



Problem J
Units

The use of units is ubiquitous in science. Physics uses units to distinguish distance (e.g., meters, kilometers), weight (e.g., kilograms, grams), and many other quantities. Computer scientists have specialized units to describe storage capacity (e.g., kibibytes, mebibytes, etc.). You are to write a program to display the conversion factors for a set of units.

Specifying the relationship between various units can be done in many different, but equivalent, ways. For example, the units for metric distance can be specified as the group of relationships between pairs for units: 1km=1000m, 1m=100cm, and 1cm=10mm. An alternative set of pairs consists of: 1km=100000cm, 1km=1000000mm, and 1m=1000mm. In either presentation, the same relationship can be inferred: 1km=1000m=100000cm=1000000mm.

For this problem, the units are to be sorted according to their descending size. For example, among the length units cm, km, m, mm, km is considered the biggest unit since 1km corresponds to a length greater than 1cm, 1m, and 1mm. The remaining units can be sorted similarly. For this set, the sorted order would be: km, m, cm, mm.

This problem is limited to unit-systems whose conversion factors are integer multiples. Thus, factors such as 1 inch = 2.54 cm will not be considered. Further, the set of units and the provide conversions will always permit a larger unit to be expressed as an integer multiple of the next smaller unit.

Input

The input will consist of several problems. Each problem begins with a line giving the number of units, N, where N is an integer in the interval [2, 10]. The following line will contain N unique case-sensitive units, each of which consists of at most 5 characters. Following the set of units will be N-1 unique lines, each specifying a relationship between two different units, with the format containing the following four space-separated pieces: name of the unit; an "="; a positive integer multiplier larger than 1; and the name of a second unit that is smaller than the one to the left of the equal sign. Each of these lines establishes how many units are equivalent to the larger unit on the left. Each unit will appear in the set of N-1 lines and will given in such a way to ensure the entire system is defined.. The set of multiples will yield conversion factors that will not exceed $2^{31} - 1$.

A line containing just a zero will mark the end of all problem descriptions.

Output

For each set of units, produce one line of output that contains the equivalent conversions. The conversions should be sorted left to right, with the largest unit appearing on the left. The conversion factors should be defined with respect to the leftmost unit (i.e., the largest unit) and should be separated by " = ".





Sample Input 1

```
4
km m mm cm
km = 1000 m
m = 100 cm
cm = 10 mm
4
m mm cm km
km = 100000 cm
km = 1000000 mm
m = 1000 mm
6
MiB Mib KiB Kib B b
B = 8 b
MiB = 1024 KiB
KiB = 1024 B
Mib = 1048576 b
Mib = 1024 Kib
6
Kib B MiB Mib KiB b
B = 8 b
MiB = 1048576 B
MiB = 1024 KiB
MiB = 8192 Kib
MiB = 8 Mib
0
```

Sample Output 1

```
1km = 1000m = 100000cm = 1000000mm
1km = 1000m = 100000cm = 1000000mm
1MiB = 8Mib = 1024KiB = 8192Kib = 1048576B = 8388608b
1MiB = 8Mib = 1024KiB = 8192Kib = 1048576B = 8388608b
```