Data Structures Assignment-3

Tax Collection

Due to huge variations in budget requirements the government has decided that it will now be collecting income taxes daily. The tax system is simple, there are only two income categories - low income and high income. Low income pay 10% and high income pay 50% of their daily income as taxes. These categories are based on a cut-off C. All incomes $< C$ come under lower income and the rest($\geq C$) come under high income. Every morning the finance council decides the day's budget requirement B_{req}. To keep the people happy the government wants to keep the cut-off C as high as possible, but according to the law C cannot exceed 10^9 and the tax collected must able to cover the budget requirement B_{req}. You are tasked with deciding the highest possible cut-off C, or to inform the finance council if the requirement cannot be met.
Each day the following happens:

1. Some people fired and become unemployed.
2. Some unemployed people get hired.
3. Finance Council announces the budget requirement B_{req}.
4. You decide the cut-off C.
5. Taxes are collected based on the cut-off C.

Given a sequence of n days, calculate the cut-off C for each day.

Input

First line of the input contains an integer n, the number of days.
For each day you get a sequence of updates in the following order:

1. "F I_f" which indicates that someone with income I was fired.
2. "H I_h" which indicates that someone was hired and earns I.
3. "A B_{req}" announcing the day's budget requirement and marking the end of the day.
   A day will contain multiple type-1 and type-2 queries followed by a type-3 query marking the end of the day.

Output

Your output must consist of n lines, one for each day.
After the announcement of B_{req} for a day, print that day's highest possible cut-off C or print "Alert!" if the requirement cannot be met.

Constraints

$1 \leq n \leq 2 * 10^5$
$0 \leq I_f, I_h < 10^9$ are multiples of 100.
Atleast one person with income I_f exists who is fired.
$0 \leq B_{req} \leq 10^{14}$
The total number of hires and fires does not exceed $5 * 10^5$.
I_f, I_h **and** B_{req} **are generated randomly, so you only need to consider average case time complexity.**

Sample Input 1

```
5
H 100
H 10000
H 300
A 5100
F 10000
H 1000
A 500
A 100
F 1000
A 500
A 200
```

Sample Output 1

```
300
1000
1000000000
Alert!
100
```

Sample Explanation 1

The following happens each day:

1. Three people with income 100, 10000 and 300 are hired. B_{req} is 5100. Setting C to 300 puts 100 in low income, 10000 and 300 in high income. Total tax collected is

$$100 * 10/100 + 10000 * 50/100 + 300 * 50/100 = 5160$$

   Setting any higher C will leave us with less than the required budget.

2. The person with income 10000 was fired and one with income 1000 was hired leaving us with three incomes - 100, 300 and 1000. B_{req} is 500. 1000 is the highest possible C satisfying the budget.

3. B_{req} is 100. All values of C will satisfy B_{req}. We can set C to ∞, but we are only allowed values upto 10^9.

4. Person with income 1000 is fired. 100 and 300 remain. B_{req} is 500. We cannot collect this much tax no matter how much we set C, so we alert the finance council.

5. B_{req} is 200. $C = 100$ is the highest value which satisfies the budget.

Sample Input 2

```
3
H 100
H 100
H 2000
H 2000
H 5000
A 3000
F 100
F 100
F 2000
F 2000
F 5000
A 1
A 0
```

Sample Output 2

```
2000
Alert!
1000000000
```

Sample Explanation 2

The incomes are $100, 100, 2000, 2000, 5000$. To get 3000 we definitely need to have a 2000 and 5000 in the high income category. On the second day everyone was fired. We cannot collect any tax so $B_{req} = 1$ cannot be satisfied. On the third day, however, B_{req} is 0. So we can set C to the maximum permitted value of 10^9.

Limits

Time: 3 seconds

Memory: 256 MB