Balancing Chemical Equations

Write a program that, given an equation such as

$$\_H_2O+\_CO_2 = \_O_2+\_C_6H_{12}O_6.$$

will fill in the blanks to produce a balanced equation, such as

$$6H_2O + 6CO_2 = 6O_2 + C_6H_{12}O_6,$$

More specifically, an equation is input in the form of a sequence of lines, one for each molecule (e.g., H_2O or CO_2) in the formula. The k^{th} line has the following form:

$$sign_k n_k\, atom_{k,1} count_{k,1} \cdots atom_{k,n} count_{k,n}$$

where $sign_k$, k, $atom_{k,j}$, and $count_{k,j}$ separated by whitespace; $sign_k$ is $\pm$; each $atom_{k,j}$ consists of one or two alphabetic characters, and each $count_{k,j}$ is a positive integer. After all the lines describing molecules, there is a delimiting line of the form

```
0 0
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If there are m input lines, the problem is find m positive integer values, $C_1, \ldots, C_m$, such that for every distinct two-character atom name, a, appearing in the input,

$$\sum sign_i \cdot C_i \cdot count_{i,j} \;=\; 0,$$

where the sum is over all i and j for which $atom_i, j = a$.

For example, if part of the input is "N 2", this represents two atoms of N (nitrogen). If it occurs on a line (molecule) with C_i equal to 3, it represents 6 atoms. A *sign* of +1 indicates that this molecule appears on the left of an equation, and -1 indicates that it appears on the right. The problem, then, is to get the result of adding up the number of atoms of N with a +1 *sign* and subtracting the number of atoms with -1 *sign* so as to get a total of 0. Further, the C_i must be chosen so that this happens for all atoms simultaneously. An atom may be repeated in a given line of input, as in

```
+1  6 C  1 H  5 C  1 O  1 O  1 H  1,
```

which stands for CH_5COOH.

The input for the illustrative equation at the beginning of this problem is

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+1  2 H  2 O  1
+1  2 C  1 O  2
-1  1 O  2
-1  3 C  6 H 12 O  6
00 00
```

and the output is to be as shown in that example.