company can hire a direct subordinate. So, at the beginning, it's up to the CEO to hire other employees who will be directly below the CEO in the tree structure. At any point in time, any employee can make a sale. Total compensation of any employee is calculated based on the sum of sales of all members of the subtree rooted at that employee, so it's important at any point in time to be able to calculate the total sales in any subtree of the company structure.

In order to start your company and allow others to start similarly structured companies, you have decided to write a computer program that will read in a set of operations from the following set:

- 1) Add an employee (first add is the CEO, rest are made by current employees)
- 2) An employee makes a sale
- 3) Query for the total sales in an employee's subtree at that point in time

and execute the appropriate command, in the order given, producing output for all commands of type three.

The Input

The first line of input will contain a single integer, T ($T \leq 10$), representing the number of company structures to analyze. The first line of each company structure to analyze will contain a single positive integer, n ($n \leq 100000$), representing the number of operations to execute for that company. The following n lines will each contain a single command with one of the following three formats:

```
ADD SPONSOR NEWEMPLOYEE
SALE EMPLOYEE X
QUERY EMPLOYEE
```

All employee names will be strings of 1 to 4 uppercase letters. In the first format, SPONSOR will be the current employee who is hiring a new employee, and the NEWEMPLOYEE will be the new employee to be added directly below the sponsor. The very first command for each company will be an add command with the sponsor "ROOT", indicating that NEWEMPLOYEE is the root of the tree structure for that company. No employee of any company will be named "ROOT". In the second format, EMPLOYEE will be the employee in question and X will be a positive integer less than 1000 representing the value of the sale made by the given employee. In the third format, EMPLOYEE will be the employee in question for which we must find the total

sales of her subtree in the company. All names given for current employees for all three types of commands are guaranteed to be valid current employees.

It is guaranteed that all employees added will be identified by distinct strings and that the tree structure produced will not have a height greater than 100. (Note: The height of a tree with two nodes is 1.)

The Output

For each company output a single line header of the form

COMPANY K

where K is the number of the company, starting with 1. For each query (command of type 3 in the input), output a single line with a positive integer representing the current total sales of the subtree of the employee queried. Note: Each company will have at least one query.

Sample Input

```
2
14
ADD ROOT BILL
ADD BILL EVELYN
ADD BILL SARAH
SALE BILL 25
SALE EVELYN 75
SALE SARAH 10
QUERY BILL
ADD EVELYN MATT
ADD MATT ANYA
SALE ANYA 1000
QUERY MATT
QUERY EVELYN
QUERY BILL
QUERY SARAH
11
ADD ROOT MARILYN
ADD MARILYN GARY
ADD MARILYN REMY
ADD MARILYN BRIANNE
ADD MARILYN TAJ
SALE TAJ 10
SALE REMY 20
SALE BRIANNE 40
SALE MARILYN 30
QUERY GARY
QUERY MARILYN
```

Sample Output

```
COMPANY 1
110
1000
1075
1110
10
COMPANY 2
0
100
```